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FEASIBILITY STUDIES FOR TIANJIN'S MEDICAL WASTE HANDLING AND DISPOSAL/ TREATMENT FACILITY; CIVILIAN RADIOACTIVE WASTE MANAGEMENT, MONITORING, AND DISPOSAL SYSTEM; AND CHEMICAL/HAZARDOUS MATERIAL EMERGENCY RESPONSE SYSTEM

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VOLUME I

MEDICAL WASTE HANDLING AND DISPOSAL/TREATMENT FACILITY

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1.0 INTRODUCTION

This Final Report is prepared as one of the three final submittals pursuant to a Feasibility Study (FS) titled "Tianjin Medical Waste Collection, Storage, Transportation System, and Disposal Facility" and funded by the U.S. Trade and Development Agency (USTDA) through a cooperative grant agreement (Grant No. GH2371445) with the Tianjin Environmental Protection Bureau (TEPB). The purpose of this study is to assist the TEPB in evaluating Tianjin's current medical waste management program and the feasibility for a central medical waste treatment/disposal facility. Recommendations for the medical waste management program and alternative treatment technologies are also provided for future planning, expansion, and improvement of Tianjin's existing medical waste management system and central treatment facility.

The scope of the FS was to assist SEPB in defining management, technical, and financial requirements for the design, construction, and operation of a centralized medical waste treatment and disposal facility with a throughput rate of 25 tons per day. However, as the FS was awarded after the construction and prior to the operation of the Tianjin Hazardous Waste Treatment Centre (THWTC), medical waste is currently handled exclusively by the THWTC pursuant to mandates from the central government of People's Republic of China (PRC). With the existing 40 to 50 tons/day rotary kiln incinerator and the recently acquired advanced autoclave disinfection unit from Germany, the THWTC has sufficient capacity to handle Tianjin's medical waste loads. Therefore, financial and economic analysis was prepared for a future plant using non-incineration treatment alternatives.

2.0 EVOLUTIONS OF MEDICAL WASTE REGULATIONS IN U.S. AND PRC

Healthcare (hospitals, clinics, nursing homes), veterinary, research centers, laboratories, and pharmaceutical operation generate the following four categories of wastes: municipal solid waste (MSW), regulated medical waste or infectious waste, hazardous waste, and radioactive (RAD) waste. The first step in developing a comprehensive medical waste management, handling, and treatment program is to understand the proper classifications or definitions of these waste streams, the governing regulations, characteristics, generation source(s), and quantities of each waste category.

Regulated medical or infectious waste refers to waste that is capable of producing infectious diseases. In the U.S., regulated medical waste is often cross-referenced as biohazardous, potentially infectious, pathological, biomedical, or "red bag" waste. A comparison of regulated medical waste definition, classification, regulations, and handling/treatment methodologies between the U.S. and P.R.C. is discussed in the following sections. In general, management and treatment of regulated medical waste are governed by the central governments in the PRC and by the state governments in the U.S.

Currently, both P.R.C. and U.S. have their respective definitions and regulations for infectious/regulated medical wastes, each developed based on common issues as well as unique socioeconomic backgrounds. Therefore, it is important to understand the evolutions of medical waste regulatory schemes before developing an effective management and treatment system.

2.1 Surface of Medical Waste Concerns in the U.S.

Historically, the medical profession has, by necessity, dealt with the management, treatment, and disposal of hospital/medical infectious waste in a safe and efficient manner. However, the public did not become noticeably concerned with this issue until the summers of 1987 and 1988 when illegally disposed medical waste of various types was washed up along the beaches of Monmouth/Ocean County in New Jersey. Some affected beaches were closed, resulting in the loss of up to one billion dollars in tourist-related revenue. Federal and state regulatory agencies, along with many private environmental groups subsequently conducted studies or took other steps to address the problems of medical waste management. Members of Congress also introduced numerous bills in response to the political pressure created by the public outcry over the beach contamination and health and safety issues. In November 1988, Congress passed the Medical Waste Tracking Act of 1988 (MWTA), which became subchapter X of the Solid Waste Disposal Act (SWDA).

The MWTA provided for a two-year demonstration program to track medical waste from its generation to disposal. USEPA established a program that started on June 22, 1989 and ended two years later. The MWTA specifically applied to the Great Lakes States and Connecticut, New Jersey, and New York. All of the Great Lakes States were given the option to not participate in the demonstration program (and any other states were given the opportunity to participate); and Connecticut, New Jersey, and New York could petition out if their state regulations were at least as stringent as the federal regulations. None of the Great Lakes States chose to participate, while none of the other three States petitioned out. Therefore, MWTA only applied to New York, New Jersey, Connecticut, Rhode Island, and Puerto Rico, which voluntarily entered the program. Louisiana and the District of Columbia voluntarily joined the program, but later petitioned out of it.

In addition to this demonstration program, USEPA collected information on medical waste and developed a training course and manual for medical waste incinerator operators. Moreover, the Occupational Safety and Health Administration (OSHA) promulgated regulations concerning occupational exposure to bloodborne pathogens. Although the MWTA had expired in June 1991 and not been re-enacted, the term of medical waste has been incorporated into RCRA. Currently, over 85% of the states in the U.S. have developed their own regulations concerning medical waste.

2.2 Medical Waste and Regulated Medical Waste Definitions in the U.S.

At the federal level, the 1989 MWTA defines medical waste as:

> "*Medical waste refers to any solid waste that is generated in the diagnosis, treatment, or immunization of human beings or animals, in research pertaining thereto, or in production or testing of biologicals. Biologicals refer to preparations made from living organisms and their products, including vaccines, cultures, etc., intended for use in diagnosing, treating, or immunizing humans or animals or in research pertaining thereto. Medical waste includes materials such as sharps, fabrics, plastics, paper, waste chemicals/drugs that are not RCRA hazardous waste, and pathological waste. Medical waste does not include household waste, hazardous waste, or human and animal remains not generated as medical waste.*"

USEPA adopted this definition of medical/infectious waste in the 1995 Proposed Rule for hospital/medical/infectious waste incinerator (HMIWI) air emission standards. SWDA was amended extensively and was essentially replaced by RCRA in 1976. RCRA was then amended in 1984, and again in 1988 by MWTA. Since MWTA contained a definition of the term "medical waste," it was added into RCRA for implementation. However, this proposed definition was challenged by the public because of its broad coverage. After re-evaluation, USEPA adopted the definition of "regulated medical waste" from the MWTA as the most appropriate definition of medical/infectious waste in its 1997 Final Rule for the HMIWI air emission standard.

"Regulated medical waste (by MWTA) or medical/infectious waste (by USEPA) refers to any waste generated in the diagnosis, treatment, or immunization of human beings or animals, in research pertaining thereto, or in the production or testing of biologicals that is listed in paragraphs (1) through (7) of this definition. The definition of medical/infectious waste does not include hazardous waste identified or listed under the regulations in part 261 of this chapter; household waste, as defined in Section 261.4(b)(1) of this chapter; ash from incineration of medical/infectious waste, once the incineration process has been completed; human corpses, remains, and anatomical parts that are intended for interment mation sic; and domestic sewage materials identified in Section 261.4(a)(1) of this chapter.

(1) Cultures and stocks of infectious agents and associated biologicals, including: cultures from medical and pathological laboratories; cultures and stocks of infectious agent from research and industrial laboratories; wastes from the production of biologicals; discarded live and attenuated vaccines; and culture dishes and devices used to transfer, inoculate, and mix cultures.

(2) Human pathological waste, including tissues, organs, and body parts and body fluids that are removed during surgery, autopsy, or other medical procedures, and specimen of body fluids and their containers.

(3) Human blood and blood products including: liquid waste human blood; products of blood; items saturated and/or dripping with blood; or items that are now caked with dried human blood but were saturated and/or dripping with blood; including serum, plasma, and other blood components, and their containers, which are used or either intended for use in either patient care, testing and laboratory analysis or the development of pharmaceuticals. Intravenous bags are also included in this category.

(4) Sharps that have been used in animal or human patient care or treatment or in medical, research, or industrial laboratories, including hypodermic needles, syringes (with or without the attached needle), Pasteur pipettes, scalpel blades, blood vials, needles with attached tubing, and culture dishes regardless of presence of infectious agents. Also included are other types of broken or unbroken glassware that were in contact with infectious agents, such as used slides and cover slips.

(5) Animal waste including: contaminated animal carcasses, body parts, and bedding of animals that were known to have been exposed to infectious agents during research 9including research in veterinary hospitals), production of biologicals, or testing of pharmaceuticals.

(6) *Isolation wastes including: biological waste and discarded materials contaminated with blood, excretions, exudates, or secretions from humans who are isolated to protect others from certain highly communicable diseases, or isolated animals known to be infected with highly communicable diseases.*

(7) *Unused sharps including the following unused, discarded sharps: hypodermic needles, suture needles, syringes, and scalpel blades.*

In addition to the above waste types, surgery/autopsy wastes in contact with infectious agents (discarded soiled dressing, sponges, drapes, gowns, and gloves); dialysis wastes (effluent and equipment in contact with blood of the dialysis patients); and discarded medical equipment and parts in contact with infectious agents; and laboratory waste in contact with infectious agents (lab coat, gloves, slides and cover slips) had also been listed for consideration as infectious wastes by USEPA in MWTA demonstration program and in the USEPA 1986 guide for infectious waste management, but were not explicitly indicated in the 1997 definition primarily because USEPA determined that potentially infectious items from these waste categories are covered by the other seven regulated waste types.

It should be pointed out that although most of the states have developed their definitions of regulated medical waste based on the federal USEPA definition, differences exist in the descriptions of each waste category and which of these categories should be considered infectious. Some states explicitly include cultures and stocks from research and industrial laboratories or from the production of biologicals. Some states regulate only contaminated sharps, while others include unused sharps. Several states also included chemotherapy waste or waste contaminated with pharmaceutical compounds as part of regulated medical waste. Nearly a dozen states require that body parts can only be disposed of by incineration (cremation) or interment (burial), but some states exclude teeth and contiguous structures of bone and gum under this category. Additionally, there are cases in which the state legislation permits the state regulatory authority to designate new waste categories into the regulated medical waste list as deemed appropriate.

Despite the variations in definitions, most of the regulated medical waste contains the first six (6) USEPA waste categories as they represent the majority of the waste generated by the healthcare business.

2.3 Development of Regulated Medical Waste Regulations in PRC

Several categories of regulated medical waste were initially listed as part of the hazardous waste by the PRC Central Government. According to "PRC National Hazardous Waste List" published and enforced in 1998, hospital surgical waste, pharmaceutical manufacturing waste, and outdated pharmaceutical products are designated HW-01, HW-02, and HW-03 on the published hazardous waste list.

The hospital surgical waste (HW-01) included a wide variety of medical waste that covered by Categories 1, 2, 3, 5 and 6 of the MWTA/USEPA regulated medical waste definitions. It also included sludge from the healthcare's wastewater treatment process. The pharmaceutical manufacturing waste (HW-02) primarily refers to cultures and stocks, waste streams, and chemicals (including catalysts, solvents) associated with the manufacturing and testing of

commercial pharmaceutical products or drugs, including chemotherapy waste. Outdated medical waste (HW-03, excluding those specified in HW-01 and HW-02) includes expired chemical testing agents, medicines, drugs, and chemotherapy agents from pharmaceutical manufacturers, healthcare facilities, schools, research laboratories, and wholesale/retail stores.

Due to increasing public health concerns about the Severe Acute Respiratory Syndrome (SARS) as well as safe handling and treatment/disposal of medical waste, PRC State Environmental Protection Administration (SEPA) and Ministry of Health (MOH) jointly developed an updated definition and list of regulated medical waste on October 13, 2003 (MOH [2003] No. 287), which is currently implemented by the central government and provincial regulators.

2.4 Medical Waste and Regulated Medical Waste Definitions in PRC and Tianjin

Under the new definitions, regulated medical waste is divided into five (5) major categories:

(1) Sharps refers to medical waste that could puncture or cause cuts, including needles, scalpels, knifes, scrapers, glass and cover slides, glass test tubes, and ampoules.

(2) Pharmaceutical waste refers to expired, outdated, deteriorated, or contaminated pharmaceutical products, including antibiotics, drugs, medicines, vaccines, serum-based biological reagents, chemotherapy agents, and cytotoxic carcinogens.

(3) Chemical waste refers to toxic, corrosive, and flammable chemicals, including diagnostic imaging and laboratory chemical waste, peroxy acid, glutaraldehyde disinfectants, mercury thermometers, and pressure barometers.

(4) Infectious waste refers to waste capable or has the potential of causing or spreading diseases, including (a) materials (soiled dressing, cotton balls, swaps, cotton strips, and bandages; sponges; drapes; gowns; sheets; gloves; and medical equipment) contaminated with patient's blood, body fluid, and excretion; (b) MSW from isolation rooms that may be or suspected to be contagious for spreading infectious diseases; (c) culture and stocks of infectious substances and associated biologicals; (d) medical specimen; (e) discarded human blood and serum; and (f) disposable sanitary[1] as well as medical equipment and devices[2] that are considered infectious waste.

(5) Pathological waste refers to human tissues, organs, and body parts removed during surgery, autopsy, research, or other medical procedures and discarded animal carcasses/body from medical research activities

Similarly but prior to the publication of the new national criteria, Tianjn Environmental Protection Bureau (TEPB) has issued its own interim medical waste pollution prevention/inspection standards on August 11, 2003 (TEPB Reg. [2003] No.207), which contained the definition and classification of infectious medical waste. According to TEPB, regulated medical waste included all infectious medical waste generated from preventive

[1] Disposable sanitary devices are general disposable items used to protect human health and are directly or indirectly in contact with the patients

[2] Disposable medical equipment and devices are used for patient examination, diagnosis, or treatment and care; including syringes, gloves, suction tube, vaginal endoscope tubes, rectal endoscope tubes, tongue suppressant, towels, and others that are in contact with patient's skin and mucous

healthcare, medical procedures, and medical research activities. The infectious medical waste includes the following categories:

(1) Infectious waste – waste contains pathogens or capable of causing infectious diseases, including lab cultures and stocks, isolation waste, feces, MSW, as well as materials (sheets, mop, clothes) and medical equipment that have been in contact with infectious patients.

(2) Pathological waste – human body parts, plasma, organs, tissues, and body fluids generated from research activities or medical procedures; animal parts or carcasses from research activities.

(3) Sharps – waste capable of puncturing or causing abrasions, including disposable needles, intravenous injection needles, scalpels, knives, and broken glass.

(4) Pharmaceutical waste – waste contains drugs or medicine, including outdated and expired drugs/medicines, or substances/materials contaminated by pharmaceutical products.

(5) Mutagenic and toxic waste – waste contains toxic drugs or chemicals capable of inhibiting normal cell growth/development or causing mutagenic effects to DNA, such as chemotherapy waste.

(6) Chemical waste – chemical waste including chemical reagents from laboratories, film developing waste, and expired or discarded disinfectants or solvents.

(7) Heavy metal waste – typically refers to waste containing mercury, such as thermometers or pressure barometers.

(8) Sludge – generated from wastewater treatment processes of healthcare facilities.

TEPB subsequently adopted the PRC's national medical waste classifications as implementation guidelines for Tianjin. A comparison of regulated medical waste between the U.S. and PRC indicates similarity in majority of the waste categories, with the exception that PRC included pharmaceutical waste, chemotherapy waste, chemical waste, mercury, and wastewater sludge as part of the regulated medical waste. This is largely due to differences in the regulations, socio-economic structure, healthcare system, population distribution pattern, and cost benefit considerations. In the U.S., hazardous waste generated from the healthcare facilities are not classified as medical waste and are regulated under RCRA hazardous waste regulations. These include but are not limited to chemical solvents (xylenes, toluene, methanol, acetone, chloroform, methylene chloride, trichloroethylene, etc.); formaldehyde waste (Formalin solution used in pathology, autopsy, dialysis, nursing units, and emergency and surgery rooms); chemotherapy wastes (Chlorambucil, Cytoxin, Daunomycin, etc.); mercury, film developing chemicals used in radiology, and disinfecting solutions (glutaraldehyde). Most of the U.S. healthcare facilities also utilize local public-owned treatment works (POTW) to treat and process their sanitary waste, thus eliminating the need to operate wastewater treatment plants and handle waste sludge. Table 1 summarizes the comparisons of regulated medical waste types between PRC and the U.S.

Table 1. Comparisons of Regulated Medical Waste Categories

Waste Categories	EPA[1]-1986	EPA-1988	EPA-1997	AORN[2]	New York	California	PRC[3]
Cultures and stocks, or microbiologic wastes	√	√	√	√	√	√	√
Pathological wastes including body parts	√	√	√	√	√	√	√
Human blood, blood products, other body fluids	√	√	√	√	√	√	√
Sharps (used and/or unused)	√	√	√	√	√	√	√
Animal wastes	√	√	√	√	√	√	√
Isolation wastes	√	√	√			√	√
Selected isolation wastes only				√			
Contaminated medical equipment	√		√			√	√
Surgery wastes	√		√			√	√
Laboratory wastes/chemical	√					√	√
Dialysis wastes	√		?/√			√	√
Chemotherapy wastes						√	√
Hazardous waste due to fixatives or pharmaceuticals						√	√
Other designated categories					√	√	

NOTES: Examples of what comprises each of the above categories may differ slightly.
1 - EPA is Environmental Protection Agency, 2 - AORN is Association of Operating Room Nurses, 3 - PRC is People's Republic of China

SOURCES: EPA 1986 (Guide for Infectious Waste Management, EPA/ 530-SW-86-014, Environmental Protection Agency, Washington, DC, May 1986); EPA 1988 (Medical Waste Tracking Act of 1988, 42USC 6992); EPA 1997 (Standards of Performance for New Stationary Sources and Emission Guidelines for Exiting Sources: *HMIWI Final Rule, 40 CFR pt. 60*); AORN (AORN Position Statement, Association of Operating Room Nurses, Denver, CO, March 14,1994); NY (Public Health Law 1389 as revised by Chapter 438 of the Laws of 1993); CA (Medical Waste Management Act, California Health and Safety Code, Sections 117600-118360); PRC Ministry of Health and State Environmental Protection Administration - October 13, 2003 [Medical Waste Classification Catalog, No. (2003) 287]

3.0 CHARACTERISTICS AND COMPOSITION OF MEDICAL WASTE

Medical waste is only part of the overall hospital solid waste generated from healthcare facilities. According to a study conducted by Brunner[3] in 1996, hospital sold waste generally consisted of: 56.4% MSW, 17.5% medical waste, 10.9% corrugated cardboard, 8.5% patient waste, 3.1% paper, 2% hazardous waste, 0.4% wooden pallets, 0.4% dry cell batteries, 0.3% x-ray film, and 0.4% other waste. Regulated medical waste or infectious waste is estimated to be 15% or less of the overall waste stream.

Regulated medical waste varies significantly in it chemical (hazardous, radioactive, or non-hazardous), biological, and physical (solid, liquid, or gas) characteristics, which are similar to medical waste generation rate, determined by the type, size, and occupancy rate of the healthcare facilities. That is, general medical and surgical hospitals will generate a different quantity and mix of wastes than psychiatric or other specialty hospitals. In the U.S., regulated medical waste containing hazardous waste constituents (heavy metals, solvents, cytotoxic compounds) are to be regulated as hazardous waste under RCRA although it may also be infectious and meet the definition of a regulated medical waste.

Low-level radioactive wastes (LLW) are produced in healthcare facilities from administering radiopharmaceuticals and performing nuclear medicine and radio-immunology procedures. Generally these LLW are in small quantity (accounts for less than 5% of the total LLW

[3] C. R. Brunner, Medical Waste Disposal (Reston, VA: Incinerator Consultants Incorporated, 1966)

generated in the U.S.) and have a very short half-life. That is, typically half of the material decays to a non-radioactive form in hours or days. LLW is regulated by NRC and state regulations; therefore, medical waste containing LLW is not subject to regulations pertaining to regulated medical waste. Medical waste also exhibits biological characteristics because it contains a wide range of bacteria, viruses, and other microorganisms (e.g., mycobacteria, yeasts, fungi, parasites, and rickettsia) that are sufficiently virulent to infect human bodies if given an exposure route.

The physical characteristics (e.g., bulk density, moisture content, and heating values) of medical waste vary significantly depending on the type of waste. The following shows, in a descending order, typical physical properties of the top five medical waste categories in the U.S. Detailed information is shown in Table 2

1. Bulk density (lbs/ft^3) – sharps (450 to 500), glass (175 to 225), human anatomical (50-75), residual fluid (62 to 63), and disinfectant (48 to 62).
2. Moisture content (weight percent, %) – residual fluid (80 to 100); human anatomical (70 to 90); infected animals (60 to 90); bedding, shavings, paper, fecal matter (10 to 50); gauze, pads, swabs, garments, cellulose (0 to 30).
3. Heating vales (BTU/lb) – plastics (13,860 to 20,000); alcohol disinfectants (10,980 to 14,000); gauze, pads, swabs, garments, cellulose (5,600 to 12,000); bedding, shavings, paper, fecal matter (4,000 to 8,100); infected animals (900 to 6,400).

Table 2. Characteristics of Medical Waste

Waste Component	Bulk Density as Fired (lb/cu.ft.)	Moisture Content as Fired (weight percent)	Heating Value as Fired (Btu/lb)
Human anatomical	50-75	70-90	800-3,600
Plastics	5-144	0-1	13,860-20,000
Swabs, absorbents	5-62	0-30	5,600-12,000
Alcohol, disinfectants	48-62	0-0.2	10,980-14,000
Infected animals	30-80	60-90	900-64,000
Glass	175-225	0	0
Bedding, shavings, paper, fecal matter	20-46	10-50	4,000-8,100
Gauze, pads, swabs, garments, paper, cellulose	5-62	0-30	5,600-12,000
Sharps, needles	450-500	0-1	0-60
Fluids, residuals	62-63	80-100	0-2,000

KEY: 1 lb/cu.ft. = 16.03 kg/m^3, 1 Btu/lb = 2.324 J/g1 Btu/lb = 2.324 J/g
SOURCE: T. Milburn, "Biomedical Waste Incineration BACT Application Considerations." Proceedings of the Third National Symposium on Infectious Waste Management. Chicago, IL, April 1989, as cited in R. Barton. G. Hassel, W. Lanier, and W. Seeker. State of the Art Assessment of Medical Waste Thermal Treatment, EPA Contract 68-03-3365 and ARB Contract A832-155 (Irvine, CA: Energy & Environmental Research Corp., 1989).

Shredded infectious waste has a wide-range of bulk densities from 10 to 150 lbs/ft^3 depending on the composition; however, a value of 20 lbs/ft^3 is typically used by the waste industry. Table 3 shows the typical composition of regulated medical waste in the U.S. and a general comparison of medical waste with MSW and hazardous waste (Table 4). As can be seen, the MSW and medical wastes are similar in most of their waste composition, except that the medical waste has a higher plastic content and heating value than MSW.

Table 3. Typical Composition and Characteristics of Infectious Medical Waste

Waste Composition	
Cellulosic Material (paper & cloth)	50-70%
Plastics	20-60%
Glassware	10-20%
Fluids	1-10%
Typical Characteristics	
Moisture	8.5-17% by weight
Incombustibles	8% by weight
Heating Value	7,500 BTU/lb

NOTE: A national average for infectious waste generation of 1.38 lbs/bed/day (0.627 kg/bed/day) or 2.29lbs/patient/day (1.04 kg/patient/day).

Table 4. Comparison of Medical and Municipal Waste Compositions

Waste component	Amount in Waste (percent by weight)		
	Medical Waste	Municipal Waste	Hazardous Waste[a]
Dry cellulosic solids	45.1	54.2	0
Wet cellulosic solids	18.0	12.2	0
Plastics	14.2	7.4	12
Rubber	0.7	N/A	N/A
Solvents	N/A	N/A	58
Non-combustibles	20.4	26.2	N/A
Pathological	1.6	N/A	N/A
Heating value (Btu/lb)	6,000	4,335	6,030

NOTES: a-- For a typical commercial incinerator accepting a broad range of wastes.
1 Btu/lb = 2.324 J/g, N/A--Not Available

SOURCES: D. Campbell, "Hospital Waste Management in Canada," Proceedings of the National Workshops on Hospital Waste Incineration and Hospital Sterilization. U.S. Environmental Protection Agency, San Francisco, CA, May 1988, as cited in R.Barton, G.Hassel, W.Lanier, and W.Seeker, State of the Art Assessment of Medical Waste Thermal Treatment, EPA Contract 68-03-3365 and ARB Contract A832-155 (Irvine, CA: Energy & Environmental Research Corp., 1989).

In 2003, TEPB conducted an annual medical waste survey of 474 medical facilities within its jurisdiction area. The survey separated medical waste into five (5) major categories, including disposable medical apparatus/equipment (syringes, needles, plastic tubing), clinical waste (soiled bandages, cottons, clothes, pathological waste), medicine/pharmaceutical waste, photochemical waste, and wastewater treatment sludge. The survey results are shown in Table 5. Among the 1,564 tons of total medical waste generated per year, disposable medical apparatuses/equipment accounted for the most by weight (38.4%), followed by wastewater sludge (31.6%), clinical waste (23%), photochemical waste (6.5%), and pharmaceutical/medicine waste (0.5%). The above distributions are typical of medical waste compositions in P.R.C. since most of the medicare facilities are equipped with their own wastewater treatment plants; therefore, sludge generated from the wastewater treatment process is a significant makeup of the medical waste.

4.0 MEDICAL WASTE GENERATION RATES

Medial waste generation rate indicates the effectiveness of a medical waste management system and drives the selection as well as design of a medical waste handling/treatment process for a centralized treatment plant. An accurate inventory of current medical waste generation provides

essential information necessary for selecting the proper size and number of treatment unit. Additionally, the inventory data can be used to develop more realistic projections of future medical waste generation rates, thus allowing treatment facility expansion be considered during the initial design phase.

4.1 U.S. Medical Waste Generation Rates

Medical waste accounts for less than 2% of all municipal solid waste (MSW) produced in the U.S.[4], but its potential public health impact has made it a subject of concern. In 1990, USEPA estimated that about one million medical waste generators produced approximately 4 million tons of medical waste. Of the 4 million tons of medical waste, infectious waste made up approximately 465,600 tons or 11.6% of total medical waste. Over three-fourths (3/4) of the infectious waste, or 359,000 tons, were generated by approximately 7,100 hospitals. Ironically, they only accounted for less than 2% of the total number of hospital/medical/infectious waste generators. The remaining 23% of infectious medical waste was produced by 12,700 nursing homes (29,600 tons per year or 6.36%), 180,000 physician's offices (26,400 tons per year or 5.67%), 15,500 clinics (16,700 tons per year or 3.59%), 4,300 laboratories (15,400 tons or 3.31%), 98,400 dentist's office (7,600 tons per year or 1.63%), 38,000 veterinarians (4,600 tons per year or 0.99%), 20,400 funeral homes (3,900 tons or 0.84%), and 900 blood banks (2,400 tons or 0.52%)[5]

In the U.S., the rates of waste generated from healthcare facilities vary widely. One study of overall hospital waste conducted by USEPA found a range from 8 to 45 lbs/bed/day, with an average of 23 lbs/bed/day or 10.45 kg/bed/day[6]. For other type of healthcare facilities, the following overall waste generation rates have been reported: 5 lbs or 2.3 kg/patient/day by physician's offices, 3 lbs or 1.4 kg/person/day by nursing homes, and 0.5 lbs or 0.2 kg/patient/day by laboratories.

Rutala and associates conducted a nationwide waste generation survey of U.S. hospitals based on the number of beds[7]. The results of waste generation survey are shown in Table 5. The national average infectious/regulated medical waste generation rates in this table have been widely used by the U.S. healthcare organizations as benchmarks for evaluating their operating efficiencies.

Table 5. Hospital Waste Generation Rates (W.A. Rutala, W. Odette, and G. Samsa)

Bed Size	Total Waste				Regulated/Infectious (% of Total Waste)
	kg/bed/day	lbs/bed/day	kg/patient/day	lbs/patient/day	
<100	2.59	5.71	5.13	11.3	13.3
100 - 299	4.7	10.4	7.16	15.8	15.0
300 - 499	5.67	12.5	8.63	19.0	14.9
>500	5.83	12.8	7.69	16.9	14.9
Average	**4.18**	**9.21**	**6.93**	**15.3**	**15.0**
Regulated/Infectious Medical Waste Generation Rate (Average)					**1.38 lbs or 0.63 kg/bed/day, or 2.3 lbs or 1.04 kg/patient/day**

[4] Office of Solid waste, USEPA, Characterization of Municipal Solid Waste in the United States: 1996 Update, EPA530-R-97-015, 1997

[5] Office of Solid Waste, USEPA, First Interim Report to Congress – Medical Waste Management in the United States, 1995

[6] USEA, Hospital Waste Combustion Study: Data Gathering Phase, EPA-450/3-88-017, 1988

[7] W.A. Rutala, JAMA, Vol. 262 (12), September 1989; W.A. Rutala, W. Odette, and G. Samsa, Infectious Waste Management, 4(4), 198, 1989

4.2 Tianjin's Medical Waste Generation Rates

Based on the information provide by TEPB, Tianjin had 2,636 medical waste generators in 2003, including 486 major hospitals (Classes III, II, and I[8]) and over 2,150 convalescent homes, physical therapy clinics, out-patient services, sanatorium, specialty clinics, infirmaries, medical research/education institutes, and private clinics. The 486 major hospitals were distributed in six (6) metro districts, four (4) new districts, three (3) coastal districts, and two (2) suburban districts and three (3) counties. Although these 486 hospitals accounts for less than 19% of the total healthcare facilities, they generated over 80% of the total medical waste in Tianjin. The remaining 81% of healthcare facilities contributed only less than 20% of the overall medical waste. Other information relevant to the medical waste generation inventory including 40,090 total numbers of beds (with 38,837 or 97% associated with the 486 major hospitals), an average bed occupancy rate of 60% (or 217 days per year), 19.3 million out-patients served in 2003, and 46,000 in-patients served in 2003.

In 2003 TEPB conducted a medical waste survey for 474 healthcare facilities to determine the quantities and distribution of medical waste generated. Table 6 shows the distribution of various healthcare facilities from representative districts/counties and their surveyed medical waste generation rates. Among the 474 facilities, 439 fell under the Classes III through I major hospital category or 92.6% of total survey population. The total annual medical waste generated was 1,564 tons and of which, disposable apparatuses/equipment accounted for 38.4%, followed by wastewater sludge (31.6%), clinical waste (23%), photochemical waste (6.5%), and pharmaceutical/medicine waste (0.5%). Other observations include:

- Ranking of medical waste generation by districts (in a descending order) – six metro district (57%), three coastal districts (25%), four new districts (8%), three counties (5%), and two suburban districts (4%).
- Ranking of medial waste by quantities (in a descending order) - disposable medical apparatuses/equipment (two No. 1 and three No. 2), wastewater sludge (one No. 1, two No. 2, and two No. 3), clinical waste (two No. 1 and three No. 3), photochemical waste (five No. 4), and pharmaceutical/medicine waste (five No. 5).

Based on the assumptions that more than 80% of medical waste was generated by the 486 Classes I through III hospitals and the survey conducted in 2003 included 439 Classes I through III hospitals. The total medical waste generated during 2003 in Tianjin can be calculated as following:

Total quantities of medical waste generated in 2003 = 1,564 tons x (486/439) x (1/0.8) = 2,164 tons

With a 20% margin of error, the actual quantities could range from 1,731 tons to 2,597 tons. To calculate the equivalent weight of medical waste generation by the number of hospital bed, the following values are used.

[8] The Chinese hospital system is divided into three classes; they are, in a descending order, Class III (city or metropolitan hospitals), Class II (suburban and county hospitals), and Class I (*street/community hospitals*)

Table 6. Medical Waste Generation Survey of 474 Hospitals (Source: Tianjin EPB, 2003)

Dist. Groups	District or County Names	Medical Waste Generation (Quantities in tons /yr)																	Hospital Classes								
		Disposable Medical Waste	% of Total Waste	% Total of All 18 Dist.	Pathological Waste	% of Total Waste	% Total of All 18 Dist.	Waste Medicines	% of Total Waste	% Total of All 18 Dist.	Photo Waste	% of Total Waste	% Total of All 18 Dist.	Hospital Wastewater Sludge	% of Total Waste	% Total of All 18 Dist.	Total Medical Waste Generation	Total Quantity & % of All 18 Dist.	% Total	III	II	I	0	II & III	I, II, III	I & 0	Total II & III	Total I & 0
Inner City Six Metro Districts	Heping	108.99	32.6	19.8	41.75	12.7	16.9	0.08150	0.0	2.0	2.154	0.7	2.7	178.9	53.9	25.5	327.7755		21.0	13	5	1	0	18	19	1		
	Nankai	45.49	59.6	8.4	18.06	23.7	7.3	0.13000	0.2	3.3	6.343	8.3	7.9	6.3	8.3	0.9	76.3230		4.9	5	7	15	12	12	27	27		
	Hedong	21.8	63.0	4.0	4.13	11.9	1.7	0.75000	2.2	18.8	4.919	14.2	6.1	3	8.7	0.4	34.5990		2.2	2	4	10	1	6	16	11		
	Hebei	85.07	43.1	15.8	9.13	4.6	3.7	0.37000	0.2	9.3	28.844	14.6	35.8	73.83	37.4	10.6	197.2440		12.6	6	7	19	10	13	32	29		
	Hexi	64.06	41.6	11.9	37.78	24.5	15.3	0.32000	0.2	8.0	5.403	3.5	6.7	46.35	30.1	6.7	153.9130	894.63	9.8	8	9	12	12	17	29	24		
	Hongqiao	17.27	16.5	3.2	13.29	12.7	5.4	0.00250	0.0	0.1	3.4921	3.3	4.3	70.725	67.5	10.2	104.7796	0.57	6.7	2	4	12	0	6	18	12	72	104
			42.7	%		15.0	%		0.5	%		7.4	%		34.3	%												
Outer City Four Perimeter Districts	Dongli	4.36	8.9	0.8	19.77	40.4	8.0	0.54100	1.1	13.6	3.258	6.7	4.0	21	42.9	3.0	48.9290		3.1	1	6	0	0	7	7	0		
	Xiqing	6.2	52.7	1.2	3.71	31.5	1.5	0.20660	1.8	5.2	1.65	14.0	2.1	0	0.0	0.0	11.7666		0.8	0	7	9	0	7	16	9		
	Beicheng	8.08	20.6	1.5	12.97	33.0	5.3	0.05100	0.1	1.3	1.195	3.0	1.5		43.3	2.5	39.2960	122.02	2.5	0	3	13	0	3	16	13		
	Jinnan	7.7	35.0	1.4	5.68	25.8	2.3	0.03800	0.2	1.0	4.21	19.1	5.2	4.4	20.0	0.6	22.0280	0.08	1.4	0	2	32	0	2	34	32	19	54
			29.3	%		32.7	%		0.8	%		10.7	%		26.5	%												
Three Coastal Districts	Tanggu	67.01	64.0	12.4	13.08	12.5	5.3	0.08450	0.1	2.1	4.6965	4.5	5.8	19.605	18.9	2.9	104.6790		8.7	0	6	14	0	6	20	14		
	Hangu	9.06	36.3	1.7	7.98	32.0	3.2	0.00000	0.0	0.0	0	0.0	0.0	7.92	31.7	1.1	24.9600	396.18	1.6	0	5	3	0	5	8	3		
	Dagang	45.18	17.0	8.4	19.23	7.2	7.8	0.27000	0.1	6.8	7.46	2.8	9.3	194.4	72.9	28.0	266.5400	0.25	17.0	0	25	69	0	25	94	69	36	86
			39.1	%		17.2	%		0.1	%		2.4	%		41.2	%												
Two Suburban Districts	Wuqing	17.71	41.0	3.3	19.74	45.7	8.0	0.89000	2.1	22.4	4.82	11.2	6.0	0	0.0	0.0	43.1600	65.92	2.8	3	8	22	0	11	33	22		
	Baodi	5.98	26.3	1.1	7.09	31.1	2.9	0.00200	0.0	0.1	0.591	2.6	0.7	9.1	40.0	1.3	22.7630	0.04	1.5	0	2	18	0	2	20	18	13	40
			33.7	%		38.4	%		1.0	%		6.9	%		20.0	%												
Three Counties	Jixian	10.11	18.5	1.9	4.31	7.9	1.7	0.00000	0.0	0.0	0.13	0.2	0.2	40	73.3	5.8	54.5500		3.5	0	4	23	0	4	27	23		
	Ninghe	8.74	48.1	1.6	6.1	33.5	2.5	0.23500	1.3	5.9	1.107	6.1	1.4	2	11.0	0.3	18.1820	85.14	1.2	0	4	14	0	4	18	14		
	Jinghai	8.24	66.4	1.5	2.94	23.7	1.2	0.01000	0.1	0.3	0.215	1.7	0.3	1	8.1	0.1	12.4050	0.05	0.8	0	2	3	0	2	5	3	10	40
			44.3	%		21.7	%		0.5	%		2.7	%		30.8	%												
Total		539.05			246.74			3.88210			80.4876			693.633			1563.8927			40	110	289	35	150	439	324	150	324
Average			38.4	%		23.0	%		0.5	%		6.5	%		31.6	%				Total			474					474

Survey data showed

1. Among all the medical waste generated, disposable apparatuses consists of the largest waste by weight (38 4%) , followed by sludge (31%), pathological waste (23%), photo waste (6.5%), and medicine waste (0 5%)
2. Geographical-wise, the Inner city 6 metro districts contributed 57% of total medical waste by weight, followed by the 3 coastal districts (25%), outer city 4 perimeter districts (8%), 3 counties (5%), and 2 suburban districts (4%)
3. The inner city 6 metro districts and 3 coastal districts also have the no. 1 and no 2 of Classes III & II (72 and 36) and I & 0 (104 and 86) hospitals

0 634261 kg per bed per day 0 219 kg per bed per day (disposables only)
0.1582996 kg per person per day (both out-patients and in-patients)

- Number of bed based on a 60% or 219 days occupancy rate
- Total number of beds: 40,090

The resulting equivalent medical waste generation rates were between 0.2 and 0.3 kg/bed/day. It should be pointed out that these bed equivalent values also included wastewater treatment sludge (which accounted for nearly 32% of the total medical waste generated in the surveyed hospitals). If the wastewater sludge is removed from the calculations, the equivalent weight would be from 0.11 to 0.17 kg/bed/day. In either case, the bed equivalent weights for medical waste generation in Tianjin are within the world-wide range, but significant lower than other available values as shown in Table 7. A possible explanation is that Tianjin has implemented a more through control and waste segregation plan for its medical waste than other cities in PRC. Another interesting note is that the bed equivalent weight values are similar between Shanghai (0.12 to 0.22 kg/bed/day, based on actual weight records) and Tianjin, considering these equivalent values are mostly for disposable apparatuses and clinical waste.

Table 7. Variations of Regulated/Infectious Medical Waste Equivalent Weights

Region/Country	World-wide	Korea	Africa	North America	U.S.	China		
						Shanghai	Hongzhou	Guongzhou
Equivalent Weight of Infectious Medical Waste (kg/bed/day)	0.15 to 1.5	0.4 to 0.7	0.5 to 1.2	0.6	0.63	1 (0.12 to 0.22*)	0.6	0.8

Note: * Data provided by Shanghai HWMC in November 2003, based on medical waste treated by two local incineration facilities, primarily disposable medical apparatuses, excluding pathological and chemical wastes that were not treated by incineration

Tianjin is currently processing its regulated medical waste through Tianjin Hazardous Waste Treatment Centre (THWTC, to be discussed in the later section). The waste treatment capacity ranges from 20 to 30 tons per day, with approximately half of which (50% or 10 to 15 tons) are medical waste consisting mainly of disposable apparatuses/equipment, clinical waste, photochemical waste, and pharmaceutical/medicine waste. The remaining waste processed by THWTC is industrial/hazardous waste. Using a 0.17 kg/bed/day equivalent weight and an estimated 0.02 kg/patient for out-patient services, the daily medical waste generation rate is calculated to be 7.88 tons (6.81 tons from in-patients plus 1.07 tons from out-patients). The discrepancy between the actual treatment quantities and inventory records indicates the needs for additional and continuous medical waste surveying efforts to improve the accuracy and meaningfulness of medical waste inventory.

4.3 Facility Visit and Medical Waste Inventory Program

Several representative medicare facilities in Tianjin were visited as part of the FS, including the Tianjin First Central Hospital, Tianjin Medical University Stomatological Hospital, Tianjin Metabolism Hospital, and Tianjin Yellow River Hospital. Additionally, the project team visited Tianjin Hazardous Waste Treatment Centre, a designated medical waste treatment facility by the TEPB.

- **Tianjin First Central Hospital** – Founded in 1949, it is a top-ranking Class III (the highest local ranking based on hospital scale, service areas, and number of patient served/bed available) general hospital with over 720 beds (over 100% bed occupancy),

30 clinical departments, and five research institutes. In addition to in-hospital patients, Tianjin First Central Hospital also services approximately 1,000 out-patients per day. It was rated one of the "China's Best 100 Hospitals" in 1999. Tianjin First central Hospital generates approximately 800 kg to 1 ton of medical waste daily, consisting mainly of disposable waste (100 kg), glass apparatuses (40 kg), and pathological waste (remaining). Prior to the SARS incident, the hospital used an onsite incinerator to treat pathological waste (including organs and body parts) and transported disposable medical equipment/apparatuses to municipal landfills for disposal as MSW. After the SARS, the hospital was mandated to collect and transport all medical waste to Tianjin Hazardous Waste Treatment Centre for centralized treatment and disposal.

- **Tianjin Medical University Stomatological Hospital** – Established in 1988, the Stomatological Hospital is a Class I specialty hospital that provides both internship training for the students of Tianjin Medical University and services to the public. It currently has 50 beds and serves between 400 and 500 patients per day. The hospital typically generates three (3) to four (4) transfer boxful of medical waste daily and tracks the waste storage/shipment information via an internally developed waste tracking form. The information is then input into the regular waste manifest documentation system on a monthly basis to comply with the TEPB requirements.

- **Tianjin Metabolism Hospital** – It is a specialty hospital with 158 beds and 100% bed occupancy. Additionally, the Metabolism Hospital also services 200 to 240 out-patients per day. The facility has designated individuals in each floor to collect disinfected medical waste at 2:00 p.m. and 4:00 p.m. daily. Medical waste collected is then transported using a dedicated elevator to a centralized medical waste storage area pending offsite treatment and disposal. The Metabolism Hospital generates approximately 800 kg of medical waste per month.

- **Yellow River General Hospital** – It is a top-ranking Class II general hospital with 338 beds and approximately 75% bed occupancy, served between 600 and 700 out-patients per day, and generated approximately 150 kg of medical waste per day (consisting of 70 kg of disposable equipment/apparatuses, 10 kg of sharps, 10 kg of soiled dressing, 1 to 1.5 kg of pathological waste, and approximately 60 kg of glasses). The Yellow River General Hospital has its own radiology department, which utilizes ^{131}I isotope for Thyroid treatment. Therefore, it is equipped

with secured isotope storage and waste retention facilities. Yellow River General Hospital also has developed and promulgated an internal medical waste management policy (No. 20, 2003) in accordance with State Department Regulation No. 380 and Tianjin Department of Health Services Regulation No. 387. This policy is comprehensive, detailed, and practical; which described personnel organization and responsibilities, emergency response planning, medical waste transferring, clinical medical waste handling/management, personnel protection and responsibilities of medical waste handlers, disinfection of medical waste transportation equipment, as well as process flow diagrams of medical waste management, collection, and transportation.

- **Tianjin Hazardous Waste Treatment Centre (THWTC)** – This treatment facility was a joint venture between the Tianjing Solid Waste Treatment Centre and the French company CGEA-ONYX, a subsidiary of Vivendi (VIOLA), which encompassed approximately 70,000 square meter and an investment of over 135 million RMB (Chinese dollar, US $1 equals to RMB $8). The treatment centre was initially designed to handle industrial and hazardous waste; hence consisted of various waste treatment technologies, including physical and chemical treatment for liquid waste, solvent recovery, solidification, incineration, compaction, and landfill operation. After the SARS and since its starting operation on September 1, 2003, the treatment facility has been designated by TEPB to treat Tianjin's medical waste using its incineration and landfilling processes. The domestically manufactured rotary kiln incinerator, with a design capacity of 40 to 50 tons per day, was operated at 25 to 30 tons per day. Among the waste treated by the incinerator, approximately 50% (10 to15 tons) is medical waste, consisting mainly of disposable equipment/apparatuses, sharps, and pathological waste. Disinfected glassware or empty medicine bottles were typically crashed and buried in a lined landfill designed for disposal of industrial/hazardous waste. The treatment facility also maintained its own medical waste transportation fleet, medical waste transfer boxes, and a disinfection facility.

Section 4.2 shows a significant discrepancy between the anticipated and surveyed medical waste generation rates. The calculated bed equivalent daily medical waste generation rate of 7.88 tons is not only less than the 10 to 15 tons indicated by THWTC, but also far less than the 25 tons indicated in the TOR (Term of Reference) of this FS. Therefore, unless there is a provision of waste quantity guaranty or government subsidization due to quantity shortage, this over-estimation will greatly affect the design and operation costs (particularly under a BOT scenario when an investment return is expected) of the centralized or regional medical waste treatment facilities. The following two factors might have contributed to the discrepancy between the actual and estimated medical waste generation rates:

(1) Not all medical wastes have been treated. Since majority of the healthcare facilities in China are government-operated and the generator-pay concept has not been well received, the requirements for proper collection, storage, transport, and treatment of medical waste have created significant financial burdens to the healthcare organizations and public. As a result, some medical waste may have been inadvertently classified and

disposed of as regular MSW to reduce the cost for medical waste treatment. This can be corrected via more explicit regulations, rigorous inspection and enforcement actions, and public education. Studies have shown that the quantity of medical waste is also driven by the type of charging system. A flat cost per bed ($/bed) charging system will likely generate more medical waste (including some MSW which should not be considered as medial waste), thus ensuring the quantity and providing better control of medical waste since the waste treatment cost is not a function of waste quantity. A weight-based ($/ton) charging system is based on the generator-pay concept ("generate more and pay more") and is preferred by the treatment facility, but the risk is that some medical waste may be "mistakenly" classified as general MSW by the generators to avoid paying for higher treatment cost. A more reasonable approach may be a combination of the two, that is a flat cost per bed rate can be applied initially until an agreed-upon quantity is exceeded (e.g., 0.5 to 1 kg per bed per day, or 120% of accurate medial waste generation rate by the survey data), after which point the generator will pay the treatment facilities on the weight basis ($/kg) for any excessive waste.

TEPB has determined to use a weight-based charging rate of RMB $3/kg for treatment and disposal of medical waste (TEPB Regulation No. 214, August 22, 2003). Therefore, the impact of this set treatment cost to the change of waste quantity remains to be seen.

(2) The medical waste generation rate is low due to different medical waste definitions or existing waste segregation and minimization effort. Based on the comparison of medical waste definitions between U.S. and PRC, it appears that the Chinese medical waste generation rate "should" be higher than that of the U.S. due to inclusive of more waste categories by the PRC regulations, government-managed healthcare system, higher populations in China, and less aggressive waste minimization/reduction practices by the Chinese healthcare organization (may not be the case for Shanghai). However, based on the observation of medicare operations in Tianjin, most of the key hospitals (which are also large quantity medical waste generators) have implemented efficient and effective medical waste management system to control the generation and handling of infectious medical waste. Therefore, the actual medical waste generation rate may be lower than what has projected. For example, the surveyed infectious medical waste generation rate in the U.S. was approximately 0.63 kg/bed/day in 1989. During the past 15 years, the U.S. health organizations have initiated active waste minimization and reduction programs to reduce the quantities of infectious waste due to soaring healthcare and waste treatment costs. Although there is no official record or data available, it is reasonably to assume that today's infectious medical waste generation rate would be much less than 0.63 kg/bed/day. Similar conditions may exist in Tianjin.

In the U.S., state regulators only provide regulations, guidance, and enforcement actions for medical wastes, while the healthcare facilities (medical waste generator) are solely responsible for proper treatment and disposal of their medical wastes. The relationship between the waste generators and treatment facilities is built on a supply-demand market base. The state regulator has the jurisdiction over safe operation of the treatment facilities and the approval of treatment technologies, but would not be involved in treatment plant operation, cost, or contractual issues between the waste generators and treatment providers. This simplifies the roles and responsibilities for all parties (i.e., waste generators, treatment facilities, and regulators).

In PRC, the municipal government frequently acts as both regulator and facilitator, and sometimes as an owner or joint-venture (JV) partner of a waste treatment facility, such as the case of THWTC. Recently, PRC has aggressively promoted BOT or BOO (build-operate-own) type of infrastructure investment projects, including construction and operation of medical waste treatment facilities. These types of projects are built on the basis of Return of Investment (ROI), in which the vendor requires relatively accurate projection of the waste type and quantities for facilities design, investment capital planning, and fee calculations for return. Therefore, representative and realistic medical waste generation rate or inventory information is fundamental to a successful and sustainable medical waste management and treatment program.

The Tetra Tech team has proposed a medical waste inventory program to TEPB, which includes modification of an existing medical waste survey form and development of a joint work force (a task team) between the TEPB and Tianjin Department of Health Services (TDHS) to conduct a comprehensive medical waste survey and inventory program for all medical waste generators in Tianjin. The main components of the medical waste survey/inventory program include:

- Identification of survey and inventory program area and participants – including all registered healthcare facilities within six (6) metro districts (Heping, Nankai, Hedong, Hebei, Hexi, and Hongqiao), four (4) perimeter districts (Dongli, Xiqing, Beicheng, and Jinnan), three (3) coastal districts (Tanhgu, Hangu, and Dagang), two (2) suburban districts (Wuqing and Baodi), three counties (Jixian, Ninghe, Jinghai), Tianjin Economic Development Authority (TEDA) district, and Tianjin Port.
- Development of a mandatory medical waste survey questionnaire as shown in Table 8;
- Distribution of the survey questionnaires to all applicable healthcare facilities for completion by appropriate facility personnel who will also be held accountable for the accuracy and thoroughness of the survey information;
- Collection and analysis of the completed survey questionnaires annually for a minimum of five (5) years to establish statistical valid baseline medical waste generation data and trends of medical waste evolutions;
- Review of survey data for thoroughness, consistency, discrepancies, and waste generation trends;
- Validation of the survey results by conducting on-site visits and interviews for a statistically-significant number of healthcare facilities of each type; and
- Development and update of an electronic medical waste generator inventory database based on the information provided in the survey questionnaires.

Upon completing the initial medical waste survey and inventory program, the "medical waste generators or registrants" are required to update the survey information annually. This allows the joint task force to evaluate the changes or trends of medical waste generation activities and adjust regulations as necessary.

Table 8. Medical Waste Survey Form (1 of 2)

Daily Medical Waste Generation and Transferring Record									
Survey Registration No.									
Name of Healthcare Facility									
Month, Year									
Days	Date	Quantites by Weight (kg/ton)					Name of Medical Waste Handlers		Waste Transferring Time
		Disposables	Sharps	Pathological, Cultures, Specimen	Pharmaceutical and Chemical	Sludge	Hospital	Transporter	
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									
26									
27									
28									
29									
30									
31									
Name and Signature of Reviewer (Monthly)									

1. Weight **must be based on actual measurements**
2. This form must be completed daily by the waste handler (or during the collection and storage of medical waste) and monthly by the designated reviewer

Table 8. Medical Waste Survey Form (2 of 2)

General Information						
Survey Registration No.						
Name of Healthcare Facility						
Type of Healthcare Facility (General/Specialty)						
Class			Ranking			
Address						
Person in Charge						
Phone No.			Fax No.		e-mail	
No. of Bed			Bed Occupancy Rate (%, annual)			
No. of In-patients (annual)			No. of Out-patients (annual)			
Medical and Other Wastes Generation/Handling						
1. Disposable Materials (soiled dressing, cotton balls, swaps, cotton strips, and bandages; sponges; gowns; gloves; etc.) and Medical Equipment (plastic syrings, injection tubing, etc.) Contaminated with Patient's Blood, Body fluid, and Excretion; Including those from Isolation Patients						
Onsite Disinfection/Destruction	Yes		Explain			
	No		Explain			
Waste Generation Rate (kg/ton)	Monthly			Annually		
Waste Storage	Container Type		Refrigerated or Rm Temp.		Storage Time	
Waste Treatment	Onsite			Offsite		
Treatment Method	Incineration		Others			
2. Sharps (needles, scalpels, knifes, scrapers, glass and cover slides, glass test tubes, and ampoules, etc.)						
Onsite Disinfection/Destruction	Yes		Explain			
	No		Explain			
Waste Generation Rate (kg/ton)	Monthly			Annually		
Waste Storage	Container Type		Refrigerated or Rm Temp.		Storage Time	
Treatment	Onsite			Offsite		
Treatment Method	Incineration		Others			
3. Pathological Waste (human tissues, organs, body parts, and discarded animal carcasses/bodies, etc.), Cultures, Biological Stocks, and Medical Specimen						
Onsite Disinfection/Destruction	Yes		Explain			
	No		Explain			
Waste Generation Rate (kg/ton)	Monthly			Annually		
Waste Storage	Container Type		Refrigerated or Rm Temp.		Storage Time	
Treatment	Onsite			Offsite		
Treatment Method	Incineration		Others			
4. Pharmaceutical Waste (outdated or contaminated pharmaceutical products) and Chemical Waste						
Waste Generation Rate (kg/ton)	Monthly			Annually		
Waste Storage	Container Type		Refrigerated or Rm Temp.		Storage Time	
Treatment	Onsite			Offsite		
Treatment Method	Incineration		Others			
5. Wastewater Treatment Sludge						
Waste Generation Rate (kg/ton)	Monthly			Annually		
Waste Storage	Container Type		Refrigerated or Rm Temp.		Storage Time	
Treatment	Onsite			Offsite		
Treatment Method	Incineration		Others			
Total Annual Medical Waste Generation						
Total Annual Quantity Based on Facility Records						
Total Annual Quantity Based on Manifests						
Certification						
Person Complete the Survey			Signature		Date	
Reviewer			Signature		Date	

5.0 DEVELOPMENT OF AN EFFECTIVE MEDICAL WASTE MANAGEMENT SYSTEM

The success or failure of the medical waste program depends, to a large extent, on the policy and management systems currently in place. The key activities for an effective medical waste management system include legislation, regulation, administration, and enforcement. In the U.S., the 1989 MWTA enabled the USEPA to develop and promulgate regulations, on the federal level, to manage infectious waste. The regulations are entered into the Federal Register (40 CFR Parts 22 and 259) as federal regulations. Other federal agencies also published requirements for medical waste in their specific jurisdictions (transportation, occupational safety) and had the administrative and enforcement authorities for the federal laws/regulations, including:

- Department of Transportation HAZMAT (DOTRSPA), which regulates interstate medical waste transportation and provides uniform transportation standards (medical waste tracking requirements) and packaging standards
- Food and Drug Administration (FDA), which regulates medical devices such as sharps containers that are designed for safe containment of waste or used needles
- Nuclear Regulatory Commission (NRC), which regulates some of the radioactive medical waste
- Occupational Safety & Health Administration (OSHA), which regulates medical waste in the workplace, including exposure to bloodborne pathogens
- U.S. Postal Services (USPS), which regulates medical waste in the postal system

Under the framework of federal regulations, forty-three (43) states have developed their own medical waste regulations and management program. Although similar in their context, each state has it own interpretation, jurisdiction system, and guidelines pertaining to infectious or regulated medical waste. The California State Department of Health Services (CDHS) developed and administered the "California Medical Waste Management Program" as mandated by the Medical Waste Management Act (California Health and Safety Code Sections 117600-118360); whereas New Jersey Department of Environmental Protection (NJDEP) and New Jersey Department of Health and Senior Services (NJDHSS) jointly developed and implemented "Regulated Medical Waste (RMW) regulations" under N.J.A.C. 7:26, Subchapter 3A. Under Chapter 438 of the New York State Laws (which amended the Environmental Conservation Law and Public Health Laws concerning regulated medical waste in New York State), New York State Department of Health (NYDOH) and New York State Department of Environmental Conservation (NYDEC) developed their prospective interpretive guidelines and jointly administered New York State's regulated medical waste (RMW) program. In the event of a joint-regulatory situation, the department of health typically has jurisdiction over on-site treatment, storage, and destruction processes operated by healthcare facilities; as well as development of treatment standards, approval of alternative medical waste treatment technologies, and investigation of physical injury associated with exposure to regulated medical waste. The department of environmental protection has jurisdiction over generator's tracking program; offsite transportation of treated and untreated medical waste; offsite transfer, storage,

and treatment/disposal of regulated/infectious waste; and illegal/unauthorized dumping of regulated medical waste.

An important concept in developing an effective and sustainable regulatory medical waste management program is to collaborate with the healthcare communities - an example is the partnership between the California State Department of Health Services (CDHS) and California Hospital Association (which is an affiliation of California healthcare providers). This allows the regulator to deal with a unified voice that represents the majority of the healthcare organizations on medical waste regulations and management issues. In some cases, the "healthcare associations" have been given authority by its members to provide not only technical assistance but also certification on regulatory compliance or waste management practices. This model can be leveraged by SEPB-HWMC during the process of developing Shanghai's medical waste survey and inventory program as well as "Medical Waste Consolidation, Treatment, and Pollution Control Guidelines."

The following are key factors for an effective medical waste management system:

- Clear objective and reasoning for the legislation, empowering appropriate regulatory agency or agencies to develop regulations and/or standards.
- Adequate and thorough regulations/standards that cover the entirety of the legislation with incorporation of public and expert comments.
- Clear administrative and enforcement responsibilities for multi-lateral regulatory agencies.
- Effective implementation and enforcement actions in conjunction with public education programs.
- Affordable but financially viable charging system to sustain the administration and operation of medical waste management system.

Environmental measures intended to protect the public health and environment are imbedded in the administrative, technical, and enforcement components of the medical waste management program. Examples for the administrative measures include registration and permit requirements, manifest tracking system from generators to treatment/disposal facilities; technical measures include treatment of infectious waste prior to disposal, specs for waste containment/storage/treatment; and enforcement measures include inspection, certification, fines, and lawsuits.

As indicated before, the federal guidelines set minimum standards that each state has to meet, and each state manages their own programs. Medical waste management programs from states vary in complexity and scope, but all have common elements critical to a successful program. Described below are the basic key elements that have to be addressed from the legal, regulatory, and enforcement side of the medical waste management system:

1) Governing Definitions provide explicit explanations of regulatory and technical terms used in the medical waste management program.

2) Powers and Duties of the Regional/Local Regulatory Agency divide the jurisdictions and administrative responsibilities of various state and local regulatory agencies.

3) Goals/Objectives of the Medical Waste Management Program clearly state the purposes of the program, for the protection of public health, welfare, and the environment.

4) Funding Sources/Financing describes the mechanism used to develop and maintain the functionality of the medical waste management program as well as any publicly operated treatment, storage, disposal facilities.

5) Enforcement Authority provides regulatory agencies the enforcement and inspection authorities for non-compliance conditions as well as legal and financial penalties for the violators (generators, transporters, TSD facilities).

6) Database of Registrants specify registration requirements and information to be provided by the waste generators.

7) Requirements for Large and Small Quantity Generators (LQG and SQG)
   a. Definitions and Limitations
   b. Registration
   c. Management Plans
   d. Treatment Records; Waste Tracking and Documentation Requirements
   e. Containment and Storage Requirements
   f. Waste Treatment Requirements
   g. Fee Schedule

8) Requirements for Transporters/Haulers
   a. Registration
   b. Exemption
   c. Tracking Documents
   d. Fee Schedule

9) Requirements for Transfer Stations and Common Storage Facilities
   a. Permit Requirements
   b. Containment and Storage Requirements
   c. Record-keeping Requirements
   d. Fee Schedule

10) Requirements for Medical Waste Treatment Facility
   a. Permit Requirements
   b. On-Site and Off-Site Requirements
   c. Record-keeping Requirements
   d. Facility Inspections
   e. Containment and Storage Requirements for Treatment Facilities
   f. Treatment Technology Requirements
   g. Security and Warning Sign Requirements
   h. Emergency Procedures
   i. Fee Schedule

11) Methods of Treatment list treatment and disposal technologies approved for various medical waste, their respective treatment specifications/standards, emergency action plan, and evaluation for alternative technologies.

12) General Technical Containment and Storage Requirements specify medical waste and RMW storage requirements under various conditions as well as decontamination for reusable containers.

13) Home-Generated Medical Wastes and Consolidation Points describe the types and quantities of home-generated medical waste as well as its transportation and disposal methods.

14) Trauma Scene Medical Waste Management provides registration requirements, list, and fee schedule for trauma scene waste management practitioners as well as requirements for removing, transporting, and storing trauma scene waste.

15) Permit Suspension or Revocation provides conditions and proceedings for temporary or permanent suspension or revocation of any medical waste permits.

16) Waste Minimization and Reduction provides regulatory technical assistances and incentives for waste minimization/reduction practices.

Appendix A contains copies of medical waste management program/guidelines from the States of California and New Jersey as reference document.

As the regulators are responsible for developing and implementing a sustainable medical waste management plan for the states, it is also customary for them to work with or provide technical assistance to the healthcare organizations to develop workable medical waste management plan for the healthcare industries following specific steps described below.

1) Understanding the Federal, State, and Local Laws and Regulations Governing Medical Waste – This is essential for any healthcare providers that generate regulated medical waste as the laws and regulations specify the definitions, handling, storage, transportation, and disposal/treatment requirements for regulated medical waste.

2) Understanding the Current Waste Handling System at the Facility – These include where the waste is generated; what types of regulated medical waste are generated; how it is handled, stored, and transported through the facility; and how it is transported and treated offsite or treated onsite. Flow charting the waste stream through the facility is particularly beneficial in understanding the various points of waste generation and temporary storage, as well as taking all other variables into account. Once the flow of medical waste through the facility is understood, handling and record-keeping practices for the waste stream need to be evaluated against the law/regulation requirements. The final evaluation consists of meeting or complying with the needs of the organization, such as cost effectiveness or corporate image/mandates.

3) Designing the Plan for the Needs of the Facility – The medical waste management plan must be able to meet the existing and future needs of the healthcare facility. In addition to handle the current waste stream as defined through steps 1) and 2), the plan must have sufficient capacity to handle the varied components of the waste stream. If onsite treatment is provided, the plan must have backup system or contingency plan developed in the event of main treatment equipment breakdown or is taken out of service for maintenance. The plan must also have provisions to handle partially treated waste and untreated waste, as well as appropriate documentation and disposal options during emergency conditions.

4) Following Appropriate and Available Regulatory Plan Guidelines – Certain states have developed guidelines or checklist to assist medical waste generators in preparing medical waste management plan, which can be a useful tool and should be referenced if available. A checklist developed by the CDHS and a sample medical waste management plan are provided in Appendix B.

5) Developing Training to Communicate the Plan – The medical waste management plan developed and adapted by the administration of the healthcare facility must be communicated to all employees via a training program.

6) Evaluating the Effectiveness of the Plan – The medical waste management plan needs to be reviewed for effectiveness and updated periodically by a dedicated team. One way of improving the effectiveness is for the facility to identify desired outcomes and develop a vision for how the medical waste system should look when it is optimally operated. Ideally the medical waste handling system should be analyzed to determine what critical factors contribute to its successful operation and towards fulfilling the vision of the desired outcomes. The critical factors should be measured where possible on a rutine basis and placed in a database. Objectives can be developed based on these measurements utilizing the concepts of statistical process control (SPC) to verify whether the system or a component of the system is in or out of control. Managers and those involved with operating the various components of the medical waste management system should determine the protocols to measure and monitor their respective components of the system.

6.0 MEDICAL WASTE HANDLING AND TREATMENT IN U.S.

Medical waste is generally segregated and placed into appropriate waste containers at the point of generation. Healthcare organizations seldom conduct any pre-treatment or disinfection of medical waste prior to onsite or offsite treatment. Except for sharps and fluids, infectious medical wastes are generally placed in plastic bags, plastic-lined cardboard boxes, or other leak-proof containers that meet specific performance standards. In the U.S., red or orange bags are commonly used to contain infectious medical waste, while general waste is placed in black, white, or clear bags. Sharps containers must be rigid, leak-proof, break-resistant, and puncture resistant. Several different types of medical waste containers are available in the market, including but may not be limited to: red bags; reusable or disposable sharps containers with various lid types (e.g., straight drop, mail box drop, torturous path, and lab lid); chemotherapy or cytotoxic containers; pharmaceutical containers; and red anatomical containers for pathological medical waste. All of the medical waste containers are required to have clear biohazard label and identification of their contents. If medical waste is to be transported for offsite treatment, it will be placed in rigid, durable, secured, and leak-resistant transfer boxes typically provided by the treatment facilities

Some states consider containers with blood or body fluid exceeding a fixed volume (i.e., 20 to 50 mL) a regulated medical waste, while other states have no volume specifications. As far as chemotherapy waste is concerned, most states follow the 1987 USEPA "empty container" criterion that is, a container with less than 1 inch by volume or 3% by weight of chemotherapy agent residue is considered to be an empty container. Similar criterion has been applied to other pharmaceutical waste containers. Tubing used for intravenous injection is generally cut at

approximately 3 inches above the injection needle, with the lower portion attached to the needle being handled as sharps waste.

Although World Health Organization (WHO) suggests maximum storage time[9] for medical waste to prevent putrefaction, most states in the U.S. do not specify the maximum storage time or conditions (e.g., room temperature or refrigerated) for onsite storage of medical wastes, except that it must be maintained in non-putrescent state for its integrity (including labels and markings) as well as free of nuisance or noxious odors, vermin and insects, and standing liquid. California is one of the few states that imposes different maximum allowable storage times for onsite generators and offsite facilities based on the amount of waste generated and the conditions that the waste is stored (above or below 0°C):

- A generator produces less than 20 lbs biohazardous and sharps waste per month has a maximum allowable onsite storage time of 30 days at a storage temperature greater than 0°C. Conversely, a generator produces 20 lbs or more biohazardous and sharps waste per month has a maximum allowable onsite storage time of 7 days under the same condition.
- A generator can store biohazardous and sharps waste onsite up to 90 days under a 0°C storage condition.
- The maximum allowable storage time for biohazardous and sharps waste at a transfer station is 30 days, at or below 0°C.
- The maximum allowable storage time for an offsite storage (away from the generator) or treatment facility is 7 days, below 0°C.
- The above storage time is contingent upon the physical conditions of the waste (without offensive odors or causing public nuisance).

Depending on the requirements, some states (e.g., North Carolina, New York State) do not require medical waste generators to register with the state regulatory agency, whereas other states require all (New Jersey) or selected (California, small quantity generators that operate onsite treatment processes and all large quantity generators) medical waste generator to register for either leveraging fees or gaining better management control.
Most, but not all states require that certain medical waste tracking forms be completed by the waste generators and accompanied with the waste during its transportation to an offsite transfer station or treatment facility. The medical waste tracking form generally includes, but may not be limited to information such as:

- The name, address, phone number, contact, and registration number (if applicable) of the medical waste generator
- The name, address, phone number, and registration number and expiration date of the transporter
- The types and quantities of medical waste transported
- The dates of waste generated or consolidated, waste removed from the generator's facility, waste received by the transfer station, and waste received by the treatment facility

[9] Maximum storage time for medical waste as suggested by WHO: 72 hours in winter and 48 hours in summer for temperate climates; 48 hours in the cool season and 24 hours in the hot season for warm climates

- The name, address, telephone number, permit number, and the signature of an authorized personnel of the treatment facility receiving the medical waste.

Additionally, most but not all states require that the haulers who transport regulated medical waste be hazardous waste-licensed or registered with the state regulatory agency as regulated medical waste haulers (some states exclude small quantity waste haulers from this requirement). Generators and transporters are generally required to submit copies of medical waste tracking forms or summary reports to the regulatory agency governing regulated medical waste on a semi-annual or annual basis.

Transportation of packaged medical waste to offsite treatment facilities is generally conducted by enclosed, flat-bed trucks. DOT does not have any special technical specifications or requirements for medical waste transportation vehicle, except for the posting of biohazard labels.

Various treatment technologies have been evaluated by the USEPA and state regulatory agencies. In the first two interim reports USEPA was required to submit to Congress under the MWTA, the agency identified nine technologies, either existing or potentially available, for the treatment of infectious medical waste:

- incineration,
- autoclaving,
- gas sterilization,
- chemical disinfection with grinding,
- thermal inactivation,
- irradiation,
- microwave treatment,
- grinding and shredding, and
- compaction.

The Office of Technology Assessment (OTA) also identified other potential treatment methods, including thermal destruction in molton glass furnaces, electrohydraulic disinfection, pulse-power technology, plasma torch technology, pyrolysis, electrocatalytic oxidation, steam sterilization combined with dry grinding and shredding, and thermal inactivation (dry heat sterilization) combined with shredding or compaction.

Currently, USEPA and most states accept several proven technologies, including incineration and alternative treatment methods such as steam autoclave, microwave irradiation, chemical or mechanical/chemical treatment, and radiofrequency irradiation for treatment of infectious/regulated medical waste. Draft fact sheets regarding these alternative treatment technologies and their performance guidelines prepared by USEPA are provided in Appendix C. However, some states may require case-to-case approval or, at least, technology demonstration for the not-so-widely used microwave/radiofrequency irradiation methods and other innovative technologies (including variations from the typical approved technologies such as the so-called advanced or high efficiency autoclaves). Many treatment process vendors have already acquired formal approvals or certificates of acceptance for their treatment processes in multiple states, which will aid to the permitting or regulatory approval process at new locations. Appendix D provides lists of alternative treatment technologies that have been approved by the States of

California, North Carolina, and New York. Solid medical waste after being treated and meet the regulatory standards are typically disposed of at municipal landfills as regular MSW, bulk blood, body fluids, and small quantities of pathological wastes that are liquefied or suspended in liquids can be discharged into sanitary sewer, septic, or municipal sewer system after proper treatment and rendering it non-infectious pursuant to Section 307(b) through (d) of the Clean Water Act.

Table 9 provides a summary of 1998 state regulatory survey on medical waste management approach. It should be pointed out that some states may have changed their regulatory requirements since then. This table shows that not all states require medical waste be treated prior to landfilling or rendered unrecognizable (e.g., change of physical shape). Some states only require that human tissues be made unrecognizable. Many states, however, require that sharps be broken or ground up, made unusable, and/or packaged in puncture-resistant containers. A few states also prescribe specific treatment process for certain types of waste. For examples, chemotherapy waste can only be incinerated or anatomical parts can only be incinerated, cremated, or interred.

State regulations for treating pathological waste are generally more stringent and may require specific treatment method(s) such as incineration, cremation, interment, or sterilization followed by grinding or shredding to render the waste unrecognizable.

Prior to the MWTA in 1989, most non-infectious medical waste is disposed of directly at municipal landfills without prior treatment. Most infectious medical waste is either incinerated (onsite or offsite) or steam sterilized (onsite). The American Hospital Association reported in 1983 that 67% of U.S. hospitals used onsite incinerators, 16% used steam sterilization (autoclave) followed by landfilling, and 15% used offsite treatment to dispose of their medical waste[10] By the mid-1990's, due to more stringent state regulations limiting emissions from medical waste incinerators, USEPA estimated that less than half (<50%) of the hospitals operated onsite medical waste incinerators. Moreover, USEPA estimated that 95% of other healthcare facilities such as nursing homes, out-patient clinics, and doctor and dentist offices no longer operate onsite medical waste incinerators. Instead, many of these medical waste generators switched to either onsite treatment by autoclaving or offsite treatment in large regional commercial treatment facilities. Barton and associates estimated that 90% or more of existing, onsite incinerators in New York State and California would likely be retired in the 1990's as these states adopted more stringent air emission standards for medical waste incinerators[11]. The California Air Resource Board (CARB) indicated that nearly 80% of the hospitals in California used alternative treatment technologies to on-site incineration[12]. The percent of medical waste treated by onsite or offsite incinerators is expected to decline even further after 2002, when the USEPA's new source performance standards (NSPS) for medical waste incinerators became effective and enforceable. In fact, currently there is no incineration process in California for treating medical waste.

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[10] OTA background paper, *supra* note 27, at 1 (citing W. Rutala & F. Sarubbi, *Management of Infectious Waste from Hospitals* 4(4), in Infectious Waste Management, 1983

[11] Barton, R., Hassel, G., Lanier, W., and Seeker, W., "*State of the Art Assessment of Medical Waste Thermal Treatment,*" EPA Contract 68-03-3365 and ARB Contract A832-155, 1989

[12] Fry, B., "*Air Toxics and Medical Waste Incinerators,*" Incineration Conference, UC-Irvine and Co-sponsor, San Diego, CA, May, 1990

Table 9. Summary of Medical Waste Management by Various States in the U.S.

States	Specific Medical Waste Regulations?	Approved Alternative Technologies?	Landfilling of Untreated Waste Allowed	Medical Waste Must be Rendered Unrecognizable?
Alabama	Y	Y	N	Y*
Alaska	Y	N	N	N
Arizona	N	N	Y	N
Arkansas	Y	N	N	Y
California	Y	Y	N	N
Colorado	Y	N	Y	N
Connecticut	Y	Y	N	Y
Delaware	Y	Y	N	Y
Washington D.C	N	N	N	N
Florida	Y	Y	N	N*
Georgia	Y	Y	Y	N
Hawaii	Y	N	N	N
Idaho	N	N	Y	N
Illinois	Y	Y	N	N
Indiana	Y	N	N	N
Iowa	N	Y	N	Y
Kansas	Y	Y	Y	N
Kentucky	Y	N	-	-
Louisiana	Y	Y	N	Y*
Maine	Y	N	N	Y
Maryland	Y	Y	N	Y*
Massachusetts	Y	Y	N	N
Michigan	Y	Y	Y	Y*
Minnesota	Y	Y	N	N
Mississippi	N	N	N	N
Missouri	Y	N	N	N
Montana	Y	Y	N	Y*
Nebraska	Y	Y	Y*	-
Nevada	Y	N	Y	N
New Hampshire	Y	N	N	N
New Jersey	Y	Y	N	Y
New Mexico	Y	Y	N	N
New York	Y	Y	N	N
North Carolina	Y	Y	Y	N
North Dakota	Y	N	N	N
Ohio	Y	Y	Y	N
Oklahoma	Y	N	N	N
Oregon	Y	Y	Y*	N
Pennsylvania	Y	Y	N	N
Rhode Island	Y	Y	N	Y
South Carolina	Y	Y	Y	N
South Dakota	Y	N	N	N
Tennessee	N	N	N	Y
Texas	Y	Y	N	Y
Utah	Y	N	Y	N
Vermont	Y	N	N	N
Virginia	Y	Y	N	Y
Washington	N	N	Y	N
West Virginia	Y	Y	N	N
Wisconsin	Y	Y	N	Y
Wyoming	N	N	Y	N

NOTES: Y = yes, N = no, - = not available, * some types, sharps
SOURCE: "Medical Waste Still Healthy After All These Years," Dee Naquin, Waste Age, Vol. 29, No. 7, July 1998.

Although incineration process has the advantages of significant volume reduction (by about 90%), assured destruction, sterilization, weight reduction, and the ability to treat most types of

wastes with little or no pre-treatment requirements; its popularity for treating regulated/infectious medical waste has steadily decreased in recent years due to the following reasons.

1. Increasing public concerns about toxic emissions and hazardous residues generated by incineration. Incinerators (including those burn medical waste) are known to produce emissions of dioxins/furans, particulate matter (PM), metals (cadmium, lead, and mercury), acid gases (HCl and SO_2), and NO_x as well as bottom ash containing heavy metals, dioxins/furans, and other toxic substances that have the potential to harm human health and ecosystems when they are released into the environment. Dioxins and heavy metals have been linked to cancers, immune system disorders, birth defects, and other health effects. Medical waste incinerators have been identified as a leading source of dioxin and mercury in the environment.

2. Increasing cost due to the needs for pollution control equipment to meet new emission standards and permit requirements. Prior to 1997, there were no federal regulations governing air emissions from medical waste incinerators. The 1990 Clean Air Act (CAA) Amendment added Section 129, requiring USEPA to establish NSPS for new solid waste (including hospital/medical/infectious waste) combustion units and to establish emission guidelines for existing units; which resulted in the development and promulgation of the 1997 USEPA Final Rules. Under the regulation, medical waste incinerators must meet the emission limits and be permitted within a year after the USEPA approval of its state's implementation plan or, if its state does not have a control plan, in keeping with the federal implementation deadline by September 2000 (36 months after the promulgation of Final Rules). Regardless of which plan applies, all existing (defined as units built on or before June 30, 1996) and new incinerator units must be in full compliance with their respective emission standards by September 2002 (five years after the promulgation of Final Rules).

   To meet the new emission standards, medical waste incinerators will need to install air pollution control devices such as wet scrubbers or wet scrubbers with dry injection/fabric filter system with carbon, depending on the size of the unit. Some older incinerators may be required to retrofit their secondary combustion chambers to achieve "good combustion." The new regulations also require routine monitoring of stack emissions and operating parameters; as well as operator training/qualification, inspection, waste management plan, reporting, and recordkeeping activities. All of these could cause a significant increase of the treatment cost by onsite incineration and render it less attractive. Table 10 shows the level of MACT (Maximum Achievable Control Technology) recommended by USEPA for various sizes of medical waste incinerators. Table 11 shows the emission standards promulgated by USEPA for various sizes of medical waste incinerators. Table 12 provides operating parameters to be monitored and minimum measurement and recording frequency for the medical waste incinerators. However, the following combustion units are excluded from the NSPS list: co-fired combustors, combustors of hazardous waste, municipal waste combustors, pyrolysis units, and cement kilns

Table 10. Levels of Air Pollution Control Associated with Each Regulatory Option for New Hospital/Medical/Infectious Waste Incinerators

Types of HWIW Incinerators	Regulatory Options		
	1	2	3
Small 200 lb/hr	Good combustion and moderate efficiency wet scrubber	Good combustion and moderate efficiency wet scrubber	Good combustion and high efficiency wet scrubber
Medium 201-500 lb/hr	Good combustion, dry injection/fabric filter system, and high efficiency wet scrubber	Good combustion, dry injection/fabric filter system with carbon, and high efficiency wet scrubber	Good combustion, dry injection/fabric filter system with carbon, and high efficiency wet scrubber
Large > 500 lb/hr	Good combustion, dry injection/fabric filter system with carbon, and high efficiency wet scrubber	Good combustion, dry injection/fabric filter system with carbon, and high efficiency wet scrubber	Good combustion, dry injection/fabric filter system with carbon, and high efficiency wet scrubber

Table 11. 1997 EPA Emission Limits for New Hospital/Medical/Infectious Waste Incinerators

Pollutants	Emission Limits at 7% Oxygen Content		
	Small ≥ 200 lbs/hr	Medium Between 201 and 500 lbs/hr	Large 500 lbs/hr < Capacity
Particulate Matter	69 mg/dscm	34 mg/dscm	34 mg/dscm
Carbon Monoxide	40 ppmv	40 ppmv	40 ppmv
Dioxins/Furans	125 ng/dscm total or 2.3 ng/dscm TEQ	25 ng/dscm total or 0.6 ng/dscm TEQ	25 ng/dscm total or 0.6 ng/dscm TEQ
Hydrogen Chloride	15 ppm or 99% reduction	15 ppmv or 99% reduction	15 ppmv or 99% reduction
Sulfur Dioxide	55 ppmv	55 ppmv	55 ppmv
Nitrogen Oxides	250 ppmv	250 ppmv	250 ppmv
Lead	1.2 mg/dscm or 70% reduction	0.07 mg/dscm or 98% reduction	0.07 mg/dscm or 98% reduction
Cadmium	0.16 mg/dscm or 65% reduction	0.04 mg/dscm or 90% reduction	0.04 mg/dscm or 90% reduction
Mercury	0.55 mg/dscm or 85% reduction	0.55 mg/dscm or 85% reduction	0.55 mg/dscm or 85% reduction

NOTES: mg = milligrams, dscm = dry standard cubic meter, ppmv = parts per million by volume, ng = nanograms, TEQ = toxic equivalent, In addition, new incinerators are subject to a 5% visible emission limit for fugitive emissions generated during ash handling and a 10% stack opacity limit

3. Increasing siting and permitting difficulties associated with locating new incineration facilities. This is primarily caused by the first two reasons. Siting and construction of new incineration facilities are subject to more stringent public scrutiny and regulatory approval, including extensive environmental impact studies and public hearing process, which can be time-consuming and costly.

4. Increasing availability and commercialization of non-incineration treatment alternatives. The development and application of non-incineration alternatives to treat regulated medical waste have been evolved from conceptual design and/or pilot test to full-size commercialization stage in the last 10 to 15 years. These alternative technologies have one or more of the following advantages over the incineration: (a) environmental and public health friendly due to less harmful emissions or waste byproducts, (b) cost effective and yet able to meet the required treatment standards for public health protection, or (c) capable of generating reusable treatment products. Examples are the next generation advanced autoclave units, steam sterilization in conjunction with grinding or shredding, microwave disinfection, radiofrequency disinfection, pyrolysis oxidation, plasma arc oxidation, molton glass technology, thermal depolymerization, laser technology, and superheated steam or water treatment process, to name a few. Some of these alternative technologies have been used in other industries with sufficient maturity and have gone through extensive regulatory demonstrations for their efficacy in treating medical waste.

Table 12. Operating Parameters to be Monitored and Minimum Measurement and Recording Frequencies for Hospital/Medical/Infectious Waste Incinerators

Operating Parameters to be Monitored		Minimum Frequency		Control System		
		Data Measurement	Data Recording	Dry Scrubber Followed by Fabric Filter	Wet Scrubber	Dry Scrubber followed by Fabric Filter and Wet Scrubber
Maximum Operating Parameters	Maximum Charge Rate	Continuous	1 x hour	yes	Yes	N/A
	Maximum Fabric Filter Inlet Temperature	Continuous	1 x minute	Yes	N/A	Yes
	Maximum Flue Gas Temperature	Continuous	1 x minute	Yes	N/A	N/A
Minimum Operating Parameters	Minimum Secondary Chamber Temperature	Continuous	1 x minute	Yes	Yes	N/A
	Minimum Dioxin/ Furan Sorbent Flow Rate	Hourly	1 x hour	Yes	N/A	N/A
	Minimum HCl Sorbent Flow Rate	Hourly	1 x hour	N/A	N/A	N/A
	Minimum Mercury (Hg) Sorbent Flow Rate	Hourly	1 x hour	N/A	N/A	N/A
	Minimum Pressure Drop Across the Wet Scrubber or Minimum Horsepower or Amperage to Wet Scrubber	Continuous	1 x minute	N/A	Yes	Yes
	Minimum Scrubber Liquor Flow Rate	Continuous	1 x minute	N/A	Yes	Yes
	Minimum Scrubber Liquor pH	Continuous	1 x minute	N/A	Yes	Yes

NOTES: N/A = Not Applicable

5. Increasing awareness of resource conservation, recycling, and re-use by the public and healthcare organizations promote non-destructive medical waste treatment options. Typical examples are reformulation of the treated medical waste as supplemental fuel for the power industry; re-use of waste energy via a heat recovery unit for steam/hot water generation or as supplemental fuel for industrial boiler operations; recycling of treated waste plastics for manufacturing industrial-grade, reusable transfer containers for medical or other MSW waste; or use of treatment product as substitutes for road base material, sandblast grit, or iron ore in cement industry.

Based on information provided by Health Care Without Harm (HCWH), a non-government organization (NGO) campaign network with 423 organization in 51 countries, the number of medical waste incinerators has dropped from approximately 6,200 in 1988 to 115 in 2003, a reduction rate of over 98% in the U.S. The number of medical waste incinerator is expected to be further reduced in the next five years with the approval of other non-incineration treatment alternatives[13]. However, HCWH also noted an opposite trend in developing countries and countries in transition, primarily due to less stringent air emission requirements or lacking of

[13] J. Emmanuel, G. McRae, J. Weinberg, F. Mahmoudi, "Promoting Best Practices to Reduce Health Care Waste and Avoid Dioxin and Mercury Releases – Summary of a GEF Concept Paper," Health Care Without Harm, June 17, 2003

monitoring and regulatory enforcement structures. Photographs of medical waste handing and treatment processes used at selected U.S. healthcare and treatment facilities are provided in Photo Logs #1 through #3.

7.0 MEDICAL WASTE MANAGEMENT AND TREATMENT IN PRC

Although with a shorter history and less sophisticated management system than the U.S., PRC has had its own basic regulatory frame work, policies, and management programs for medical waste. To a certain extent, PRC has more stringent and less flexible regulations for medical waste handling, storage, and treatment comparing to the U.S. The regulatory frame work in PRC is that the central government develops and promulgates national policies and regulatory guidelines, while the provincial and local governments implement and enforce such policies and regulations. This is different from the U.S. in that the federal government authorizes each state to develop its own medical waste management program and regulations according to the local needs.

The following provides a list of selected rules and regulations promulgated by the PRC central government agencies for medical waste. Appendix E contains copies of Chinese versions of these regulations.

- *People's Republic of China (PRC) Prevention of Infectious Diseases*, February 12, 1989
- *Technical Guidelines for Hazardous Waste Pollution Prevention*, November 17, 2002
- *Management Guidelines for Sterilized, Disposable Medical Equipment*, State Food and Drug Administration, Regulation No. 24, October 13, 2000
- *Management Guidelines for Disinfection*, Ministry of Health, Regulation No. 27, July 1, 2002
- *Medical Waste Management Guidelines*, State Department, Regulation No. 380, June 16, 2003
- *Technical Standards for Medical Waste Transport Vehicles (Interim Guidelines)*, State Environmental Protection Administration; General Administration of Quality, Supervision, Inspection, and Quarantine; National Development and Reform Commission; June 30, 2003
- *Technical Standards for Medical Waste Incineration (Interim Guidelines)*, State Environmental Protection Administration; General Administration of Quality, Supervision, Inspection, and Quarantine; National Development and Reform Commission; June 30, 2003
- *Medical Waste Management Guidelines for Healthcare Organizations*, Ministry of Health, Regulation No. 36, October 15, 2003

Medical waste collection and transport vehicle

Proper signage and labeling for medical waste collection/transport vehicle

Stacked medical waste transfer boxes inside the collection/transport vehicle

Medical waste feed conveyor system

Medical waste feed station with radioactive and VOC scanning instruments

Decontamination of medical waste transfer boxes (Container wash line with pressure spray bars)

Photo Log #1 - Stericycle Yorkville Wisconsin ETD (Electro-Thermal Deactivation) Medical Waste Treatment Facility

ETD control panel

ETD treatment unit and discharge conveyor

Staging area for decontaminated medical waste transfer boxes

A view of treated medical waste

Photo Log #1 - Stericycle Yorkville Wisconsin ETD (Electro-Thermal Deactivation) Medical Waste Treatment Facility

Red bag medical waste container

Plastic bags for biohazardous medical waste and other non-medical waste

Locked and fully enclosed sharps container

Autoclaves used for onsite treatment of medical waste

Stainless steel carts used to contain medical waste for autoclave treatment

Carts and containers used to carry biohazardous waste and reusable equipment/material

Photo Log #2 - Cider Sinai Hospital, Los Angeles, California

Storage of clean medical waste transfer containers

Medical waste transfer container decontamination area

A view of lockable plastic medical waste transfer container

Medical waste collection/transport vehicle

An interior view of medical waste collection/transport vehicle

Weighing and recording of medical waste

Photo Log #3 - Sanitec Sun Valley Medical Waste Treatment Facility, California

RAD scanner for detection of undesirable RAD waste

Unloading of medical waste into the hopper of microwave treatment unit

Cleaning/disinfection of loading bin after each medical waste load

Feed hopper, mechanical shredder, magnetrons, and enclosed screw conveyor of the microwave treatment unit

Discharge of treated medical waste from the microwave treatment unit into a compactor

Biological indicators used to confirm the performance and efficacy of microwave treatment unit

Photo Log #3 - Sanitec Sun Valley Medical Waste Treatment Facility, California

Not until 2003, medical and pharmaceutical wastes are considered part of the hazardous waste in China and are subject to similar if not the same handling, storage, transportation, and treatment requirements as hazardous waste. The 2002-2003 out break of SARS and increasing public health/safety concerns related to illegal recycling and re-use of contaminated disposable medical apparatuses (plastic containers, syringes) led to the re-evaluation of China's current medical waste management policies and disposal/treatment methods. The outcomes are the development and promulgation of a series national management guidelines associated with medical waste definition, classification, collection, storage, transportation, treatment/disposal, and legal obligations in 2003.

Some of the important components of these new or updated guidelines are summarized below.

- Medical waste definitions and classification (referred to Section 5 of this FS report).
- Medical waste management responsibilities for healthcare organizations - includes legal responsibilities; dedicated medical waste management structure and personnel; standard operating procedures for waste collection and temporary storage; employee safety/injury prevention and accident reporting requirements for on job injuries or deaths; as well as emergency responses and reporting requirements for incidental spills and releases. The PRC State Department authorizes the local (county level and higher) municipal health and environmental protection departments as joint regulatory agencies for managing medical waste issues. The local health department is responsible for worker injury and disease prevention associated with the collection, transport, storage, and disposal/treatment of medical waste; while he environmental protection department is responsible for environmental protection and pollution prevention associated with the operation of healthcare and medical waste treatment facilities.
- Medical waste classification, collection, and temporary storage by healthcare organizations – PRC Ministry of Health requires disinfection of all medical equipment (including the disposable ones) after it is in contact with patients' skin and mucus. Infectious waste, pathological waste, sharps, pharmaceutical/chemotherapy waste, and chemical waste shall be collected separately and affixed with proper labeling. Medical waste containing anesthetics/narcotics, radioactive substances, chemotherapy agents, chemicals, and disinfectants, as well as mercury-containing waste medical equipment (thermometers, barometers) shall also be collected separately and handled by designated groups or organizations. Highly infectious stock and culture waste shall be steam or chemically disinfected at the points of generation prior to being collected and handled as infectious waste. Wastewater from a healthcare facility as well as feces and urine from isolation or infectious/suspected infectious patients shall be disinfected to meet the national discharge standards prior to being discharged into the sewer system. Upon collection, infectious, sharps, and pathological waste shall be placed in double containers, sealed, inspected for puncture and leakage, recorded, and carted to the temporary storage area on a daily basis. Temporary storage of medical waste shall not be conducted in an open environment and the maximum storage period shall not exceed 2 days or 48 hours after collection. Temporary medical waste storage facility shall meet the following minimum requirements: away from hospital, food preparation, general activity, and MSW storage areas; with full enclosure and dedicated facility operators; protected from insects, vermin, rainwater, leakage, and direct sunlight exposures; and with explicit

warning signs. Pathological waste shall be stored in refrigerated units or maintained in non-putrescent state.

- Medical waste transport to offsite treatment facilities - Transport of medical waste from a temporary storage area/facility to a centralized medical waste treatment facility shall be conducted in the same manner as hazardous waste, with appropriate manifests. Medical waste is strictly prohibited to be transported via postal services, airway, and rail system. Waterway transport of medical waste is strictly prohibited in designated drinking water protection zone. Transport of medical waste on other navigable waters is only permitted when there is no ground transport means. Medical waste generators are required to register with local environmental protection bureaus, including information such as source, type, quantity, time of waste generation and transfer, final destination, and proper chain-of-custody signatures. According to the central government, medical waste treatment facilities are required to provide medical waste transport vehicles to the generators at a collection frequency of no longer than 2 days after the waste has been placed in temporary storage areas/facilities.

  To standardize medical waste transport vehicles, the PRC central government developed and promulgated an interim technical specifications in June 2003[14] that incorporated sophisticated design requirements for air leakage (varied from 5 to 13 m^3/hr for a cargo size of 5 m^3 and less to 40 to 70 m^3/hr for a cargo size of greater than 40 m^3), fluid containment, and temperature controls (5 to 10 W/K of total heat loss for a cargo size of 5 m^3 and less to 50 to 70 W/K for a cargo size of greater than 40 m^3). Other requirements for standard equipment included isolated driver and cargo spaces, disinfection and emergency spill collection/containment kits, personnel protective equipment, medical waste transfer box (0.6 m-L x 0.5 m-W x 0.4 m-H), leak-poof cargo space, and air-tight floor drains with liquid collection device. The design capacity of the medical waste transport vehicle is based on the size of the transfer box (0.12 m^3) and its specific unit weight of 200 kg/m^3. Accordingly, each transfer box is thought to be weighted 0.24 kg when it is full. Design of the overall interior cargo space shall also take into account that one-quarter of the cargo space must remain unoccupied for ease in air circulation, disinfection, and cool-down. There were also additional administrative and labeling requirements for medical waste transport vehicles (see Appendix E for more information in Chinese).

  It is interesting to note the level of detail placed by the PRC central government on the design of medical waste transport vehicles, which is contrary to the U.S. in that, the later only sets minimum requirements for transport vehicles, but concentrates on the design, construction, and overall integrity of the waste containers to ensure safe containment of medical waste during routine transportation or in an accident situation. Besides, the capital investment for a specially designed medical waste transport vehicle is considerably higher than a regular fully enclosed flat-bed truck.

- Medical waste treatment - The PRC central government specifies that local municipal governments (county level above) shall be responsible for the organization and construction of centralized medical waste treatment facilities. The timelines for

[14] The effective period of "Interim Standards for Medical Waste Transport Vehicles" is between June 30, 2003 and June 30, 2004. After June 30, 2004, the PRC central government will either promulgate permanent vehicular standards for medical waste or extend the existing interim standards

constructing a centralized medical waste facility are by June 6, 2004 for cities with district subdivisions and by June 6, 2005 for the counties. In the absence of a centralized medical waste treatment facility, healthcare facilities in rural areas are required to manage their medical waste onsite according to the local health and environmental protection bureaus' requirements, but minimally includes: (a) disinfection and physical destruction of all sharps waste, (b) incineration of all medial waste if possible, and (c) disinfection followed by landfill burial for medical waste that cannot be incinerated. Centralized medical waste treatment facilities are required to obtain operating permit from appropriate local regulatory agencies, ensure that the unit processes for medical waste storage and treatment comply with the requirements of local health and environmental protection departments, provide personnel training, conduct inspections and evaluations of treatment facilities and personnel qualification (in the U.S. this is typically done by a qualified third party to ensure the fairness and validity of the evaluation), and to ensure the implementation of safe disposal and treatment of medical waste. The central government also requires that centralized medical waste treatment facilities to maintain operation records and facility evaluation reports onsite and file all necessary information with local environmental protection department. Centralized treatment facilities are further responsible for the proper storage and final disposition or treatment of medical waste.

Although the PRC central government did not explicitly specify incineration as the sole medical waste treatment technology, its published "Interim Technical Standards for Medical Waste Incinerator" on June 30, 2003 is the only regulatory performance guidance standards available for medical waste treatment. This together with the central government's recommendation of incinerating all medical waste whenever feasible prompts the provincial and local municipal governments to plan for or engage in the installation of centralized medical waste incineration facilities, without thoroughly considering its cost benefits, technical applicability, and public acceptability. Other important factors that made the medical waste incineration favorable are that the treatment process is well understood, technology development is relatively mature, and incineration would render medical waste harmless (despite the generation of harmful byproducts such as bottom ash and dioxin/furan air emissions) and completely destroy its physical shapes so that illegal reuse of waste medical containers can not occur.

To minimize the impacts of air emissions from medical waste incinerator on the environment and public health, the central government also developed and promulgated "Interim Technical Standards for Medical Waste Incinerators" on June 30, 2003[15] (a copy of Chinese version is provided in Appendix E). Under this interim standard, the types of medical waste that can be treated by incineration are defined and descriptive information on the physical conditions, technical specifications, as well as environmental protection and safety requirements is also provided.

Similar to the U.S., the PRC central government requires that the medical waste incinerators meet the following technical specifications:

1. The incinerators shall be constructed of quality material (particularly with the fire bricks and insulation liners) with a life expectancy of not less than 10 years.

[15] The effective period of "Interim Standards for Medical Waste Incinerators" is between June 30, 2003 and June 30, 2004. After June 30, 2004, the PRC central government will either promulgate permanent vehicular standards for medical waste incinerators or extend existing interim standards

2. The incinerators shall consist of a primary and secondary combustion chamber, with supplemental fuel and air available in the secondary combustion chamber to enhance complete combustion and destruction of VOCs and other air-borne organic pollutants.
3. The incinerators shall be operated under the negative pressure at all times.
4. The incinerators shall have fully enclosed, negative pressure automatic feeding and waste loading/offloading systems.
5. The incinerator shall have complete corrosion-resistant air emission control devices including, scrubbers for removing/neutralizing acid fumes, bag house for removing particulate matters, and activated carbon powder injection for adsorbing dioxin/furan in the incinerator' exhaust.
6. The incinerators shall have automatic process control system, warning/safety features, and on-line stack monitoring capabilities for the exhaust gas.
7. When burning medical waste with heating values less than 1,000 Kcal/hr, the temperature in the center of the primary chamber shall not be lower than 750°C.
8. The oxygen content in the incinerator exhaust shall be between 6 and 10% (on a dry weight basis). The surface temperature of an operating incinerator shall be less than 50°C.
9. Temperature in the secondary combustion chamber shall be maintained at or above 850°C, with a minimum of 2 seconds gas residence time.
10. The incinerators are required to meet a minimum destruction efficiency of 95% or higher by weight.

A comparison of emission standards for medical waste incinerators between the U.S. and PRC is shown in Table 13. It is interested to note that through-put rates for small, medium, and large incinerators are much higher in China than in the U.S. (300 kg/hr versus 90 kg/hr for a small unit, between 300 and 2,500 kg/hr versus 91 and 227 kg/hr for a medium unit, and greater than 2,500 kg/hr versus 227 kg/hr for a large unit). In general, the U.S. emission standards are more stringent, with the exception of mercury and dioxins/furans. Additionally, the U.S. standard not only contains numerical objectives but also allows the flexibility for percent of reduction based on the Maximum Achievable Control Technologies (MACT). The PRC regulations also included emission standards for hydrogen fluoride and other heavy metals, which are absence from the USEPA emission standards. Other information provided in this interim standard is discharge limitations for wastewater generated from the medical waste incinerators and analytical methods for both incinerator emissions and wastewater.

8.0 MEDICAL WASTE MANAGEMENT IN TIANJIN

Based on the PRC central government's requirements, TEPB has developed several local ordinances to promulgate collection, transport, and centralized treatment of medical waste. These local ordinances included:

- TEPB's Recommendations on Centralized Medical Waste Treatment, Tianjin Municipal Government Document (2003) No. 91, August 1, 2003 – Specifies authorities and

responsibilities of TDHS and TEPB; city boundaries requiring centralized medical waste treatment; treatment requirements for rural areas outside the centralized medical waste treatment boundaries (disinfect and destroy sharps and disposable apparatuses, incinerate all medical waste whenever possible, disinfect and landfill medical waste that cannot be incinerated); storage and transportation requirements for medical waste; standard charge fee of RMB $3.00/kg for treating medical waste and contractual requirements between waste generators and treatment facility; personnel training program; medical waste manifesting system; the needs for developing standard operating procedures (SOP), management plan, emergency response plan, and inspection plan for regulatory agencies, medical waste generators, transporters, and treatment facilities; and occupational health and safety training and protection.

Table 13. Comparison of PRC and U.S. Emission Limits for Hospital/Medical/Infectious Waste Incinerators

Pollutants	Emission Limits (U.S. is based on 7% and PRC is based on 11% oxygen content)					
	Small		Medium		Large	
	U.S. (≤ 91 kg/hr)	PRC (≤ 300 kg/hr)	U.S. (between 92 and 227 kg/hr)	PRC (between 301 and 2500 kg/hr)	U.S. (> 227 kg/hr)	PRC (> 2500 kg/hr)
Particular Matter	**69 mg/dscm**	100 mg/dscm	**34 mg/dscm**	80 mg/dscm	**34 mg/dscm**	65 mg/dscm
Carbon Monoxide	**40 ppmv**	87.3 ppmv	**40 ppmv**	70 ppmv	**40 ppmv**	70 ppmv
Dioxins/ Furans	125 ng/dscm total or 2.3 ng/dscm TEQ	**0.5 ng/dscm TEQ**	25 ng/dscm total or 0.6 ng/dscm TEQ	**0.5 ng/dscm TEQ**	25 ng/dscm total or 0.6 ng/dscm TEQ	**0.5 ng/dscm TEQ**
Hydrogen Chloride	**15 ppmv** or 99% reduction	67 ppmv	**15 ppmv**	47 ppmv	**15 ppmv**	40.2 ppmv
Sulfur Dioxide	**55 ppmv**	152.8 ppmv	**55 ppmv**	114.6 ppmv	**55 ppmv**	76.4 ppmv
Nitrogen Oxides	**250 ppmv**	265.8 ppmv	**250 ppmv**	265.8 ppmv	**250 ppmv**	265.8 ppmv
Lead	1.2 mg/dscm or 70% reduction	**1 mg/dscm**	**0.07 mg/dscm**	1 mg/dscm	**0.07 mg/dscm**	1 mg/dscm
Cadmium	0.16 mg/dscm or 65% reduction	**0.1 mg/dscm**	**0.04 mg/dscm**	0.1 mg/dscm	**0.04 mg/dscm**	0.1 mg/dscm
Mercury	0.55 mg/decm or 85% reduction	**0.1 mg/dscm**	0.55 mg/dscm	**0.1 mg/dscm**	0.55 mg/dscm	**0.1 mg/dscm**

NOTE: Bold - Lower value of the two

- Healthcare Facility Medical Waste Management System, Interim Regulation (2003) No. 403, August 6, 2003 – This interim regulation was developed and promulgated by TDHS, which provides the definitions of medical waste; responsibilities of healthcare facilities and oversight agencies (TDHS and district DHS); outlines of healthcare facility medical waste management implementation plan (collection method and containers, collection routes and schedules, internal waste transferring procedures and requirements, special operating procedures, occupational health and safety requirements during the handling/collection/transferring/storage of medical waste, etc.); medical waste management structure and responsibilities; emergency response; training requirements; and regulatory oversight functions and enforcement actions against violators.
- Implementation of TEPB's Recommendations on Centralized Medical Waste Treatment, TEPB Regulation (2003) No. 206, August 11, 2003 – Internal notification to district EPBs, Tianjin Environmental Compliance Inspection Group, Tianjin Enironmental

Monitoring Centre, and Tianjin Solid Waste and Poisonous Chemical Management Centre, which provided more detailed and specific descriptions of relevant regulations and regulatory authorities/responsibilities of various agencies (including enforcement actions); medical waste transferring and manifesting requirements; and documentation and reporting requirements.

- Tianjin Medical Waste Pollution Prevention and Inspection Standards (Interim), TEPB Regulation (203) No. 207, August 11, 2003 – This interim regulation specified general local regulatory inspection and monitoring requirements for medical waste pollution prevention during the collection, storage, transport, and treatment processes. It included the following contents: objectives and scope; relevant Central Government and Tianjin regulations an technical specifications/standards; definitions of medical waste, incinerator, safe landfill, medical waste storage facility, and medical waste transport vehicles; types of regulatory inspections (onsite, routine, random, individual, and combined); inspection requirements (personnel, documentation, enforcement actions); inspection items (housekeeping and recordkeeping activities at healthcare facilities and medical waste treatment plant); environmental monitoring for incinerator and landfill operations; and technical specifications of medical waste transport vehicles.

- Medical Waste Classification Packaging Instruction by TEPB, August 15, 2003 – Four different colors and two sizes of plastic bags were designated for containing medical waste: yellow bag (700 mm x 550 mm for infectious waste), red bag (700 mm x 550 mm for contagious or isolation waste, 400 mm x 300 mm for contagious sharps waste), green bag (400 mm x 300 mm for general sharps waste). TEPB also designed three types of cardboard boxes to contain plastics bags of contagious/isolation waste and sharps as well as general sharps waste, with corresponding color of letters printed on the exteriors of the cardboard boxes (600 mm x 400 mm x 500 mm box with red imprints for contagious/isolation waste, and 400 mm x 200 mm x 300 mm box with red or green imprints for contagious or general sharps).

- Notice of Medical Waste Quantification and Charging System, TEPB Regulation (2003) No. 214, August 22, 2003 – This notification officially specified Tianjin's medical waste treatment charging rate of RMB $3.00/kg (or US $0.17/lb) and that the medical waste treatment cost should be included as part of the healthcare cost. The regulation also recommended that the weights of medical waste be determined based on either of the following two methods.

  Option 1. Weight of medical waste = (measured weight of medical waste with transfer box) – (weight of empty transfer box; which are 42 kg for the standard 660-L box, 6 kg for the standard 125-L box, and 3.6 kg for the standard 115-L box)

  Option 2. At the absence of a scale and when the transfer box is 80% full or more, the weight of medical waste can be approximated using a PRC's national standard of 200 kg/m^3. As such, the approximated weights of medical waste in the 660-L and 125-L transfer boxes are 132 kg and 25 kg, respectively.

  Under Option 1, the weight of medical waste must be weighed inside the transfer boxes. Under no circumstances should the medical waste be removed from the transfer boxes.

Copies of the above local ordinance in Chinese versions are provided in Appendix F. These local ordinances adequately set the framework for Tianjin's current and future medical waste

management system. Major differences between the U.S. state's and Tianjin's medical waste management system are in fee structure and government's involvement in treatment and disposal activities. The U.S. state regulations generally set clear annual renewable fee schedules for generator, transporters, and treatment/disposal facilities, which allows additional revenue to sustain a more effective government management, enforcement, and technical support process. As a legislative and regulatory entity, state or municipal governments in the U.S. seldom involve themselves in the actual waste handling or treatment process. The regulatory entity is only responsible for developing, promulgating, and enforcing laws/regulations/ordinance. All activities associated with waste handling, transportation, treatment, fee set-up and collection are primarily negotiated among the waste generators, transporters, and treatment facilities, on a supply-and-demand market basis. Since waste handling and treatment cost is the most important driver in a market basis system, the state regulatory agencies also allow and encourage the treatment vendors to develop alternative treatment technologies based on the understanding that the technology vendors are legally responsible for meeting the regulatory treatment standards. This prompts the healthcare organization and waste treatment communities to work closely to develop more efficient, cost effective, and technically sound medical waste treatment processes to reduce healthcare costs.

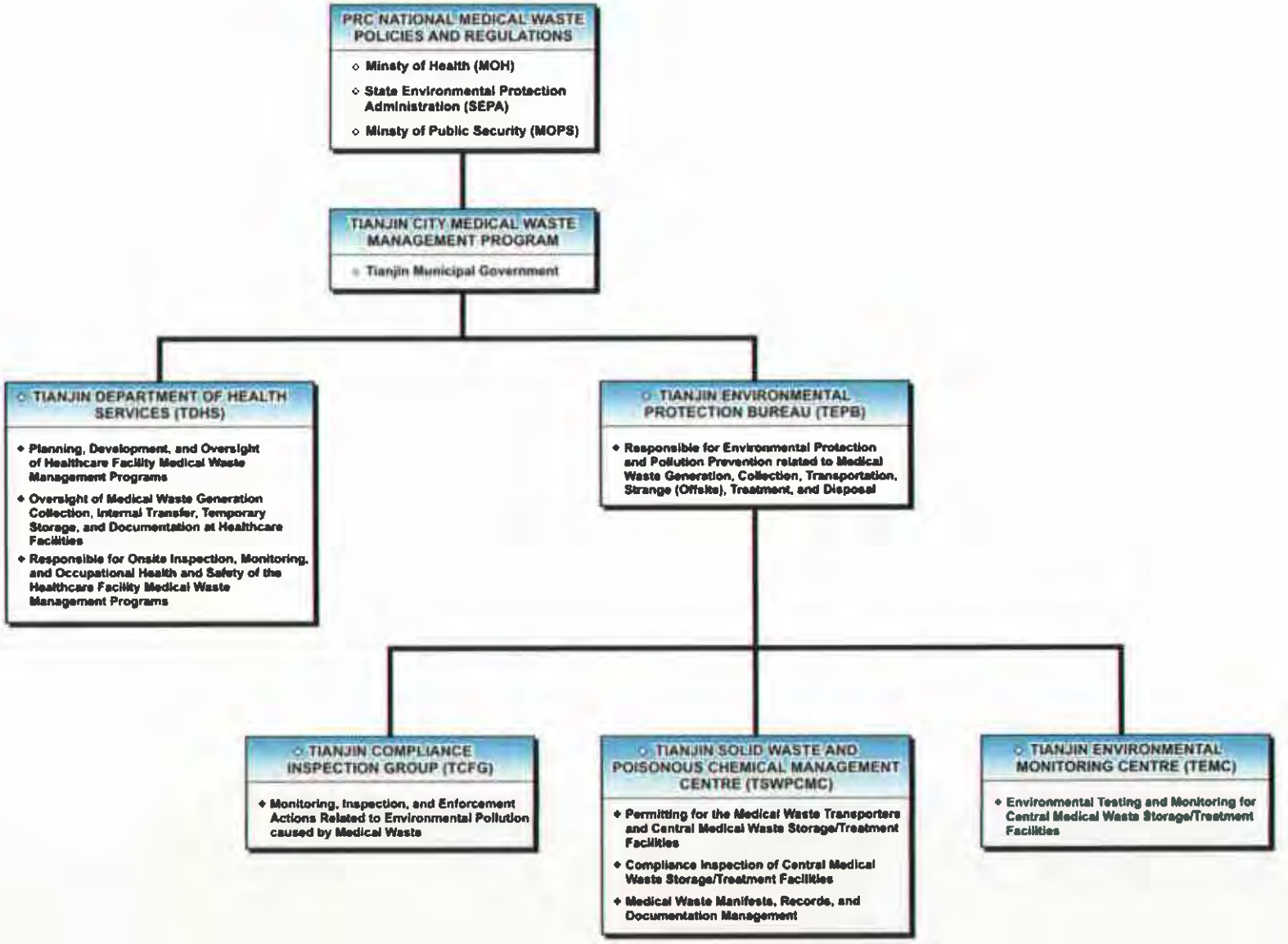
Similar to the PRC central government, Tianjin's medical waste program is jointly administered by TEPB and TDHS. TDHS is responsible for developing, overseeing (including inspecting), and enforcing healthcare facility's medical waste management planning and system implementation. It is also in charge of personnel training and health and safety protection of the medical waste management program. TEPB, on the other hand, is responsible for the environmental pollution protection and prevention associated with the medical waste generation, collection, storage (healthcare facility), transportation, offsite storage, as well as treatment and disposal (central treatment facility) activities. Figure 1 shows an overview of Tianjin's medical waste regulatory infrastructure and their responsibilities, including three branches of TEPB organization, namely the Tianjin Compliance Inspection Group, Tianjin Solid Waste and Poisonous Chemical Management Centre, and Tianjin Environmental Monitoring Centre.

Observations made during the team visits to different classes of hospitals in November 2003 indicated that Tianjin probably has one of the best coordinated and executed medical waste management system in PRC, as reflected by the TEPB's active rule-making and regulatory oversight; healthcare facility's well planned medical waste management plan, infrastructure, and SOP; as well as the Tianjin Hazardous Waste Treatment Centre's (THWTC's) transportation and treatment operations.

9.0 MEDICAL WASTE HANDLING AND TREATMENT IN TIANJIN

In general, disposable medical waste (plastic syringes, needles, gloves, aprons/sheets, rubber/plastic tubing, sharps, soiled dressing, etc.) after its generation are first placed in a designated waste segregation areas, with clear warning signs and free from public/patient accesses and insect/rodent nuisance. The waste is segregated based on waste types and packaging requirements. Disposable syringes, needles, plastic/rubber tubing, and other disposable apparatuses that have been in contact with the patients are first disinfected by submerging the waste in disinfection solution with an effective chlorine concentration of 2,000 mg/L or 16% to 18% of peroxy acetic acid for 20 to 30 minutes. Disposable syringes with

Figure 1 - Overview of Tianjin Medical Waste Regulatory Infrastructure and responsibilities



needles are manually separated and the needles physically bent/destroyed prior to being disinfected (instead of being tossed entirely into a rigid enclosed sharps container). All of these activities were conducted by designated personnel (typically the nurses). The disinfected medical waste are then drained to remove excessive disinfection solution before being placed in double plastic bags of various colors (red, yellow, and green) awaiting to be transported to temporary storage facilities according to pre-set collection schedules. Some healthcare facilities also use mechanical grinder or shredder to process the disinfected needles and syringes prior to placing them in temporary storage. Biological cultures and stocks are first autoclaved (sterilized) prior to their handling, treatment, and disposal. Blood, body fluids are first disinfected (some by chemical only and others by both chemical and autoclave), then discharged into the healthcare facility's wastewater treatment process for additional treatment. The treated wastewater is finally discharged into the city sewer system upon meeting the PRC's national wastewater discharge standards. Re-usable materials and medical equipment are autoclaved before their re-use.

Yellow plastic bags are used to contain infectious medical waste, including paper, soft waste (soiled dressing, cotton balls, bandages, swaps, and disinfected sheet), non-sharps disposable apparatuses (disinfected tubing, plastic medicine cups, etc.), and sterilized pathological waste and biological cultures/stocks. Green plastic bags and corresponding cardboard boxes are used to contain disinfected sharps. Red plastic bags and corresponding cardboard boxes are used to contain all medical and solid waste generated from contagious or suspected contagious patients.

Each hospital has designated personnel for waste collection and custody. Upon collection, the medical waste-containing plastic bags are sealed and carted to the temporary storage facility where the bags are placed directly into the plastic transfer boxes or first into the hard cardboard boxes (sharps and contagious waste only) and then into the plastic transfer boxes, weighted, pending transportation to an offsite facility for treatment and disposal. As a precautionary measure, all medical waste containers, internal transport equipment, and surfaces of storage areas are required to be disinfected using a disinfection solution with an effective chlorine concentration of 2,000 mg/L. Daily medical waste generation rates and types are required to be recorded on daily logs, verified, and maintained by designated personnel and submitted to TEPB on a monthly basis.

Medical waste is generally weighted prior to being placed inside the TEPB specified medical waste transfer boxes although this process is expected to be modified by weighing the medical waste inside the transfer boxes based on TEPB's regulation (2003) No. 214, effective on August 22, 2003. The duration of temporary medical waste storage by the healthcare facility is limited to 48 hours by TEPB and the waste storage area is required to have proper warning signage; away from the general public, patient, food processing, and MSW storage areas; and free from surface water accumulation, rodents, flies, and other nuisances. For healthcare facilities located in the rural areas where central medical waste treatment facility is not available, TEPB imposes similar requirements for disposable medical waste/apparatuses and sharps as the PRC's national standards, including disinfection and physical destruction, followed by incineration (whenever possible) or landfilling for non-incinerable waste.

Medical waste is collected minimally once every two days by the central treatment facility, which is the THWTC. A 5-copy manifest document, completed by the generator, is accompanied with each load of the medical waste. After being transported to the THWTC,

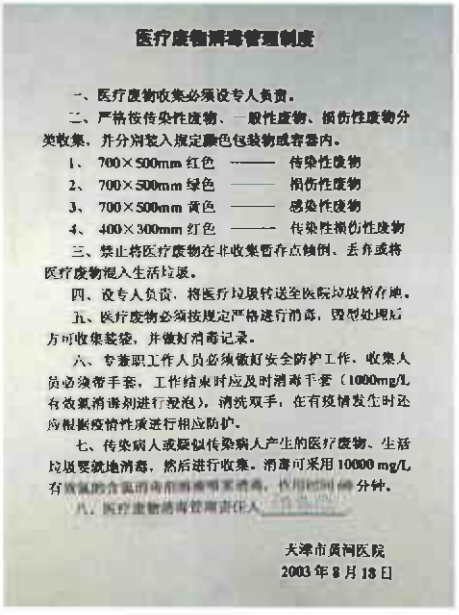
medical waste is not to be stored longer than one day if under room temperature, or 7 days if refrigerated at 0°C, prior to its final treatment and disposal. THWTC maintains its medical waste transportation fleet and provides medical waste transfer boxes to all healthcare facilities as part of its services. TEPB is authorized to approve and license medical waste transporters. The cost for medical waste transport is set at RMB $0.76/kg, which is charged to the healthcare facilities in addition to the medical waste treatment cost, which includes vehicle cost and depreciation, transportation, operation (fuel and operator) and maintenances, insurance, and disinfection. THWTC currently has ten (10) 2-ton and three (3) 5-ton medical waste transport vehicles, all designed according to the Interim Technical Standards for Medical Waste Transport Vehicles as promulgated by the SEPA on June 30, 2003. Each vehicle is operated by a driver and an escort. At the completion of unloading the waste, the transport vehicle is driven to a dedicated disinfection building within the THWTC and all interior and exterior surfaces of the transfer box and vehicle are disinfected. To ensure proper operations of the central treatment facility, TEPB conducts environmental monitoring of the followings:

- Incinerator wastewater
- Incinerator exhaust (online continuous monitoring)
- Incinerator residues and fly ash
- Leachate and cleaning fluid from the waste storage area
- Landfill gas, leachate, surface water runoff, and groundwater (up-gradient background and down-gradient)

Photographs of medical waste generation, collection, storage, and transportation activities observed during the visits of Tianjin's healthcare facilities and THWTC are presented in Photo Logs #4 and #5.

It is our understanding that since September 2003, all disposable medical waste (including syringes, sharps, plastic/rubber tubing, and soiled dressings) and some pathological waste generated from the Class 2 and higher healthcare facilities within the greater metropolitan area of Tianjin (including metro six districts, four perimeter districts, three coastal districts, two suburban districts, three counties, and Tianjin Economic Development Agency or TEDA district) have been treated by THWTC, pursuant to TEPB's Recommendations on Centralized Medical Waste Treatment, Tianjin Municipal Government Document (2003) No. 91. The most notable advantage of having THWCT as a designated medical waste treatment facility is ease in implementing centralized medical waste treatment policy since the Tianjin Municipal Government (TEPB) maintains part of the ownership of the THWCT. However, this can also be viewed as a government monopoly of the treatment market (at least in the beginning) and potential conflict of interest by the private sectors.

As stated before, THWTC was initially designed as a hazardous waste treatment facility. Therefore, it contained a variety of treatment operation/process options, including incineration (rotary kiln, domestically made), solidification, solvent recovery, compaction, physical/chemical process, and landfilling. THWTC officially started its operation on September 1 2003 and utilized incineration and landfilling as the primary treatment methods for medical waste. The incinerator has a design throughput of 40 tons to 50 tons per day. The main treatment process consists of a rotary kiln incinerator with emission control trains, such as after burners (or secondary combustion chamber), quench towers, high energy Venturi scrubbers, activated carbon injection, and bag house.



医疗废物消毒管理制度

一、医疗废物收集必须设专人负责。

二、严格按传染性废物、一般性废物、损伤性废物分类收集，并分别装入规定颜色包装物或容器内。

1、 700×500mm 红色 ——— 传染性废物

2、 700×500mm 绿色 ——— 损伤性废物

3、 700×500mm 黄色 ——— 感染性废物

4、 400×300mm 红色 ——— 传染性损伤性废物

三、禁止将医疗废物在非收集暂存点倾倒、丢弃或将医疗废物混入生活垃圾。

四、设专人负责，将医疗垃圾转送至医院垃圾暂存地。

五、医疗废物必须按规定严格进行消毒，毁型处理后方可收集装袋，并做好消毒记录。

六、专兼职工作人员必须做好安全防护工作，收集人员必须带手套，工作结束时应及时消毒手套（1000mg/L有效氯消毒剂进行浸泡），清洗双手，在有疫情发生时还应根据疫情性质进行相应防护。

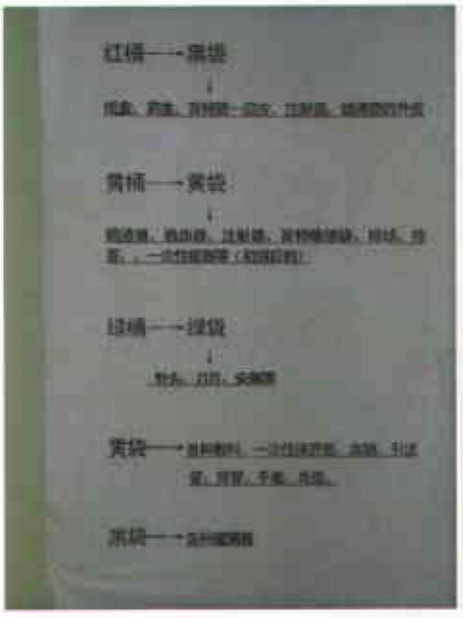
七、传染病人或疑似传染病人产生的医疗废物、生活垃圾要就地消毒，然后进行收集。消毒可采用10000 mg/L有效氯的含氯消毒剂喷雾消毒，作用时间 [illegible] 分钟。

八、医疗废物消毒管理责任人 [illegible]

天津市黄河医院

2003年8月18日

Hospital medical waste disinfection and management policy



红桶——黑袋

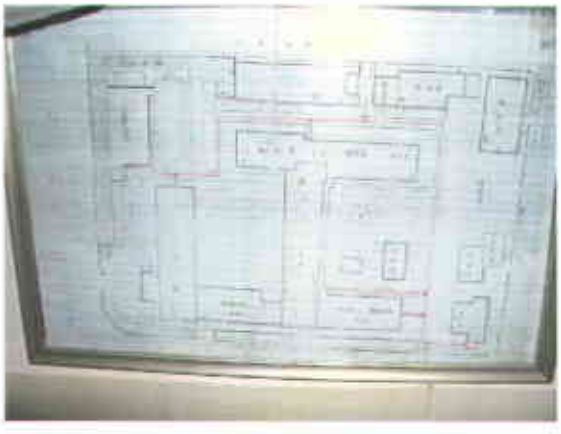
黄桶——黄袋

绿桶——绿袋

黄袋——

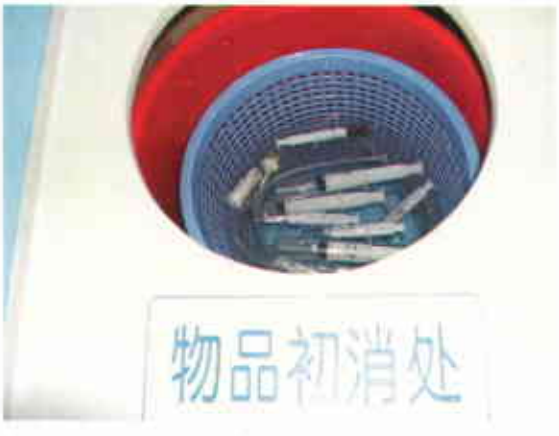
黑袋——

Hospital medical waste container color classification system policy



Hospital medical waste collection routes

Disposable medical apparatuses disinfection area



Used disposable medical apparatuses under disinfection

Used disposable medical apparatuses after disinfection

Photo Log #4 – Handling of Medical Waste by Tianjin's Healthcare Facilities

Disinfection of used needles

Disinfection of used plastic syringes

Color-coded containers for initial medical waste collection

Dedicated container for collecting waste plastic bottles

Dedicated container for collecting waste glass medical bottles

Dedicated container for collecting other disposable medical waste (gloves, aprons, plastic covers)

Photo Log #4 – Handling of Medical Waste by Tianjin's Healthcare Facilities

Mechanical shredding of used and disinfected syringes

Shredded waste syringes

Designated medical waste transfer cart within hospital

Packaged medical waste (disinfected, shredded or intact plastic syringes

Packaged medical waste (plastic tubing)

Packaged medical waste (sharps, IV injection needles)

Photo Log #4 – Handling of Medical Waste by Tianjin's Healthcare Facilities

Packaged medical waste (plastic bottles)

Cardboard boxes for packaging sharps

Medical waste in small transfer box

Medical waste in large transfer container

Interior views of hospital medical waste storage rooms containing packaged medical waste and weigh scales

Photo Log #4 – Handling of Medical Waste by Tianjin's Healthcare Facilities

UV disinfecting lamp in certain hospital medical waste

Idled batch-loaded incinerator in Tianjin First Central Hospital

Exterior views of hospital medical waste storage sheds

Medical waste transfer record

Holding tank for wastewater containing radioisotope

Safe storage of medical radioisotope

Photo Log #4 – Handling of Medical Waste by Tianjin's Healthcare Facilities

Preparation for unloading medical waste from the transfer vehicle

Unloading of medical waste manually from the transfer vehicle

Temporary stage of loose waste bags and small medical waste transfer boxes

Unloading of large medical waste transfer containers

Drain to a self-contained liquid container inside the transfer vehicle

Decontamination of medical waste transfer vehicle

Decon area for small medical waste transfer boxes

Photo Log #5 – Waste Unloading and Vehicle/Equipment Decontamination at Tianjin Hazardous Waste Treatment Center (THWTC)

According to the facility personnel, the incinerator was operated at an average rate of 25 tons to 30 tons per day, with approximately 50% of which was medical waste.

Medical waste is unloaded from the transport vehicles as is in the transfer boxes or into the facility bins, mechanically dumped into the feed hopper, pushed into the rotary kiln by a mechanical ram, and incinerated in the kiln at 850°C. Emission from the kiln is further treated in the secondary combustion chamber at 1,100°C. Temperature of the final exhaust after the quench towers, scrubbers, and bag house is less than 160°C.

There does not appear to be an immediate plan to construct another central treatment facility just for medical waste, unless the generation rate exceeds the treatment capacity of the THWTC. To add flexibility and technical options for treating medical waste, THWTC has acquired a complete set of steam disinfection (autoclave) equipment with a mechanical shredder and dryer from Germany. Additionally, THWTC has expressed interest in developing a mechanical shedding and steam disinfection system similar to the STI process in the US. Based on this, it is clear that although the SEPA has yet to adapted steam disinfection as an acceptable treatment alternative for medical waste, TEPB and THWTC recognize that incineration may not be the most cost effective and beneficial treatment technology for medical waste and is positioned themselves as a PRC national leader in alternative medical waste treatment technologies.

In general, Tianjin's medical waste management system appears to be under well controlled by the local regulatory agencies. The healthcare facilities visited also show excellent awareness and strong support to the medical waste collection, storage, and central treatment requirements. It is interested to note that in PRC, the levels of details that the regulators have to specify and control in all aspects of medical waste management. These details are reflected in:

- Medical waste regulations for generators, transporters, and central treatment facilities;
- Specific organizational and procedural requirements for collecting, storing, recording, and reporting medical waste by the healthcare facilities;
- Specific transportation routes and schedules which are coordinated with the local healthcare facilities and public safety agency; and
- Well defined and standardized medical waste transfer containers (sizes and dimensions), medical waste transport vehicles and GPS/communication system, medical waste treatment technology (incineration) and its associated emission and wastewater discharge requirements;

This is quite different from the U.S., in which the regulators only provide general guidelines and allow flexibilities for the responsible parties to do the "right things" under an intertwined socioeconomic and legal framework that involves not only the regulators, generators, transporters, and treatment facilities; but also the public. These differences are further discussed in the later section of the FS report. In addition, because the entire medical waste transportation and treatment system is a semi-monopolized, if not totally monopolized "business" by the local government, changes or modifications of this existing system would require significant financial and time investments.

10.0 TECHNICAL RECOMMENDATIONS FOR CENTRALIZED MEDICAL WASTE TREATMENT FACILITY

Part of the FS was to assist TEPB in evaluating its current medical waste collection, storage, and transportation system and providing specific technical recommendations. These recommendations are shown below.

Medical Waste Containers and Transfer Boxes

1. TEPB or TDHS should promote safe sharps management concepts within healthcare facilities through the use of modified injection apparatuses, enclosed and non-retrievable sharps containers, or onsite needle destruction equipment to replace the current manual needle disinfection/destruction practices.
2. Although medical waste is required to be transported in rigid transfer boxes, some have been observed to be transported in double plastic bags (disposable tubing) and hard cardboard boxes (sharps) without further containment. Most of the medical waste transfer boxes/containers observed have no inter-locking mechanisms to prevent the contained medical waste from spilling or releasing into the environment during the transportation. Although the PRC regulation does require a fully-enclosed medical waste transport vehicle, exposure may still occur in the waste recovery process from the damaged transport vehicles.
3. More engineering innovations (stacking, interlocking, anti-slip) could be incorporated into the design and construction of transfer boxes/containers to ensure the containment of medical waste—the US concept is to control and prevent releases from the transfer containers/boxes rather than from the transport vehicle, which is contrary to the PRC concept.
4. Empty and disinfected transfer boxes are to be delivered to the medical waste generators or collection sites in separate vehicles from those containing medical waste-filled transfer boxes to prevent the potential for cross contamination.

Treatment Facility

1. Consider adding gamma ray monitor near the queuing scale to detect accidental shipments of radioactive (RAD) waste into the facility (threshold level 2 * background level). Provide isolated and secured vehicle parking facility for radioactive loads to allow the isotopes to decay to a safe level.
2. If incineration remains to be the primary treatment option for medical waste or as a joint treatment process for medical and industrial waste, the facility should develop appropriate formula and mechanism for mixing the waste BTU contents to assure steady-state feed (to maintain a constant BTU in the feed).
3. Install de-NOx unit to handle NOx emissions.
4. An on-site survey of medical waste generation, collection, and handling should be conducted to verify the accuracy of waste generation rate provided by the healthcare facilities. This information serves as the design basis for the incinerator and charging system.

5. A key factor for a successful incineration operation is the construction material. The disinfection SOP used by the hospitals prior to waste collection may also significantly increase the chlorine contents and corrosive nature of the waste (except for peroxy acetic acid). Therefore, it is essential that the critical parts of the kilns be constructed of high-grade materials (e.g., Inconel stainless steel, low porosity high strength castable, shock-and-acid corrosion resistant bricks) and certified by an accredited material laboratory. It is our understanding that the incinerator at the THWTC is domestically made, which has a lower initial capital cost than that of an imported unit. Therefore, inspection of interior ringing, scaling, corrosion, and integrity of the fire brick insulation should be thoroughly conducted during the routine maintenance (system shut-down) periods or when there are consistent performance issues with the incinerator.
6. THWTC has acquired steam disinfection unit and intended to demonstrate the effectiveness of this alternative treatment technology in treating medical waste. It is recommended that the performance of this alternative treatment unit be systematically documented, especially against the approved microbial inactivation standards developed by the U.S. State and Territorial Association on Alternative Treatment Technologies (STAATT). The performance data can be used to leverage the approval of other steam-based disinfection technologies by SEPA as equivalent effective treatment method as incineration for medical waste.

11.0 DESCRIPTIONS OF MEDICAL WASTE TREATMENT TECHNOLOGIES

This section of the FS summarizes available medical waste treatment technologies based on the differences of their principal operation theories such as chemical, mechanical, thermal, irradiative, and biological processes. Mechanical process alone is not considered sufficient to meet the "disinfection" requirements to render medical waste non-infectious or harmless. Instead, it is frequently used in conjunction with other treatment technologies to improve treatment efficacy, reduce waste volume, and render waste unrecognizable. Mechanical process is also used to destroy needles and syringes to minimize occupational injuries and render them unusable. The following sections describe medical waste treatment technologies used in the U.S. A list of U.S. medical waste treatment technology vendors and product information (obtained via telephone interviews, survey questionnaires responses, or from company websites) is presented in Appendix G.

11.1 SHARPS TREATMENT/MANAGEMENT PROCESSES

Sharps waste management and treatment has been a major issue for the health-care industries in the U.S., primarily due to the concern for transmitting blood-borne diseases [such as Hepatitis C virus (HCV), Hepatitis B virus (HBV), and human immunodeficiency virus (HIV)] from contaminated sharps to health-care workers through needlestick and other percutaneous injuries.

The legalization of 2000 Federal Needlestick Safety and Prevention Act (PL 106-430) makes clear the responsibility of employer to reduce the risk of injuries to workers by requiring the use of sharps with the engineered sharps injury protection and encourages manufacturers of medical sharps to increase the number of safe devices in the market. This has prompted the development and use of needleless systems, devices with retractable or blunt needles, or other safe needle devices with build-in safety features.

Another alternative to reduce the risk of needlesticks is to use sharps waste treatment technologies near the point of use. However, this is generally not to be considered the same as "engineered sharps injury protection" promulgated under the Needlestick Safety and Prevention Act.

The concept of "engineered sharps injury protection" is not being fully promulgated in China since the majority of the health-care workers are still required to physically separate the needles from syringes, after their uses, and perform chemical disinfection prior to placing them into the medical waste plastic bags. This is quite different from the current U.S. practices in which the waste needles are protected with safety devices and disposed of in enclosed sharps containers. However, this may rapidly change with the reform of China's health-care system and increasing emphasis on occupational health and safety.

Several frequently used sharps management approaches in the U.S. include: (1) sharps collection followed by onsite treatment with the above-mentioned technologies (steam disinfection, microwave treatment, pyrolysis, incineration, etc.); (2) sharps collection followed by transportation to an offsite facility for a centralized treatment; or (3) a small sharps treatment system at or near the point of generation. Selection of appropriate sharps management approach depends on the quantity of sharps generated, cost effectiveness, and which option enhances occupational health and safety for the workers. Large regional health-care facilities generally use options (1) and (2), whereas clinics with limited patients may be more in favor of option (3).

National Institute for Occupational Safety and Health (NIOSH) published a document entitled "Selecting, Evaluating, and Using Sharps Disposal Containers" in January 1998. This document presents a comprehensive framework for selecting sharps disposal containers and evaluating their efficacy as part of an overall needlestick injury prevention plan. It also reviews the Occupational Safety and Health Administration (OSHA) bloodborne pathogens standard and recommends containers on the basis of a site-specific hazard analysis. The document further establishes criteria and provides tools for evaluating the performance of sharps disposal containers. As such it is a valuable tool and an important part of a comprehensive strategy to reduce injury and illness in health care workers.

Sharp containers in various sizes and configurations can be purchased from commercial vendors. The following lists a group of selected vendors and their websites.

Table 14. List of Selected Sharps Container Vendors

Supplier Name	Website Address	Supplier Name	Website Address
Stericycle.	www.stericycle.com	Hopkins Medical Products	www.hmponline.com
Life-Assist, Inc.	www.life-assist.com	Masune First Aid & Safety	www.masune.com
Kendall Healthcare	www.kendallhq.com	Biodex Medical System	www.biodex.com
BD Medical	www.bd.com	Biomed Recovery & Disposal	www.biomedwaste.com
Inmark, Inc.	www.inmarkinc.com	Alliance Medical	www.allmed.net
National Alliance for the Primary Prevention of Sharps Injuries (NAPPSI) – list of safety devices for primary and secondary prevention needlesticks	www.nappsi.org	Sustainable Hospitals – Safety Needles and Sharps Devices – list of vendors that provide reusable/recyclable sharps containers	www.sustainablehospitals.org
Bemis Manufacturing	www.bemismfg.com		

As mentioned previously, technologies have also been developed for treating needles at the point of generation, which are popular among small-to-medium size hospitals and clinics. The following provides a brief summary of selected onsite needle destruction systems.

- ✓ MedPro's *Needlyzer* is a portable FDA-approved process that uses an arc to destroy steel needles (16- to 30-gauge) via "pyroelectric oxidation," leaving behind granular oxidation residues. Each replaceable cartridge can hold 3,000 to 5,000 needle residues and a 3-stage filtration system is used to treat vapor from the pyroelectric oxidation process.

- ✓ Medical Innovations' *TAPS Processor* is a portable countertop device that can treat up to 1.5 liters of sharps waste. The process involves placing disposable plastic disks with sharps and heating the waste to 190°C for 3 to 4 hours. The waste is disinfected when in contact with the molten plastic. Upon cooling, the sharps are encapsulated in the plastics and the solid disk or plug is formed, which can be disposed of as MSW.
- ✓ Bio Medical Disposal offers a light-weight, portable system, Sharp$_x$ Needle Destruction Unit (NDU) that uses electrical current to generate heat to destroy 18- to 30-gauge hypodermic needles ½ to 2 inches in length. Waste collection is addressed in two parts: needle debris is captured in a removable receptacle while vaporized gases are directed through a filtration system. The process reduces the risks of needlesticks, but the remaining syringes still needs to be handled as sharps as mandated by OSHA (Occupational Safety and Health Administration).

- ✓ WCM Waste & Compliance Management, Inc. developed an engineering control process, Isolyser/Sharps Management System (SMS®) that encapsulates sharps in thick-walled, puncture-resistant storage containers with sizes varying from 0.8 liters to 15 liters. Encapsulation is accomplished by the polymerization of an aqueous solution of monomeric acrylamide derivatives. The product passes the paint filter test as a solid and is characterized as non-hazardous (passed the TCLP test) and non-toxic (passes the 96-hr acute aquatic bioassay), which can be disposed of at MSW landfill.
- ✓ Earth-Shield, Inc. manufactures Sharp-Shield disposal system that combines chemical and thermal processes to treat sharps waste prior to solidifying and encasing them in a "Sharps Disposal Container." The disposal system contains two components: the Sharps

Disposal Container contains dry calcium hypochlorite and is used to store between 600 to 1200 sharps waste. Upon reaching the "fill level," slurry prepared by adding water into the Solidification Compound Container is poured into the filled Sharps Disposal Container and mixed. The temperature in the Sharps Disposal Container will reach 180°F and slowly cured for 24 hours. The solidified Sharps Disposal Container can then be disposed of at a MSW landfill.

- ✓ SPS Medical Equipment Corporation's *Needle-Eater* contains a compact, air-tight chamber with a high-speed cutting devices to pulverize the sharps waste (needles, syringes, and scalpel blades) while applying a disinfectant solution to decontaminate the residues. A hardening agent is added before the waste is disposed of as regular MSW. Each container can hold the remains of 75 to 150 syringes.

11.2 Chemical Processes

Chemical disinfection is the oldest and most commonly used disinfection process by hospitals and healthcare facilities, from disinfecting reusable instruments to general cleaning of work surface. When used in treating medical waste, the following factors should be considered.

The types of medical waste treated - The types of medical waste typically treated by chemical disinfection process include cultures and stocks, sharps, liquid human and animal waste including blood and body fluids, isolation and surgery wastes, laboratory non-chemical wastes, and soft waste (gauze, bandages, drapes, gowns, bedding, etc.) from patient care. Medical waste that should *not* be treated by chemical disinfection includes organic chemicals, chemotherapeutic wastes, mercury, hazardous chemical wastes, radiological wastes, and in some cases, human anatomical wastes due to cultural, ethical, legal, and other considerations.

Type and strength of chemical disinfectant used - In the past, the most commonly used chemical disinfectants for medical waste treatment were chlorine-based due to the readily available of chlorine and hypochlorite (bleach), as well as their abilities as a biocides to inactivate a broad range of microorganisms and residual disinfection power. Chlorine dioxide (ClO_2) has been offered as an alternative to hypochlorite in the pulp and paper as well as wastewater industries. However, there were also safety concerns about onsite storage and handling of these chlorine-based chemicals. Non-chlorine chemical disinfectants have recently been introduced into the waste treatment industry, including peroxyacetic acid (aka peracetic acid), glutaraldehyde, sodium hydroxide, calcium hydroxide, and ozone. Disinfectant chemicals are normally stored in concentrated forms and diluted onsite to the desirable strengths as required by the manufacturers.

Adequate contact and exposure time between disinfectant and medial waste - Chemical disinfection typically incorporates shredding and mixing mechanisms to ensure intimate contact between chemical disinfectants and medical waste. Since microorganisms vary in their resistance to chemical disinfectants (see microbial inactivation section), it is prudent for the chemical treatment process to test for microbial inactivation efficacy and be able to consistently show a 4 Log10 or greater (or Level III) reduction of at least B. *stearothermophilus* spores at normal chemical concentrations and treatment conditions designed for the technology.

Chemical reactions between disinfectant and incompatible chemicals in medical waste – Chemical reactions or dangerous operating conditions may occur when incompatible chemicals in medical waste are in contact with the disinfectant applied. A typical example is ammonia reacts with sodium hypochlorite to form highly explosive chlorine gas and chloramines. As such the facility must require technology vendors to provide MSDS (material safety data sheet) listing incompatible chemicals with the disinfectant and emergency response actions if reactions occur.

Occupational health and safety concerns – In addition to chemical reactions, facility should also be concerned about worker exposures to concentrated disinfectant from storage and operation as well as physical impacts from the shredding and mixing of medical waste with disinfectants. A chemical treatment process should always be operated in a closed system, under negative pressure with a HEPA filtration device. Additionally, shredding and mixing should never be conducted prior to chemical treatment.

Environmental consequences from discharge of waste disinfectant liquid – Although most chemical treatment technologies recycle their chemical disinfectants, waste discharge is required periodically. In general, the waste discharge is permitted by the local health department and sanitation bureau into municipal sewer system since the volume of disinfectant waste solution is relatively insignificant comparing to the municipal sewage and therefore, not likely to cause negative impact to the POTW. However, if sewer discharge is not available, the waste disinfectant may have to be treated onsite before it can be discharged into a receiving water body. Concerns have been raised on potential generation of toxic trihalomethanes and other chlorinated aromatic compounds from chlorine-based chemicals and organic compounds in medical waste, which can enter receiving water bodies via treated wastewater effluent. However, this has not been verified. Table 15 summarizes the advantages and disadvantages of chemical treatment process

Table 15. Summary of Advantages and Disadvantages of Chemical Treatment Process

Chemical Treatment Process	
Advantages	**Disadvantages**
Treatment process and theory well understood	Potential chemical hazards related to the disinfectants
Proven successful with a good track record	Potential worker exposure/health & safety issues and environmental consequences from the reactions with incompatible chemicals in the waste stream
Various treatment capacities available form onsite treatment (small quantity), mobile system, to large-scale offsite treatment (large quantity)	
Simple waste stream composition and liquid waste can generally be discharged into municipal sewer system without further treatment	Odors and noise (from the shredders/grinders) generated from the treatment process
No harmful combustion byproducts	Maintenance cost for shredders/grinders could be high
Cost effective	Treatment efficacy must be verified by microbial indicators
Well-automated and easy to operate	

11.3 THERMAL PROCESSES

Thermal process utilizes thermal energy or heat to destroy microorganism in medical waste. Based on the operating temperature ranges, thermal process can be further divided into low temperature, medium temperature, and high temperature treatment processes. The differences in operating temperature are caused by different sources of energy and heating mechanisms. As a result, the final treatment products also vary in their physical and chemical characteristics

11.3.1 Low Temperature Thermal Processes

Low temperature thermal processes typically refer to treatment technologies operated at a temperature between 200°F (93°C) and 350°F (177°C). Depending on the heat sources, low temperature thermal processes can be further divided into wet-heat or dry-heat processes. Since the operating temperature is not sufficiently high to induce combustion or chemical breakdown, medical waste treated by a low temperature thermal process generally maintains its physical and chemical integrities (except for the loss of volatile organic components). Therefore, this treatment process is relatively ineffective in reducing waste volume.

11.3.1.1 Wet-Heat (Steam-based) Low Temperature Thermal Processes

This group of treatment processes utilize different mechanisms to generate steam as a mean of disinfecting medical waste. In theory, as heat is applied to water, its temperature rises until it reaches the boiling point or saturation temperature at which point water turns into steam. At atmospheric pressure (14.7 psia), the saturation temperature of water is 212°F (100°C). At higher pressures (e.g., 50 psia), the saturation temperature is higher (e.g., 281°F or 134°C). When steam is at its saturation temperature, the condition is referred to as a saturated condition and the steam is known as saturated steam, which is what the steam-based treatment processes typically operated at. Several steam-based treatment processes available in the market including autoclaves, retorts (autoclave without a steam jacket), microwave, and radiofrequency.

The types of medical waste that can be treated by the steam-based low temperature thermal processes include cultures and stocks, sharps, liquid human and animal waste including blood and body fluids or materials contaminated by the waste, isolation and surgery wastes, laboratory non-chemical wastes, and soft waste (gauze, bandages, drapes, gowns, bedding, etc.) from patient care. With sufficient time and temperature as well as mechanical shredders/grinders, it is technically possible to treat human anatomical wastes with the steam-based processes if accepted by the local regulatory and public communities. Medical waste that should *not* be treated by the steam-based processes includes volatile and semi-volatile organic compounds, chemotherapeutic wastes, mercury, hazardous chemical wastes, radiological wastes, sealed heat-resistant containers, and waste loads that may impede heat transfer (large animal carcasses).

Autoclaves/Retorts/Advanced Autoclaves - An autoclave consists of a metal chamber sealed by a charging door and insulted by a steam jacket. During operation, steam is introduced into both the outer jacket and inside chamber that is designed to withstand elevated pressures and contains the medical waste to be treated. Heating the outside jacket reduces condensation in the inside chamber walls and allows the use of steam at lower temperatures. Since air is an effective insulator, it is removed either by gravity displacement (or downward displacement) as the steam is introduced into the chamber, or by pre-vacuuming prior to the steam introduction. The latter has a shorter operation cycle/time

due to its greater efficiency in removing air. A retort is an autoclave without the outer jacket, hence requiring a higher operating steam temperature. It is less expensive to construct and frequently used in large-scale operations.

A typical operating cycle for an autoclave or retort involves: (1) placing medical waste into autoclavable bags or lined carts or bins; (2) introducing steam into the outside jacket if an autoclave is used; (3) loading the waste bins/carts into the chamber (periodically, biological indicators are placed in the middle of the waste load to monitor disinfection efficacy); (4) closing the charge door; evacuating air from inside the chamber if pre-vacuuming is available; (5) introducing steam into the chamber while air is being removed by gravity displacement (if pre-vacuuming is not available); (6) maintaining the required operating temperature for a set time period; (7) releasing the steam from the chamber via a condenser unit to reduce pressure and temperature; and (8) removing the treated waste load after it is cooled down (and the biological indicators for evaluation of treatment efficacy). Since steam treatment does not reduce waste volume, a mechanical shredder/grinder is generally used to reduce the waste volume and render treated medical waste unrecognizable. Table 16 summarizes the advantages and disadvantages of autoclave and retort treatment processes

Table 16. Summary of Advantages and Disadvantages of Autoclaves and Retorts

Autoclaves and Retorts (Steam-based Low Temperature Thermal Treatment Processes)	
Advantages	**Disadvantages**
Treatment process and theory well understood	Weight increase of treated waste due to condensation if a drying mechanism is not provided
Proven successful with a good track record	
Various treatment capacities available form onsite treatment units for small quantity to large-scale offsite treatment system	Potential worker exposure/health & safety issues and environmental consequences from treating waste containing mercury, VOCs, phenols, and cytotoxic agents
Approved and accepted as an alternative technology in all states of US	Treatment performance may be compromised by barriers to direct steam exposure or heat transfer
Minimal air emission issues if hazardous materials or chemicals are not mixed into the waste streams	Potential odors and noise (from the shredders/grinders) generated from the treatment process
Relatively low capital and operation costs	Provides minimal waste volume reduction and produces recognizable waste unless shredders/grinders are incorporated. Maintenance cost for shredders/grinders could be high
Well-automated and easy to operate	
	Treatment efficacy must be verified by microbial indicators

Realizing some of the disadvantages associated with the traditional autoclave/retort units, technology vendors began developing the second generation of steam-based treatment technologies, focusing on improvement of treatment performance by reducing heat transfer barriers and treatment cycle time, as well as rendering the waste unrecognizable. These new and improved treatment processes function as autoclaves or retorts, but they combine steam treatment with various other features prior to, during, and after steam disinfection. The combinations include:

- Pre-vacuum, steam treatment, followed by compaction/shredding
- Steam treatment with mixing and fragmentation, drying, followed by shredding/compaction
- Shredding, steam treatment, drying and chemical cleaning
- Shredding with steam treatment and mixing, followed by drying
- Shredding, followed by mixing and steam treatment
- Shredding, mixing and steam treatment, followed by compaction

Although these treatment processes operate differently in their configuration and unit processes, they treat the same types of medical waste and share some of the advantages and disadvantages of autoclaves. However, because of their variations from the standard autoclaves/retorts, local regulatory agencies may not considered these advanced technologies the same as their predecessors, thus requiring technology demonstrations prior to their approval or acceptance.

All steam-based treatment processes require a minimum exposure time and temperature to achieve proper disinfection. Often, the exposure times are based on twice the minimum time required to achieve a 6Log10 reduction of bacterial spores under ideal conditions; equivalent exposure times at different temperatures can be estimated. A common exposure temperature-time criterion is 250°F (or 121°C) for 30 minutes. Color-changing chemical strips or biological indicators can be used to verify appropriate exposure time and temperature required to meet the disinfection requirements.

Microwave and Radiofrequency Processes

There are other low temperature thermal processes that utilize steam as a mean for disinfection, but different from the autoclaves in that they use other mechanisms such as microwave and radiofrequency to generate moist heat and steam.

Microwaves are very short electromagnetic waves that fall within the range of radiofrequency band, above ultra-high frequency (UHF) used for television and below the infrared range. Microwave energy is generated by meganetron from high voltage electrical power, which is then transmitted into a metal channel called the waveguide that direct the microwave energy into a specific cooking area. The same principal that use microwave energy to prepare food is applied to treat medical waste. The waves of microwave energy cycle rapidly between positive and negative at a frequency of about 2.5 billion times per second. This causes water and other molecules of the waste to vibrate swiftly as they try to align themselves to the rapidly shifting electromagnetic field. The intense vibration creates friction, which in turns generates heat, converting water into steam. In the microwave processes, the heat and steam denature the cellular proteins, thereby inactivating or killing the microorganisms/pathogens. Various studies

have shown that the inactivation efficacy by microwaves on dry microbial samples is significantly reduced than that in a wet environment and it's the heat rather than microwave field that causes microbial inactivation. All of these point out the importance of steam disinfection.

The treatment process involves: (1) loading medical waste into the feed hoper with steam injection and negative air flow; (2) pre-shredding the medical waste into small pieces; (3) exposing the shredded waste to steam; (4) treating the shredded waste at 95 to 100°C by microwave generators for 30 minutes; and (5) discharging the treated waste into a bin or roll-off container for offsite disposal. Table 17 summarizes the advantages and disadvantages of the microwave processes

Table 17. Summary of Advantages and Disadvantages of Microwave Process

Microwave (Steam-based Low Temperature Thermal Treatment Processes)	
Advantages	**Disadvantages**
Treatment process and theory well understood	Capital cost is relatively high
Proven effective disinfection results (≥ 7Log10 kill for B. *subtilus*, P. *aeruginosa*, S. *aureus*, E. *faecalis*, N. *asteroids*, C. *albicans*, A. *fumigatus*, M. *bovis*, M. *fortuitum*, and ≥ 3Log10 kill for G. *miura*)	Potential worker exposure/health & safety issues and environmental consequences from treating waste containing mercury, VOCs, phenols, and cytotoxic agents
Minimal air emission issues if hazardous materials or chemicals are not mixed into the waste streams	Requires routine monitoring for microwave energy leakage
Essentially no waste liquid discharge is required	Potential odors and noise (from the shredders/grinders) generated from the treatment process
Approved and accepted as an alternative technology in all states of US	
Well-automated and easy to operate	Maintenance cost for shredders/grinders could be high
Up to 80% waste volume reduction due to pre-shredding	Treatment efficacy must be verified by microbial indicators

Radiofrequency treatment processes utilizes similar operating principal except that they use low frequency radio waves (50 kV/meter, 10 MHz) to generate the energy field and steam required to disinfect medical waste. Possible heating mechanisms involved are selective absorption of energy by different waste components, dipolar rotation of liquid molecules, and high voltage filed imposed. Because of their similarity, radiofrequency treatment processes share the same advantages and disadvantages of the microwave processes. Additionally, since both processes are operated at or below the boiling point of water (while time-temperature disinfection criteria are generally based on temperatures at or above the boiling point), biological indicators must be used to verify the treatment efficacy.

11.3.1.2 Dry-Heat Low Temperature Thermal Processes

In these processes, heat is provided in the absence of moist (without steam) through conduction, natural or forced convection, and/or thermal radiation to disinfect the waste. Some processes use heated surface (conduction and natural convection), some use circulated hot air generated from resistant heaters or natural gas (forced convection), and others use infrared or other heating elements (heat radiation). In general, the operating temperature of a dry-heat processes is higher (at about 170 to 190°C) and the treatment cycle is longer (between one and one-and-a half hours) than those of the steam-based technologies.

The types of medical waste suitable for dry-heat treatment are not much different from those typically treated by the wet-heat processes, including include cultures and stocks, sharps, liquid human and animal waste including blood and body fluids or materials contaminated by the waste, isolation and surgery wastes, laboratory non-chemical wastes, and soft waste (gauze, bandages, drapes, gowns, bedding, etc.) from patient care. With sufficient time and temperature as well as mechanical shredders/grinders, it is technically possible to treat human anatomical wastes with the steam-based processes if accepted by the local regulatory and public communities. Medical waste that should *not* be treated by the steam-based processes includes volatile and semi-volatile organic compounds, chemotherapeutic wastes, mercury, hazardous chemical wastes, radiological wastes, sealed heat-resistant containers, and waste loads that may impede heat transfer (large animal carcasses)..

Operation of the dry-heat processes involves: (1) loading the waste into feed hoper via a cart dumper under a negative pressure, (2) shredding the waste to reduce heat transfer barrier, (3) treating the shredded waste by heated surface, heating elements, or high velocity heated air, (4) discharging the treated waste into a roll-off bin or dumpster after reaching the required treatment time. Table 18 summarizes the advantages and disadvantages of the dry-heat processes

Table 18. Summary of Advantages and Disadvantages of Dry-Heat Low Temperature Thermal Processes

Dry-Heat Low Temperature Thermal Treatment Processes	
Advantages	**Disadvantages**
Treatment process and theory well understood	Relatively new technology that has limited performance records
Proven effective disinfection results (≥ 6Log10 kill for B. *subtilus* and no growth of S. *aureus*, C. *albicans*, E. *coli*, P. *aeruginosa*, A. *fumigatus*, M. *bovis*, M. *fortuitum*, and G. *sp.*)	Potential worker exposure/health & safety issues and environmental consequences from treating waste containing mercury, VOCs, phenols, and cytotoxic agents
Minimal air emission issues if hazardous materials or chemicals are not mixed into the waste streams	Not being universally approved and may require individual demonstration
No waste liquid is generated	Potential odors and noise (from the shredders/grinders) generated from the treatment process
Approved by several states as an alternative technology	
Well-automated and easy to operate	Maintenance cost for shredders/grinders could be high
Up to 80% waste volume reduction due to pre-shredding	Treatment efficacy must be verified by microbial indicators

11.3.2 Medium Temperature Thermal Treatment Processes

Medium temperature thermal treatment processes operate between 350°F (177°C) and 700°F (371°C). The mechanism that utilized by this group of technologies is described as reverse polymerization or thermal depolymerization, in which intensive heat generated by magnetrons or other means is sufficiently high to alter the physical and chemical states of organic medical waste, but will not affect inorganics such as metals and glasses. Combustion is prohibited by an oxygen-depleting or oxygen-lean environment (nitrogen gas may be added to purge oxygen from the system). Since HCl and other VOCs may form within the operating temperature range of the processes, air emission data may have to be obtained from the full-scale systems to determine if emission control devices such as a scrubber and thermal/catalytic oxidizer will be needed to meet the local air emission standards. Since there are only few available thermal depolymerization

technologies in the market and they have been recently converted from treating other waste (tires, food, and agricultural waste) into medical waste, there is very limited information on process performance, consistency, reliability, and costs. However, they offer the medical waste generators additional flexibility and options from the conventional autoclave or incineration technologies. Table 19 summarizes the advantages and disadvantages of the medium temperature thermal treatment processes

Table 19. Summary of Advantages and Disadvantages of Medium Thermal Treatment Process

Medium Temperature Thermal Treatment Processes	
Advantages	**Disadvantages**
Treatment process and theory generally understood	New technology with limited track records of full-scale performance
Proven effective disinfection results (6Log10 kill for B. *stearothermaphilus* spores)	Potential worker exposure/health & safety issues and environmental consequences from treating waste containing mercury, VOCs, phenols, and cytotoxic agents
Air emission rates smaller than the high temperature thermal treatment processes	Requires routine monitoring for microwave energy leakage
Well-automated and relatively easy to operate	May require air emission control system and testing
Up to 80% waste volume and mass reduction	High capital cost and insufficient document of O&M costs
	Treatment efficacy must be verified by microbial indicators

11.3.3 High Temperature Thermal Processes

High temperature thermal processes operate at over 700°F (or 371°C), generally from 1,000°F (or 540°C) to 15,000°F (or 8,300°C) and higher. Because of the high operating temperatures, these processes are capable of altering the chemical and physical states of organic/inorganic wastes and achieving significant volume and mass reductions (typically over 90% reduction).

Due to the high operating temperatures, almost all medical waste can be treated by the high temperature thermal processes with the exception of mercury and compressed gas containers. The medical waste treated may include, but are not limited to: cultures and stocks, sharps, materials contaminated with blood and body fluids, isolation and surgery wastes, laboratory wastes, soft wastes (gauze, bandages, gowns, bedding drapes, etc.) from patient care, plastics, blood and body fluids, pathological waste, animal waste, residual chemotherapeutic wastes, spent solvents and disinfectants (formaldehyde, glutaraldehyde, xylenes, acetone, isopropanol), expired pharmaceuticals, and low level radioactive waste.

High temperature thermal processes include incineration, pyrolysis (plasma and non-plasma), and other variations.

11.3.3.1 Incineration

Incineration thermally decomposes waste through combustion, a rapid oxidation of organic substances and generation of heat, fire, residues (ash), and gases. Three primary factors are required to initiate combustion: (1) the temperature is above the flash point, (2) the vapor-air composition falls between the flammable limits, and (3) the temperature is equal to or exceed the ignition point. At high temperature, the presence of adequate amount of oxygen in the

system often determines whether the treatment process is incineration (exothermic) or pyrolysis (endothermic). For incineration, the process of combustion occurs in the following sequence:

- Drying – Moisture is evaporated
- Volatilization – Combustible VOCs are released
- Ignition – Combustible VOCs are ignited in the presence of oxygen
- Combustion of fixed carbon – VOCs are completely combusted and fixed carbon is oxidized to CO_2

Due to the known release of a wide variety of air pollutants (NO_x, CO_2, SO_x, dioxins/furans, acids, metals) from the incineration processes, the USEPA has promulgated NSPS in 1997 and required the installation of afterburners, scrubbers, filtration devices, and membrane to meet a destruction efficiency of 99.9999%

Depending on the configuration and process principals, incinerators can be divided into the following types: rotary kiln, multiple hearth, fluidized bed, liquid injection, catalytic combustion, waste-gas flare, and direct flame. The operating temperatures for these incinerators are generally between 1,000°F (540°C) and 1,800°F (980°C). The following shows the physical conditions of the waste that can be handled by these incinerators.

Table 20. Operation Conditions and Waste Handling Capabilities of Various Incinerators

Incinerator Types	Typical Operation Temperatures	Physical States of Waste Handled
Rotary kiln	1,500°F (816°C) – 3,000°F (1,649°C)	Solid, liquid, and gas
Multiple hearth	1,400°F (760°C) – 1,800°F (982°C)	Solid, liquid, and gas
Fluidized bed	1,400°F (760°C) – 1,800°F (982°C)	Solid, liquid, and gas (waste that does not melt and form slag, disrupting fluidization)
Liquid injection	1,200°F (649°C) – 3,000°F (1,649°C)	Liquid and waste that can be liquefied
Catalytic combustion	NA	Gas with low organic contents
Waste gas flare	1,000°F (538°C) – 1,500°F (816°C)	Gas with high organic contents (non-hazardous)
Direct flame	1,000°F (538°C) – 1,500°F (816°C)	Gas containing particles

NA – Not Available

Rotary kiln, fluidized bed, and liquid injection types of incinerator are most frequently used for treating industrial waste. On the other hand, rotary kiln and multiple hearth incinerator are often used to treat medical waste due to its various physical characteristics. Among all the incinerators, rotary kiln offers the most flexibility because it (1) allows the waste to be rotated in a cylindrical container, enabling thoroughly mixing of waste and air; (2) has the greatest resistance to high temperatures; (3) can handle a wide variety of waste in large quantities; (4) can operate in batch or continuous modes; (5) can handle entire drums of waste; and (6) can be operated in an incineration or pyrolysis mode. Multiple hearth or controlled air incinerators are commonly used in the U.S. to treat medical waste. It consists of a stationary primary and secondary combustion chamber, and can be operated in a continuous and batch mode as well. The most notable advantage of multiple hearth incinerators over rotary kilns is that the waste is burnt in a much less turbulent condition, thus generating a cleaner air emission with less particulate matters.

The key features for a combustion incinerator include waste storage and handling, waste feeding, combustion, heat recovery (steam and electrical generation), air pollution control, and ash residue handling.

A typical incinerator operation involved: (1) firing the unit to desirable operating temperature; (2) loading the waste into automatic lift cart dumper, screw conveyer, and other appropriate waste delivery system; (2) emptying the waste into the feed hopper that typically operated under negative pressure; (3) feeding the waste into the primary combustion chamber by a mechanical feed ram; (4) burning the waste with supplemental fuel and air supply to carbonaceous ash residues and gases; (5) treating the gas emissions in a secondary combustion chamber (or afterburner) with supplemental fuel and air; (6) passing the gas emissions through pollution control devices (scrubbers, bag house) prior to discharging it into the atmosphere; (7) discharging the carbonaceous ash from the primary combustion chamber via a series of ash transfer rams; and (8) analyzing the ash for hazardous constituents and determining its final disposition. Table 21 summarizes the advantages and disadvantages of incineration treatment processes

11.3.3.2 Advanced Oxidation

Advanced oxidation differs from the conventional incineration in that several process modifications have been made to enhance a more complete and efficient combustion of medical waste. Besides, it minimize the potential for generating temperature gradient in the primary combustion chamber, which is the cause for dioxin/furans formation. These improvements include: (1) pre-shredding of the waste into small, light weight particles that can be injected at high speed into the primary combustion chamber; (2) multiple gas burner jets located strategically inside the primary chamber generate a rapid swirling, oxygen-rich hot vortex that keep the shredded waste in suspension for a more uniform burn; (3) higher combustion

Table 21. Summary of Advantages and Disadvantages of Incineration Process

Incineration (High Temperature Thermal Treatment Processes)	
Advantages	**Disadvantages**
Treatment process and theory well understood	Generate harmful byproducts that could impact the environment and public health (although some of the impacts can be reduced or minimized by proper air pollution control equipment
Approved and accepted as a medical waste treatment technology in US	
Proven successful with a good track record	Require equipment warm-up and shut-down periods
Various treatment capacities available form onsite treatment units for small quantity to large-scale offsite treatment system	Public opposition adds difficulties for siting, permitting, and facility operation
Ability to manage most types of wastes without pre-treatment	Construction materials failures due to corrosion and ringing
Well-automated and easy to operate	High capital and O&M costs
Significant waste volume and mass reduction (over 90%)	Offsite disposal of incinerator ash add cost and future environmental liability if it is classified as hazardous waste
Offers co-treatment options with other wastes	
Energy recovery is feasible	More intense operator training and higher qualification requirements

temperatures in both primary [1,850°F (1,010°C) and 2,000°F (1,093°C)] and secondary [2,000°F (1,093°C) and 2,150°F (1,177°C)] chambers than those in a conventional incinerator; (4) longer waste residence time (3.5 seconds) than that used in the conventional incinerator; and (5) rapid quench of combustion gas by a liquid mist injector.

Results of emission tests indicated that the process gas can meet the USEPA's NSPS for new incinerator after it has been treated by a packed bed adsorber and venturi section to remove particulate matters. Table 22 summarizes the advantages and disadvantages of advanced oxidation processes

Table 22. Summary of Advantages and Disadvantages of Advanced Oxidation Process

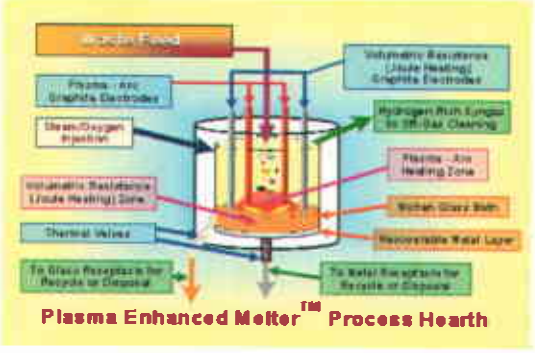
Advanced Oxidation (High Temperature Thermal Treatment Processes)	
Advantages	**Disadvantages**
Improvements of conventional incineration process	Generate harmful byproducts that could impact the environment and public health (although it is cleaner than the conventional incinerators)
More complete combustion due to waste pre-shredding, unique burner jet configuration, oxygen-rich combustion environment, longer residence time, and higher combustion temperature	
Suitable for onsite treatment, although may be scaled-up for offsite treatment	Relatively new technologies with limited performance data and require regulatory approval
Capable of meeting USEPA NSPS emission requirements	Require equipment warm-up and shut-down periods
Ability to manage most types of wastes without pre-treatment	Currently only a 2 tons per day commercial unit is available although large unit can be designed and built
Highly automated and easy to operate	High capital and O&M costs
Significant waste volume and mass reduction (over 95%)	Offsite disposal of incinerator ash add cost and future environmental liability if it is classified as hazardous waste
Energy recovery is feasible	

11.3.3.3 Pyrolysis

Pyrolysis refers to thermal destruction of waste in an oxygen-depleting (or oxygen starving) environment, or in the presence of an inert gas (nitrogen, argon, helium, etc.). Since in pyrolysis, oxygen is still present among the molecules that comprise the waste material or as air pockets trapped in the waste; therefore, carbon monoxide is also produced, along with small amounts of NO_x, SO_x, dioxins, and furan, but at levels much lower than those in incineration. Although USEPA did not include pyrolysis as part of the incineration process while promulgating the final NSPS, it has proposed performance standards for medical waste pyrolyis units (Table 23).

Table 23. Proposed Emission Limits for Pyrolysis

Pollutants	Emission Standards (7% oxygen, dry basis)
Particulate Matter	34 mg/dscm (dry standard cubic meter)
Carbon Monoxide	40 ppmv (parts per million by volume)
Dioxins/Furans	25 ng/dscm total or 0.6 ng/dscm TEQ (total equivalent)
Hydrogen Chloride	15 ppmv or 99% reduction
Sulfur Dioxide	55 ppmv
Nitrogen oxides	250 ppmv
Lead	0.05 mg/dscm
Cadmium	0.04 mg/dscm
Mercury	0.23 mg/dscm

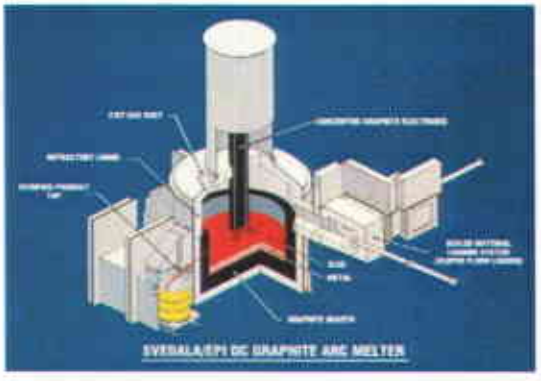


Unlike combustion, which is exothermic, pyrolysis is endothermic and involves a different set of chemical reactions that produce different reaction products, such as methane, hydrogen, and glassy slag. Off-gas generated by pyrolysis has a low-to-medium heat content and can be used as a supplemental fuel for boilers. The solid residues, depending one the operating temperatures and waste treated, can be simple carbon black or slag made of inert carbon residue, elemental metals, and glassy material remains. Depending one the process design, molten metal may also be recovered separately for other beneficial uses. The glassy slag sometimes are referred to as vitrified aggregates is inert, chemically and geologically stable, non-leachable, and has excellent structural strength. It can be used as road base materials, construction materials, and industrial sandblast grit. Due to the elevated operating temperatures employed, pyrolysis renders waste unrecognizable and can achieve as high as 98% of waste volume and mass reduction. Pathogens are not expected to survive under such high operating temperatures. Electrical resistance, induction heating, natural gas, and/or plasma energy are different ways of producing the high operating temperatures required for pyrolysis. The following describes several different pyrolysis processes.

Pyrolysis Oxidation – In this process, a non-plasma energy source such as electrical resistance or natural gas is used, the pyrolysis chamber is typically operated at or slightly above 1,000°F (538°C) range, rendering the organic portions of the medical waste to vaporized and leaving behind an inert ash (carbon black) and inorganic materials such as metals and glasses. The organic vapor emissions from the pyrolysis chamber are then treated in one or more oxidation chambers operated from 1,600°F (871°C) to 2,250°F (1,232°C). Oxygen/air is also added to achieve complete combustion of the organic vapor. Cooling and heat recovery units as well as air pollution abatement equipment (such as scrubbers and electrical precipitators) further treat the emissions from the oxidation chamber(s) prior to discharging it into the atmosphere.

Plasma-based Pyrolysis – The plasma technology utilizes ionized particles such as charged ions and ionized electrons to conduct electric current. But due to its high resistance, the electric energy is converted into heat producing temperatures ranging from 3,000°F (1,650°C) to 21,000°F

(11,600°C). Most systems use a plasma-arc torch to generate the plasma energy. The arc is established between two electrodes, then a carrier gas that is either inert or have some heating values passes between the electrodes and transfers the energy to the waste stream. In a non-transferred system, the anode and cathode are both part of the plasma torch. Another design involves the use of a DC (direct current) plasma arc, in which the arc forms between a graphite electrode and the metal in a molton bath formed from the waste in the treatment chamber.



The typical operation involves (1) feeding the medical waste into a plasma chamber where the waste is exposed to very high temperature generated by a plasma-arc torch; (2) destroying the waste instantaneously to form a product gas (sometimes also referred to as the syn gas) with a heating value that may be as high as 300 BTUs/scf; (3) recovering energy from the product gas by using it as a supplemental fuel (to produce steam, hot water, or co-generation) or in the fuel cells industry to produce clean electricity; and (4) removing the solid residue (carbon black, vitrified glassy slag, molton metal) for offsite disposal or recycling.

Induction Pyrolysis – Experiments conducted in the 1830's have shown that electric currents can be induced in an electrical conductor if it is coupled with a coil carrying an alternating current. For example, passing an alternating current through a copper coil wrapped around a metal tube generates a varying magnetic field which, in turn, creates eddy currents in the tube. With each voltage drop, electrical energy is converted into heat. As such, the treatment process uses an electrical induction coil surrounding a tube furnace to heat the furnace wall between 1,400°F (760°C) and 1,800°F (982°C). The medical waste is conveyed through the tube furnace via an auger screw in the presence of nitrogen as a purge gas. Medical waste is converted to an inert carbon residue that can be disposed of in a landfill, and a syn gas that can be cleaned in a gas cleaning system and used to fuel industrial boiler. Table 24 summarizes the advantages and disadvantages of plasma and non-plasma pyrolysis treatment processes

11.4 Irradiation (Electron Beam) Processes

Irradiation or ionizing radiation occurs when electromagnetic radiation has sufficiently high energy to knock out electrons from their atomic orbits, examples are x-ray and gamma radiation ray. The disinfection effects of ionizing radiation take place in both cellular and micromolecular levels: the radiation causes damage to DNA leading to cell death, while the free radicals react with protein and enzymes to cause them nonfunctional. There are several ways to generate ionizing radiation, from: (1) radioactive material such as Cobalt-60 that emits high-speed gamma rays, (2) ultraviolet radiation in the C range (253.7 nm, also known as germicidal or shortwave UV), and (3) high-energy electron beam.

The application of electron beam (or E-beam) technology in treating medical waste has recently been studied by research groups in the U.S. and Canada. It differs from Cobalt-60 in that the technology does not use radioactive sources and has no residual radiation once the treatment is completed. It destroys microorganisms by chemical dissociation, rapture of cell walls, and destruction of DNA and other macromolecules. The E-beam systems are highly automated and

Table 24. Summary of Advantages and Disadvantages of Plasma/Non-Plasma Pyrolysis Process

Plasma and Non-Plasma Pyrolysis (High Temperature Thermal Treatment Processes)	
Advantages	**Disadvantages**
Total destruction of waste (including pathogens) with low emissions compared to incineration	Although having lower emissions than conventional incinerators, pyrolysis still emit dioxin/furans
Suitable for large-scale, offsite treatment operation	Relatively new technologies with limited performance data and require regulatory approval
Capable of handling the widest range of medical waste except for mercury	Uncertainty in process reliability associated with design, equipment, and heterogeneity of medical waste
The waste residue is inert and consists of a mixture of carbon black and inorganics (metals and glasses), or a glassy slag that can be recycled as sandblast grit, road base aggregate, or construction material. Molton metals can also be recovered separately	Require equipment warm-up and shut-down periods
	High capital and O&M costs, particularly costs associated with electrical power consumption and electrode replacements
	Consideration for total environmental impacts from emissions of both treatment facility and power generating stations due to high energy consumption
Highly automated and computer-controlled system minimizes operator involvements	
Significant waste volume (over 95%) and mass (over 90%) reductions	
Energy recovery is feasible from the heat and/or gas generated. The syn gas with a low-to-medium heating value can be used as fuel, chemical feed stocks, or used in the fuel cells technology	

computer-controlled, which consists of a power supply, a beam accelerator that generates, accelerates, and directs electrons to the target waste;, a scanning system that delivers the required dose; a cooling system to cool the accelerator and other assemblies; a vacuum system to maintain a vacuum required by the accelerator; a shield to protect workers from radiation exposure; a conveyor system to transport the waste; and sensors and controls.

Since E-beam treatment does not alter the physical state of the medical waste, a mechanical shredder or grinder is required if volume reduction or physical destruction is part of the waste treatment objectives. In addition, some oxygen from air will be converted into ozone during the treatment process, which by itself has disinfecting and deodorizing properties but needs to be removed (reduced) before discharging into the atmosphere.

Targeted medical waste for e-beam treatment are typically cultures and stocks, sharps, materials contaminated with blood and body fluids, isolation and surgery wastes, laboratory wastes, and soft wastes from patient care.

Microbial inactivation of E-beam treatment depends on the dose (measured in *grays* or Gy, 1 Gy = 100 rads) and ability of microorganisms to repair damage to their DNA from irradiation. Another note for irradiation treatment is that bacterial cells may not be "killed" by the process but their reproductivity is impaired. Biological indicators recommended for checking irradiation treatment efficacy are *B. stearothermophilus* and *B. subtilus*. But other more resistant indicators such as *B. pumilus* (for sterilization of medical products) or *Dinococcus radiodurans* can also be used to provide additional margin of safety, if required. Table 25 summarizes the advantages and disadvantages of E-beam treatment processes.

Table 25. Summary of Advantages and Disadvantages of E-beam Radiation Process

E-beam Irradiation Treatment Processes	
Advantages	**Disadvantages**
Technology theory and application are well understood and familiar by the food processing and health-care (cancer therapy) industries	Not in full-scale, commercial application phase although laboratory and pilot units have been developed and successfully operated
Potentially suitable for large-scale, offsite treatment operation	Limited performance and operation data (including cost), requires regulatory approval
Capable of handling the widest range of medical waste except for mercury	Occupational health & safety training and protection from radiation exposure are required for operating personnel
Treatment is carried out in room temperature with no additives (steam, water, chemicals, or heated air)	An integrated radiation shield is required or a protective structure (concrete) must be constructed
Treatment process does not generate toxic emissions (except for a small quantity of ozone) or liquid effluents	A mechanical shredder/grinder is needed since the treatment process offers no volume reduction or physical changes of the treated waste – this increases noise level as well as capital and O&M costs
E-beam treatment process by itself is noiseless	
Highly automated and computer-controlled system minimizes operator involvements	Ozone off-gas needs to be removed before the exhaust is released into the atmosphere
Unlike Cobalt-60, waste after treatment does not contain ionizing radiation	Additional investigation is required in the area of inductive low-level radioactivity

12.0 SELECTION OF APPROPRIATE MEDICAL WASTE TREATMENT TECHNOLOGIES

Selection of appropriate treatment technology or technologies is affected by many performance and site-specific variables. As such there is no technology that can offer a panacea to all medical waste problems. The following discusses some of the most apparent factors to be considered when selecting medical waste treatment technologies.

12.1 THROUGHPUT CAPACITY

The throughput capacity of the selected medical waste treatment process should be able to meet the current and forecast medical waste generation rates (this is the reason why an accurate waste generation rate is critical). As a rule of thumb, the range of waste generation variability within the life expectancy of the selected treatment equipment should fall between its minimum and maximum feed rates. Since certain treatment process has flexible operation range, it is important to understand the limits and optimum operation ranges and the impacts to process performance and costs. If the throughput capacity of a single treatment process can not meet the waste generation rate(s), the facility should consider the option of using multiple units or a combination of different technologies. The later is typical useful if capital cost is a concern or when the waste can be segregated for different treatment options (e.g., a large unit to treat most of the waste and a single or multiple small units to handle difficult waste stream). Additionally, since throughput capacity is dependent on waste type and density, the facility should consult the equipment vendors based on specific waste categories intended to be handled by the facility. In general, incinerators, chemical treatment processes, and most low-temperature thermal processes (steam disinfection with or without shredders/compactors, microwave/radiofrequency) have larger throughput capacities than the medium-temperature and hi-temperature (pyrolysis, plasma, molton salt) thermal processes. Finally, the implementation of waste reduction/minimization may significantly change the quantity and composition of medical waste generated, which should be considered when assessing the required throughput capacity for the facility.

12.2 MEDICAL WASTE TYPES

Most of the medical waste treatment processes are designed to handle the majority if not all of the medical waste generated. However, due to different physical and chemical characteristics of the medical waste, the facility should consult the vendors to determine if a specific equipment is more suitable for its waste then the others. For example, certain mechanical grinders or shredders may be adequate for physically destroying hard objects such as needle, glass, or plastic; but have problems with "soft medical waste (referred to waste containing cellulose - gauze, tissue paper, bandages, cotton swabs, drapes, gowns, bedding)." Various vendors have modified existing or develop new alternative treatment technologies to enhance treatment efficiency for or compatibility with specific waste types. Checking with equipment vendors and requesting demonstration or references on these issues will ensure proper performance of the waste treatment system. When considering waste types, the facility should also take into account waste variability as a result of waste minimization or source reduction practices, as well as additional disposal or treatment costs for waste that could not be handled by the selected treatment process. Needles and glasses although can be handled by incinerators, it may be more suitable to be treated by other alternative technologies (steam disinfection, microwave, radiofrequency treatment followed by grinding) to reduce ringing and maintenance repair for the incinerators. Another example is that mercury-containing medical waste should not be treated by steam disinfection, incineration, and other methods that could generate mercury vapors or emissions.

12.3 MICROBIAL INACTIVATION

Microbial inactivation is an indication for pathogen destruction, which is the primary objective for medical waste treatment. Therefore, facility should clearly understand the local regulatory requirements (or national standards if there are no local criteria) for "disinfection" or "sterilization."

Sterilization means complete destruction of all forms of microbial life, including spores. However, total elimination of microbial life is very difficult to prove in practicality; as such, some organizations accept a reduction of 99.9999% in microbial life as sterilization. Disinfection means reduction of microbial population, particularly the disease-causing microbes or pathogens. In the U.S., a consortium of state regulatory agencies called the State and Territorial Association on Alternative Treatment Technologies (STAATT) met in 1994 and 1998 to develop consensus criteria for medical waste treatment efficacy. The first STTATT meeting developed the definitions for the following four levels of microbial inactivation.

Table 26. STTATT Definitions for Various Disinfection Levels

Levels of Microbial Inactivation	Definition by STTATT
I	Inactivation of vegetative bacteria, fungi, and lipophilic viruses at 6 Log 10 (or a 10^6 kill) reduction or greater
II	Inactivation of vegetative bacteria, fungi, lipophilic/hydrophilic viruses, parasites, and mycobacteria at 6 Log 10 (or a 10^6 kill) reduction or greater
III	Inactivation of vegetative bacteria, fungi, lipophilic/hydrophilic viruses, parasites, and mycobacteria at 6 Log 10 (or a 10^6 kill) reduction or greater; and inactivation of *Bacillus stearothermophilus* spores and *Bacillus subtilis* spores at a 4 Log 10 (or a 10^4 kill) reduction or greater
IV	Inactivation of vegetative bacteria, fungi, lipophilic/hydrophilic viruses, parasites, and mycobacteria, *Bacillus stearothermophilus* spores, and *Bacillus subtilis* spores at 6 Log 10 (or a 10^6 kill) reduction or greater

The Level IV microbial inactivation is equivalent to 99.9999% or greater destruction of microbial life. STAATT recommended that all alternative technologies (including steam disinfection) meet at least the criteria for Level III disinfection.

Microbial inactivation is generally expressed as a probability function and measured as reductions by factors of 10 in survival probability of a microbial population. Suspensions of selected pathogen surrogates representing the above-mentioned microorganisms are typically used biological indicators. The 1998 STAATT meeting recommended the use of following ATCC (American Type Culture Collection) representative biological indicators for testing of disinfection efficacy:

Mycobateria (6 Log 10 Reduction)

- *Mycobacterium phlei* – subsequently reclassified as *Mycobacterium terrae* (ATCC 1575)
- *Mycobacterium bovis* (BCG) – ATCC 35743)

Bacterial Spores (4 Log 10 Reduction)

- *Bacillus stearothermophilus* (ATCC 7953) – subsequently reclassified as *Geobacillus stearothermophilus* by ATCC in January 2002, used to test thermal inactivation
- *Bacillus subtilus* (ATCC 19659) – reclassified as *Bacillus atrophaeus* (ATCC 9372) by ATCC, used to test chemical inactivation
- *Bacillus pumilus* – used to test irradiation inactivation

The test generally entails adding the biological indicator (usually a suspension of 2×10^{10} initial inoculum in a plastic tube) to a standardized load of medical waste, running the waste load through a treatment process, and collecting the biological indicator after the treatment. The treated microbial suspensions are plated to quantify microbial recovery. In order to establish a control or baseline, the test is generally conducted in two runs. The first run involves no treatment or inactivation of the biological indicator, while the second run is conducted under normal operating conditions. Microbial populations are measured in colony-forming units (cfu) per gram of waste solid. Calculations are then made to determine microbial inactivation in terms of logarithms of the number of viable test microorganisms. The resulting number is equal to the $\log_{10}$ reduction, also known as $\log_{10}$ kill.

A $\log_{10}$ kill of 6 is equal to a 10^6 kill, a 99.9999% reduction, or a one-in-a million (0.000001) survival probability. A $\log_{10}$ kill of 4 is equal to a 10^4 kill, a 99.99% reduction, or a one-in-a ten thousandth (0.0001) survival probability.

6 log 10 kill = $\log_{10}$ kill of 6 = 10^6 kill = 99.9999% kill = 0.000001 survival probability
4 log 10 kill = $\log_{10}$ kill of 4 = 10^4 kill = 99.99% kill = 0.0001 survival probability

Table 27 provides a list of commercial suppliers for biological indicators used in evaluating treatment performance of alternative technologies.

Table 27. List of Biological Indicator Suppliers for Disinfection Efficacy

Supplier Name	Website Address	Supplier Name	Website Address
North American Science Associates, Inc.	www.namsa.com	Nelson Laboratories	www.nelsonlabs.com
Raven	www.ravenlabs.com	Alpha Multiservices	www.AlphaMultiservices.com
Vita-Tech	www.vita-tech.com	3M	www.3m.com
Advanced Sterilization Products (a Johnson & Johnson Company)	www.sterrad.com	STERIS Corporation	www.steris.com
Alfa Medical – New York	www.sterilizers.com	STS duoTEK, Inc.	www.stsduotek.com
SGM Biotech, Inc.	www.sgmbiotech.com		

Since 2000, Underwriters Laboratories (UL) has been working with STAATT, through the Accredited Organization Method of the American National Standards Institute (ANSI), to develop a consensus standard (including efficacy) for alternative technologies. A draft *UL2334 Standard for Alternative Treatment Technologies for the Disposal of Medical Waste* was developed in October 2003 for public review and comment until December 22, 2003. The ballot results from the public and UL's Environmental and Public Health (EPH) Council will determine whether the draft standard will be adopted as an American National Standard (ANS). A copy of the draft UL2334 is provided in Appendix H. The adoption of UL2334 will allow all alternative treatment technologies to be evaluated on the same performance platform. In the interim, facility should require the technology vendors to provide proof of microbial inactivation efficacy tests, certified by an independent, qualified organization or laboratory.

12.4 Environmental Impacts

When electing appropriate treatment technology, facility should consider various environmental impacts caused by the technology, including discharges or emissions to all environmental media – indoor/outdoor air, water/wastewater, and land (solid residues). A good candidate of treatment technology should be the one that causes the least impacts to the workers and environment. For medium and high temperature thermal treatment processes that generate air emissions, multiple test results for single and continuous exhaust emissions should be obtained from the vendors and other operating facilities to determine the compliance status with local emission standards (note the difference between the USEPA and PRC national emission standards). It should be pointed out that although USEPA excluded several combustion processes (co-fired combustors, cement kilns, pyrolysis) from its 1997 NPS compliance list and despite that it is generally agreed that these and other high-temperature thermal (plasma arc) technologies generate less air emissions, they may still be subject to the local incineration emission standard, particularly in foreign countries.

USEPA has developed but not promulgated performance standards for medical waste pyrolysis unit (Table 23). These proposed emission standards are more stringent than those of incineration because the endothermic reaction of pyrolysis creates less turbulence and cleaner emissions. Similar standards may also be developed or adopted by the foreign regulatory agencies.

In the U.S., liquid medical waste after proper treatment and upon meeting the NPDES or local POTW waste discharge standards can be discharged into surface water bodies or local sewer system, respectively. Additionally, solid medical waste, after being properly treated and either rendered unrecognizable or not, can be used disposed of at municipal landfills as regular MSW. Incinerator ash, if tested to be hazardous, is transported to a secure landfill for disposal. These

practices may or may not be accepted or feasible in foreign countries due to differences in cultural background, economic state, land availability, regulatory frame work, or legal system. The facility should consult local regulatory agencies and thoroughly understand the requirements for handling environmental impacts from the treatment processes as these treatment by-products or residues will have serious cost and legal implications to a medical waste treatment facility.

12.5 Regulatory Acceptance

Prior to select a treatment technology, facility should determine if the technology (or technologies) has been accepted by the local regulatory agency since this could directly affect the permitting process for the facility. As stated before, each state regulator in the U.S. has its own protocol to evaluate and approve alternative medical waste treatment technologies although this process may be simplified with prior successful technology demonstrations and acceptances from other states. In general, incineration, steam disinfection with or without mechanical shredding or grinding, chemical disinfection, microwave, and radiofrequency are among the most frequently tested and approved technologies. Plasma arc and pyrolytic technologies have also been approved, but in a smaller number of application for medical waste treatment due to its relatively small throughput rates and expensive capital investment.

In PRC, regulatory acceptance is probably one of the most important factors in selecting treatment technology. Take incineration as an example: although the PRC central government does not explicitly request incineration to be the only treatment process considered for a central medical waste treatment facility, the regulation states that "incineration all medical waste if possible." Development and promulgation of the new emission standards for medical waste incinerators and in the absence of treatment standards for other alternative technologies further prompts the local government to adopt incineration as the only "officially endorsed" medical waste treatment technology, which makes it difficult to promote or market non-incineration technologies.

12.6 Space Requirements

Space is generally more of a concern for onsite treatment than for the offsite central treatment facility, which should include the dimensions of the treatment and ancillary equipment (e.g., mechanical shredders, waste storage, fuel supplies, boilers) as well as sufficient access rooms for maintenance and repair of these equipment. Some regulators require that medical waste must be rendered unrecognizable prior to its disposal at a landfill; therefore, additional space for mechanical shredders or compactors should be considered if the treatment technology selected does not alter the physical state or characteristics of the waste. Space requirement is also proportional to the facility throughput rate and depending on the type of treatment process. Facility should inquire technology vendor to provide space requirements for all necessary equipment to run the treatment technology. Space may not be a concern for offsite treatment facility because it is typically located in less populated suburban or industrial area where the public health and environment are to be impacted the least.

12.7 Utility and Installation Requirements

Different treatment technologies have different utility requirements. Some only need electrical power to operate, while others require steam, water, compressed air, natural gas, or propane.

Even for electricity, a steam disinfection unit has much lower power requirements than an incinerator or plasma arc unit. The availability, stability, and cost of utilities are also critical operating factors to be considered for any facility. Some technologies such as pyrolysis and plasma arc processes have the capabilities of generating alternative energy or power sources, making them attractive from the standpoints of self-sufficient and environmental friendly.

12.8 Waste Volume and Mass Reduction

Reduction of waste volume and mass is another important factor to be considered for selecting treatment technology as it affects operating cost of a treatment facility. Landfilling is the most common method for the final disposition of treated medical waste in the U.S. As the number of landfills declines rapidly and their capacities diminishing, cost for landfilling has steadily increased. Therefore, selection of a treatment technology that offers high volume and mass reduction such as incineration, pyrolysis, plasma arc, and molton salt process will minimize the dependency on landfilling and reduce the disposal costs. The treatment product from a plasma arc and molton salt process is a glassy slag material with extreme geological and physical stabilities, which can be used as road base and industrial sandblast grit. Stericycle has studied the feasibility of using reformulated medical waste treatment product in various shapes and compositions as supplemental fuel for power plants, which provides another solution for waste disposal. Mechanical shredding and compaction offer another less expensive method for reducing the waste volume. It is envision that with a successful waste classification system, more treated medical waste can be recycled instead of being disposed of at a municipal landfill (e.g., disposable plastic medical waste can be recycled to make medical waste containers).

12.9 Occupational Health and Safety

Since medical waste treatment technologies use physical and chemical processes to treat medical waste, it is necessary to consider their potential health and safety impacts on the facility workers. These potential health and safety impacts may include physical hazards such as injuries from hot surface; mechanical moving parts; noise; punctures/cuts from sharps; flying objects from shredders/grinders; and exposures to ionizing and non-ionizing radiation, airborne pathogens, chemical vapors, or blood and body fluids. Facility should also obtain information from technology vendors regarding incompatible chemicals or substances with their specific treatment processes. This may include flammable liquids, pressurized containers, large metal objects, or specific chemicals. With high temperature thermal treatment processes, presence of large amount of fluid may cause a rapid release of steam and a sudden increase of pressure. Mixture of certain incompatible chemicals may also cause dangerous or violent chemical reactions and the production of undesirable toxic gases/fumes. One example is concentrated acids or ammonia reacts with sodium hypochlorite to form explosive chlorine gas or chloramines gas, respectively. Some high temperature thermal systems also require several hours to cool down after their shut-down. Confine space entry and other necessary personnel protection measures will be required for workers to enter any treatment unit for scheduled or routine maintenance repairs. Facility should ensure that the selected treatment technology has adequate and redundant safety features (safety interlocks, emergency shut-down switches, etc.) for worker protection. Facility-specific health and safety plan and emergency procedures should be prepared based on the selected treatment technology. The draft UL2334 standard contains requirements to deal with risks of fire, electrical shock, and mechanical hazards, among others.

12.10 Noise and Odors

Noise and odor control is an important topic for occupational health and public relations. The best way to evaluate whether a treatment technology has noise or odor problem and the severity of the problem is to observe the technology during actual operation, either at the manufacturing facility or preferably, at an installation in another healthcare facility.

12.11 Ease in Use and Training Requirements

Most of the medical waste treatment technologies have been designed with certain levels of automation to minimize operator errors while allowing efficient and easy control of the treatment process, safety interlocks, diagnostics, remote monitoring, and automatic documentation to meet record-keeping requirements. Some vendors also offer automatic feed system such as cart lifters or dumpers as part of standard or optional equipment to minimize worker exposures to medical waste. Facility should understand the applicability and functionality of the equipped and optional automation features and make appropriate selections.

When selecting a treatment technology, the level of required skills and necessary training for the operator should be considered. Technology vendors typically provide basic operator training for new installation; however, the facility may need to arrange for ongoing training and education. Operator training should include a basic understanding of the treatment system including its limitations, routine and scheduled maintenance requirements, SOPs, occupational safety and personal protective equipment requirements, recordkeeping, technical support/assistance program, emergency procedures, and contingency plans. In general, the level of sophistication for operator training increases from basic chemical and steam disinfection to pyrolysis, plasma arc, and other innovative technologies. The facility should document the training and qualification of its operators.

12.12 Level of Commercialization

As a rule of thumb, the facility should select treatment technologies that are mature, fully commercialized, and with good past track of records. Technologies that are fully commercialized generally have been in the market for some time, have gone through system improvement or modification stage, have been scrutinized by the regulatory and public communities, and have had established service and technical support capabilities. As such, they should have less unexpected operating and maintenance problems than the unproven new technologies. However, it may be possible to negotiate a greater discount, more favorable payment terms, or special service package with vendors whose technologies are in the initial stage of commercialization. New technology vendors sometimes may be willing to provide additional incentives to the facility in exchange of opportunity for technology demonstration. Obviously, there are risks involved in being the first to use a technology with little or no track record. Facility should carefully weigh these uncertainties when selecting a proven or new technology.

12.13 Cost

Cost is an important consideration for medical waste treatment technology. Upon evaluating and screening applicable treatment technologies, facility should then evaluate the cost effectiveness

of the initially selected technologies. The cost items may include initial capital investment for the main treatment unit and all associated ancillary equipment; operation costs related to labor, utility, and waste disposal; and maintenance costs (labor and parts) for routine and scheduled maintenance/repair work. In general, steam or chemical disinfection processes with shredders/grinders have the lowest capital costs (US$100,000 to 400,000), microwave and radiofrequency treatment units have medium range capital costs (US$250,000 to 600,000); while incinerator, pyrolysis and plasma arc units have the highest capital investments (US$800,000 to over 1,000,000).

12.14 Public Acceptance

In the U.S., public acceptance may be equally important as regulatory approval, especially during the siting process for a new treatment facility. Public opposition due to close proximity of a treatment facility to residence, school, and other sensitive receptors may severely hamper or impede the facility development, despite regulatory approval of the technologies. A typical example is public pressure against pollutant emissions from the incinerators prompts the regulators to promulgate more stringent air emission requirements for existing and new incinerators, shut-down of poorly performed incineration units, and the healthcare organizations to work with waste treatment industries to develop other alternative technologies. Environmental impact studies and public hearing also add additional challenges for the siting and construction of new incineration facility. In general, the public tends to accept technologies that they are familiar with (chemical and steam disinfection, microwave) more readily than the so-called "innovative" processes (plasma arc, electron beam). As such, a certain level of public involvements or participation during the selection of treatment technologies provides opportunity for the public to gain better understanding of the pros and cons of each treatment process, which may result in greater community support for the treatment facility. Although currently there is little public participation opportunities in China for similar projects, it is anticipated that in the near future public awareness and input will be an important consideration for any environmental projects.

12.15 Vendor Background

Facility could benefit from acquiring background information of technology vendors, including but not limited to how long they have been in business, the company's financial condition, qualifications of their key officers, whether the vendors are involved in any intellectual disputes or lawsuits, and any outstanding or past environmental/safety violations or citations. Whenever possible, facility should obtain references from technology vendors who have provided treatment equipment to in the past and contact the references on equipment delivery schedule, performance, service records, and any particular concerns or issues with both the technologies and vendors.

13.0 MEDICAL WASTE MINIMIZATION AND RECYCLING

An integral part of an effective medical waste management program is waste minimization and recycling. Although government can institute laws and regulations to "enforce" waste minimization/recycling, the most effective way is through the combination of self-awareness by the healthcare industry and governmental incentive policies (such as tax breaks or compensation). Medical waste minimization focuses on elimination or reduction of medical

waste stream. The followings are common measures that have been instituted by the U.S. healthcare organizations to achieve medical waste minimization:

- ✓ Waste prevention by eliminating medical waste generation
- ✓ Source reduction by reducing the amount of medical waste generation
- ✓ Re-use by finding other uses of a component so it does not become part of the medical waste
- ✓ Recycling by handling or treating the material so it can be used in other processes.

By definition, source reduction and waste minimization are activities that reduce the toxicity or quantity of discarded product before the products are purchased, used, and discarded. This can be achieved by

- ✓ Manufacturers considering waste issues in designs of current and planned medical and healthcare products and their packaging; and
- ✓ Consumers of medical and healthcare products (e.g., hospitals) directing their purchasing decisions, product use, and the discarding of products toward waste reduction goals, toxicity and quantity

The following describes the essential administrative steps required by a healthcare facility to achieve medical waste minimization and recycling in a healthcare organization. A waste audit that emphasizes characterization of the waste stream and development of a plan delineating necessary segregation techniques and education/training of the approach to be taken to the employee of the healthcare facility is a useful tool to assist in meeting the goals of waste minimization/recycling.

13.1 UNDERSTANDING THE WASTE STREAM

The first step in waste minimization is to understand how and where the wastes are created; the special handling and processes for workers and public safety, regulatory compliance governing the handling of the waste streams, and the varying costs of treating and disposing of the wastes.

The six major waste streams that can be generated in a U.S. healthcare facility include liquid waste, solid waste, hazardous waste, radioactive waste, medical waste, and air emissions. Each of these waste streams is governed by a specialized set of laws and regulations to ensure worker and public safety, and environmental protection. Additionally, the treatment and disposal costs vary from one waste stream to another, making it fiscally prudent to handle a waste in the least expensive waste category. Improper characterization of medical waste that can be legally handled as MSW can be a costly, but avoidable "procedural error." Preventing MSW from being classified and handled as medical waste has been the theme of U.S. medical waste minimization program over the past decade due to the realization of enormous cost saving by the healthcare facilities.

13.2 Recognizing the Need to Reduce Wastes

The handling, storage, treatment and/or disposal of waste constitute a cost of doing business with healthcare facilities. Initially, a healthcare facility may resist waste segregation because of its perceived inconvenience and the difficulty of ensuring staff compliance; however, the increased costs associated with new regulatory requirements can create an economic incentive for a greater waste segregation effort. For example, improper management of various regulated waste streams can result in additional expenditures or legal liability for nonconformance with the laws and regulations. A hierarchy exists for handling mixed waste streams that raises the mixed waste stream to the highest classification of the wastes. As such, MSW mixed with medical waste renders the entire waste stream to be treated as medical waste. This increases the cost of handling the MSW portion by a factor of 20 to 30 times over what would have cost had the waste stream not commingled.

The type of plastic used and its impact on waste treatment is an example of how waste reduction effort focuses on protecting public health and the environment. The higher HCl in emissions, on average, from medical waste incinerators compared with MSW incinerators is thought to be due to the higher level of PVC plastics in medical waste. Therefore, healthcare facilities have been pressured the plastic medical product manufacturers to find other PVC substitutes with less of environmental concern, such as polyethylene. Although not totally replaceable because of certain physical characteristics of PVC, alternative materials have been used in producing medical products.

Most healthcare facilities segregate infectious and non-infectious medical waste, but separation of other items for recycling also facilitates waste management/reduction efforts. It is not uncommon for a healthcare facility to incorporate recycling as part of the overall waste management program as shown in Figure 2. This system represents a comprehensive waste strategy designed to recycle materials as possible, effectively render infectious medical waste noninfectious, reduce the amount of waste for landfilling, use the benefit of waste-to-energy to power the hospital's laundry, and reduce some of the risks and costs associated with waste management.

It is the responsibility of the management to develop policies and provide training to the staff for them to (1) recognize the importance of waste reduction to the long-term sustainability of the healthcare facility, and ultimately the success of their own career; (2) utilize proper waste segregation practices based on different waste streams; and (3) ensure that excessive wastes are not being created.

13.3 Developing Strategy to Minimize Medical Waste

In order for waste minimization efforts to be successful, implementation strategies must be formulated. Strategies consist of plans that describe how an organizational goal will be achieved. Formal strategies contain three basic elements: (1) goals to be achieved, (2) policies that guide or restrain actions, and (3) action sequences, or programs that accomplish the goals.

Management and staff must be committed to medical waste minimization to make it a successful program within the healthcare organization. Management must communicate the need for waste minimization in a manner that inspires staff to implement positive actions in this direction. This

can be done by publishing a "medical waste minimization strategy" stating the goals of the medical waste minimization program and identifying new policies for handling and discarding "medical" and "non-medical" wastes generated in the same setting. Other actions that should be considered for inclusion in the medical waste minimization strategy include:

- ✓ Plans for staff training and follow-up monitoring
- ✓ Monthly or periodical tracking mechanism for waste minimization results
- ✓ Incentives for developing and submitting waste minimization ideas

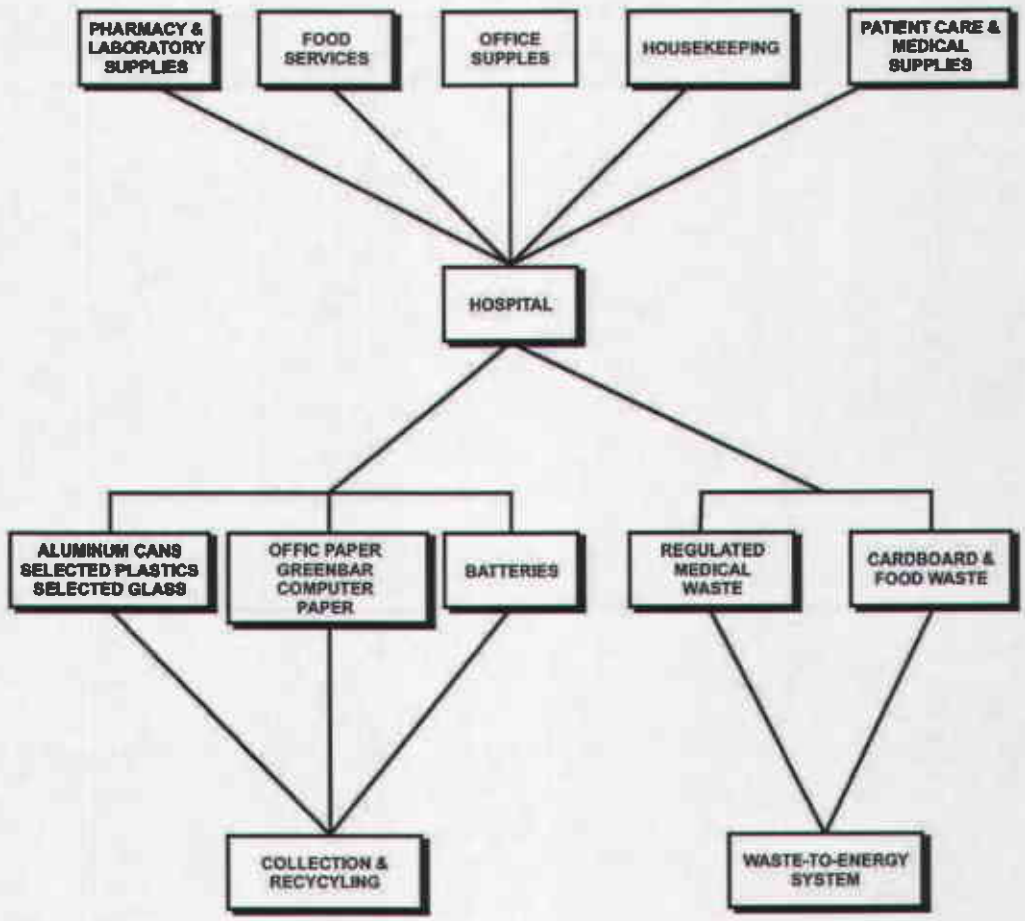


Figure 2 - Schematic of one hospital's proposed segregation categories and comprehensive medical waste management approach

- ✓ Percent of saving placed back into the generating groups/departments for capital improvement, staff training, or employee gain-sharing
- ✓ Recognition or awards for achieving milestones in implementing the strategy
- ✓ Formation of a team or council to oversee and coordinate the medical waste minimization strategy
- ✓ Preparation of tangible reports, graphs and feedback to show results.

13.4 Waste Minimization Planning and Responsibility

The medical waste minimization strategies must be formally approved by top management to demonstrate its commitment. The next step of the planning phase is to assign responsibility for the program. This responsibility can reside with an individual, a department head, team, or council as determined by top management. The top management should also empower employees with these responsibilities to work across organizational boundaries when coordinating and implementing the medical waste minimization program. Similarly, upon announcing the medical waste minimization strategies and responsibilities, the top management should also expect full cooperation from all operating units/groups within the facility.

13.5 Waste Minimization Assessment

Data of current waste streams generated within the healthcare facility, such as quantity and disposal/treatment cost per patient population in the facility or served by the facility, need to be collected during the assessment phase to serve as a baseline to measure the success of medical waste minimization program. Medical waste generation data from various operating units of the healthcare facility may be recorded on a Pareto Chart, with the waste quantities displayed in descending order from the left side of the chart. Pareto analyses can easily be used to determine the highest medical waste generating areas/units in which the minimization strategies should be initiated. Displaying the medical waste being generated by various groups/units can also assist in developing "buy-in" for implementing waste minimization strategies.

13.6 Waste Minimization Implementation

Following completion of the medical waste minimization assessment, the facility is ready to implement the waste minimization program. Data generated from the assessment phase allows top management to target major medical waste generating areas/units for potentially maximum gaining in waste reduction accomplishment. Proper communication, documentation, tracking, and accountability are essential elements for the successful implementation of a waste minimization program. The implementation phase should consist of the following:

- ✓ Applying medical waste minimization strategies to specific areas of the facility
- ✓ Tracking the waste minimization efforts and comparing the results with the waste data collected during the assessment phase of the program
- ✓ Documenting results and studying the system for continuous improvement
- ✓ Evaluating the waste minimization process to document success and determine training efficiency and needs

- ✓ Instituting policy directives incorporating improved medical waste minimization process
- ✓ Planning new medical waste minimization pilot projects for further waste reduction.

14.0 ECONOMIC AND FINANCIAL ANALYSES

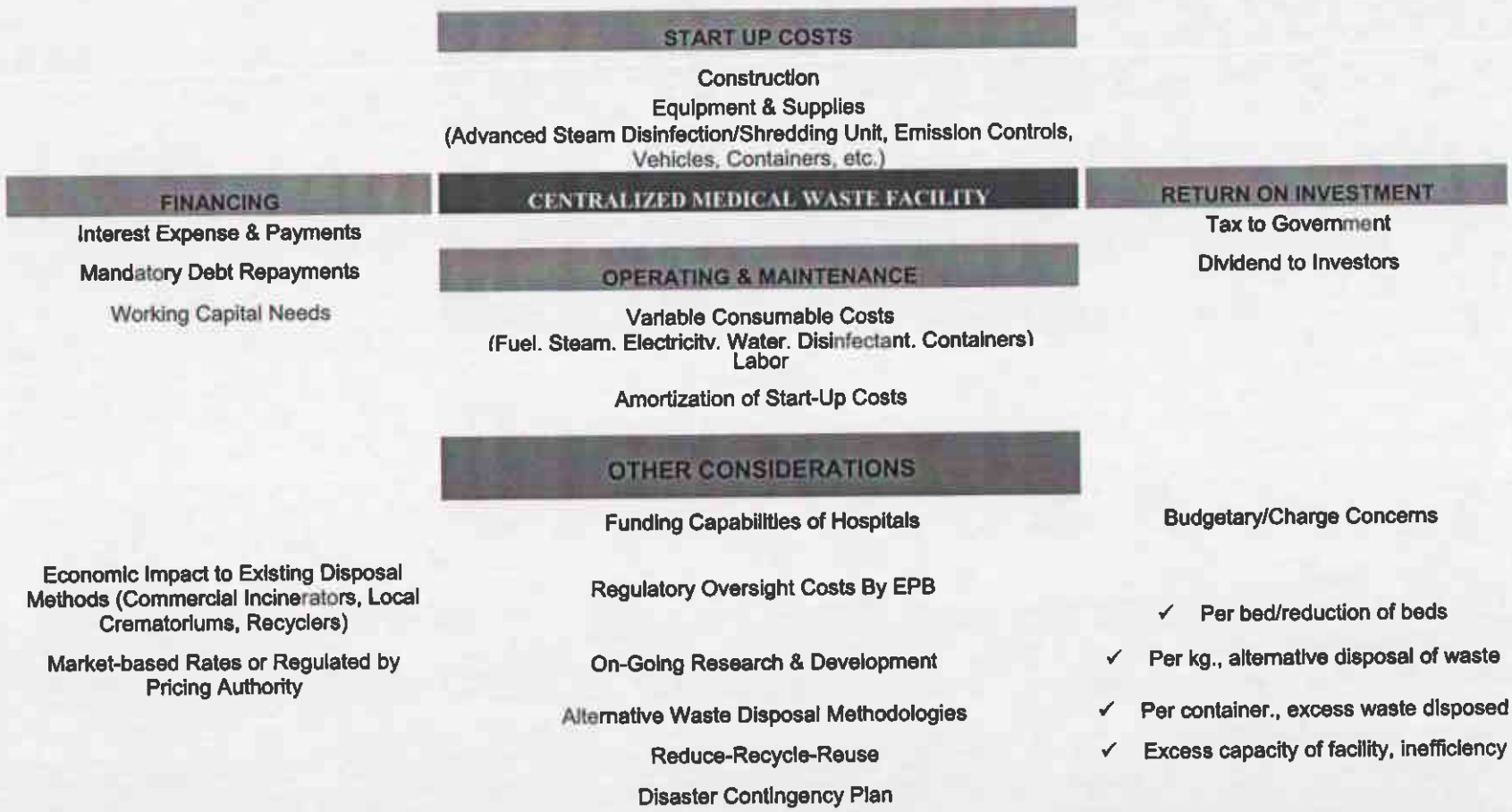
As discussed previously, THWTC is currently a designated central treatment facility for Tianjin's medical waste. THWTC employed incineration as its primary treatment technology in order to comply with the PRC central government's requirements, but also operated an advanced autoclave disinfection unit as an alternative for incineration. Since THWTC will continue operate under the current conditions, a new 25-ton facility will not be constructed until the waste generation rate exceeds the THWTC's design capacity. Additionally, based on the fact that the U.S. incinerators are considered too costly (eight to ten times more expensive) and non-competitive to those made domestically or by Japan or Korea, it is unrealistic to assume that U.S. vendors will have a fair share in the incineration market. Therefore, the new facility is assumed to use alternative treatment technologies that are more in-line with the strengths of the U.S. vendors, such as the STI Chem-Clave units that have been mentioned by THWTC.

It should also be pointed out that the economi analysis presented herein is primarily for assessing the financial feasibility of the proposed treatment technology with an "order-of-magnitude" engineering cost approach and an uncertainty ranging from ± 30 to 50%. Figure 3 depicts major financial considerations for the economic analysis of a centralized medical waste treatment facility. These key financial considerations included but might not be limited to:

Start-up costs such as cost associated with equipment acquisition and facility construction Operating and maintenance costs such as variable consumables (e.g., utilities, water, fuel, chemicals), labor, and amortization of start-up costs.

- ✓ Financing such as interest expense and payments, mandatory debt repayments, and working capital needs.
- ✓ Return on investment such as tax to government or dividend to investors.
- ✓ Other considerations, including:
  - Rate and potential economic impacts.
    - Market-based rates or rates established by local government pricing bureau.
    - Economic impact to existing disposal facilities such as commercial incinerators or local crematoriums that are currently treating and disposing medical waste.
  - Budgetary concerns.
    - If charge fee is based on a per bed rate ($/bed/day), there may be budgetary impacts from reduction of beds or increase of waste amounts due to incorporation of other non-medical waste.
    - If charge fee is based on a per weight rate ($/kg), there may be budgetary impact from reduction of waste quantities due to incorporation of medical waste into MSW or use of other less expensive treatment/disposal alternatives.

Figure 3. Major Financial Elements to be Considered for the Economic Analysis of a Centralized Medical Waste Treatment Facility



- If charge fee is based on a per container rate ($/container/day), there may be budgetary impact from overloading the waste container to save treatment cost.
- Oversized facility may cause waste of investment and inefficient operations.

- Other financial concerns, such as:
  - Funding capability of hospitals (allocate separate budget or obtain other financial sources) to sustain medical waste treatment/disposal costs.
  - Regulatory cost imposed by local oversight agencies.
  - On-going research and development (R&D) for waste disposal technologies, which could be part of the medical waste charge to improve handling, collection, transportation, and treatment/disposal of medical waste.
  - Impacts from alternative waste treatment and disposal technologies, particularly those otherwise proven effective and cost competitive than incineration but have not been officially endorsed or approved by SEPA.
  - Promulgation of waste reduce-reuse-recycle (3R) will cause a significant reduction of waste quantity, negatively affecting the designed treatment capacity.
  - Preparation of disaster contingency plan and the needs for alternative or standby emergency treatment system.

14.1 KEY TECHNICAL AND OPERATIONAL ASSUMPTIONS

Key technical and operation considerations for the economic analysis include waste sources, waste types, and centralized medical waste treatment facility.

14.1.1 Medical Waste Sources

The proposed facility will treat infectious medical wastes generated from medical procedures and related activities at hospitals, clinics and preventive medicine facilities in Tianjin; except for radioactive wastes, mercury containing wastes, explosive materials and wastes generated from treating severe contagious disease. Wastes generated form treating severe contagious disease (such as SARS - severe acute respiratory syndrome) will be treated according to the specific instruction or policies issued by the PRC's Ministry of Health and SEPA.

14.1.2 Medical Waste Types

Medical wastes to be treated at the proposed facility include wastes generated primarily from patient's rooms (i.e., clothing, bondages, gloves, disposable syringes and tubing, blood, and other human body fluids and secretions); surgical rooms (i.e., anatomical wastes such as tissues, organs, fetus, body parts, infectious wastes, blood and body fluids and waste contaminated with blood and body fluids); research and teaching laboratories (i.e., infectious wastes, disposable equipment and chemical reagents, film processing wastes); medical laboratories (i.e., pathological specimen, infectious waste, reagents and very small amount of low level radioactive wastes); and outdated pharmaceuticals.

14.1.3 Centralized Medical Waste Treatment Facility

The proposed central medical waste treatment facility will be co-located within or constructed adjacent to the existing THWTC facility, which will include the following expanded or new components: (1) waste collection and transportation, (2) waste treatment, and (3) final safe disposal.

14.1.3.1 Waste Collection and Transport

Medical waste will be collected every two days by designated medical waste transportation vehicles using specialized medical waste containers. Technical specifications of the medical waste containers and transportation vehicles will follow the requirements stipulated in "*Technical Standards for Medical Waste Transport Vehicle (Interim Guidelines), June 30, 2003.*" The transportation vehicles will also be equipped with global information system (GIS) system to allow better tracking and control of waste collection routes by the dispatch office. Waste generators will be responsible for segregating the waste and placing it in the respective containers. Designated transportation routes and waste collection time will be developed to minimize public exposures from infectious medical waste.

Number of Transportation Vehicles Required – Currently the THWTC maintains three (3) 5-ton and 12 2-ton vehicles dedicated for transporting approximately 10 tons of medical waste per day to the incineration unit. With a projected 25 tons per day generation rate, there will be a need for five (5) 5-ton and 18 2-ton medical waste transport vehicles. As a conservative approach, one 5-ton and two (2) 2-ton vehicles are also included in the new acquisition to cover possible vehicular shortage during maintenance and/or repair periods. Based on this, a total of six (6) 5-ton and 20 2-ton medical waste transportation vehicles are assumed to be needed for the expanded treatment facility.

Number of Medical Waste Collection Containers Required – The total number of medical waste collection containers needed for the expanded treatment facility includes 300 660-L and 5,250 125-L containers, based on a current number of 200 660-L and 3,500 125-L containers for handling approximately 10 tons per day of medical waste.

14.1.3.2 Capacity of Expanded Central Medical Waste Treatment Facility

The expanded medical waste treatment facility is designed to handle 25 tons per day (TPD) of medical waste based on the following assumptions: (1) advanced shredding/steam disinfection is accepted by the PRC as an alternative treatment technology for incineration, (2) THWTC will use two 15-TPD advanced shredding/steam disinfection units as the primary treatment process for medical waste, and (3) the existing advance autoclave unit and incinerator will serve as backup treatment units for emergency or during the maintenance/repair of the primary treatment units.

Treatment Technology and Pollution Control – The proposed primary treatment technology is advanced shredding and disinfection technology, in which the medical waste is fed into an enclosed shredding chamber to break up the medical waste and increase the exposure surface areas before sending it into a tilted steam disinfection chamber for steam treatment. The

treated medical waste is dehydrated by heat as it slowly moves to the discharge end of the disinfection chamber. Upon exiting the disinfection chamber, the treated medical waste is compacted and then transported to a MSW landfill for disposal. There are no pollution controls required for the treatment system since it does not generate waste fluid and air emissions.

Auxiliary Equipment - The proposed treatment technology will also require steam for disinfection. Since the expansion of the treatment facility will be located within or adjacent to the existing plant, it is assumed that house steam (low pressure 1.05 kg/sq. cm.) is readily available based on the current incineration and advanced autoclave operations in the THWTC facility. In addition to steam, other utilities (electricity, water), disinfectant/deodorant chemicals, and MSW compactors will also be needed.

14.2 Key Financial Analysis Assumptions

In addition to technical and operation assumptions, financial analysis assumptions were also made for the economic analysis and summarized below.

- ✓ Advanced shredding and disinfection units and disinfectant/deodorant chemicals will be purchased from the U.S. Installation supervision, in-service training, and equipment start-up will be conducted by the vendor at no additional charges to the client.
- ✓ All other equipment and materials will be purchased from the PRC domestic markets. Construction activities will be conducted by local work force.
- ✓ Wastewater treatment facility will use local products and constructed by local labors.
- ✓ Depreciation analysis will consider two service life cycles for major treatment equipment (e.g., 10 years for each cycle due to PRC's general accounting practices), coincided with service life cycle of the facility that is set at 20 years, and adjusted for an annual inflation rate of 3%. On the other hand, cash flow analysis will be performed for the loan repayment schedule of 15 years.
- ✓ Cost analysis is based on the assumption that Tianjin Municipal Government (TMG) will provide the land required for the central treatment facility and 30% of the total investment for initial capital equipment purchase/installation and operating or working capital (normally at 10 to 15% of total capital investment). The remaining 70% of the total investment will come from a 15-year bank loan with an annual interest rate of 6.5%.

14.2.1 Capital Cost Estimation

Capital cost refers to costs associated with equipment procurement and installation, facility and hardware construction, and start-up operation. The capital investment for the central medical waste treatment facility is estimated at $4,456,125 as shown in Table 28. Facility construction accounts for 50% of the total capital investment, followed by the advanced shredding and disinfection units and compactors (31%), transport vehicles (9%), wastewater treatment plant (6%), and waste containers (3%).

Costs for construction of storage and treatment facility are estimated at RMB $18,000,000 or US $2,250,000. Treatment facilities include vehicle inspection and receiving station, administrative buildings and amenities (restaurants, restrooms, dormitories, etc.), vehicle loading/unloading

Table 28. Capital Costs for the Expansion of the Central Medical Waste Treatment Facility and Annualized Costs

Item	Descriptions	Made		Unit Cost		Unit	Est. Total Unit	Est. Total Cost	
		US	PRC (China)	RMB $/unit	US $/unit			RMB$	US$
	Capital Investment								
1	Facility Construction (including temporary storage, treatment, supporting buildings)		√	1,500	188	m2	12,000	$18,000,000	$2,250,000
2	Wastewater Treatment Plant (construction and installation)		√	2,310,000	288,750	LS	1	$2,310,000	$288,750
3	Waste Transfer Containers (660-L)		√	2,000	250	ea	300	$600,000	$75,000
	Waste Transfer Containers (125-L)		√	100	13	ea	5,250	$525,000	$65,625
4	Transport Vehicle (2-ton)		√	112,000	14,000	ea	20	$2,240,000	$280,000
	Transport Vehicle (5-ton)		√	150,000	18,750	ea	6	$900,000	$112,500
5	Advanced Shredding/Disinfection Units (30 TPD, Two 15-TPD Units)	√		-	641,500	ea	2	-	$1,283,000
								Subtotal	**$4,354,875**
	Annualized Cost								
1	Facility & Equipment Annualized Cost			-	5%	-	Capital Cost	-	$191,088
2	Disinfectant (vehicles and others)		√	950	119	mo	12	$11,400	$1,425
3	Fuel		√	2500	313	mo	12	$30,000	$3,750
4	Vehicle/Container Maintenance		√	3000	375	mo	12	$36,000	$4,500
5	Labor (15 Administration Staff)		√	37500	4,688	mo	12	$450,000	$56,250
	Labor (30 Technicians, Drivers)		√	37500	4,688	mo	12	$450,000	$56,250
6	Overhead/Management					75%			$84,375
7	**Insurance/Tax**					4%			$91,560
8	Electricity		√	0.61	0.08	kw/hr	1848000	$1,127,280	$140,910
9	**Deodorizer**	√		-	1.00	LPH	21840	-	$21,840
10	Steam		√	0.08	0.01	kg/hr	6098400		$79,279
11	Facility Maintenance		√	0.30	0.04	$/kg waste	10920000	$3,276,000	$409,500
12	Landfill Disposal		√	70	8.750	ton	10920	$764,400	$95,550
13	Landfill Pull Charge		√	400	50	#pull/yr	927	$370,800	$46,350
								Subtotal	**$1,282,627**

area, temporary waste storage facility, main treatment building, waste disposal staging area, mechanical and electrical shops, vehicle and container disinfection and staging area, and open spaces. Since PRC requires that wastewater generated from the centralized medical treatment facilities be treated to meet the waste discharge standards prior to discharging it into the municipal sewer system, capital investment cost is also allocated for the procurement and construction of the required wastewater treatment plant, which is estimated at $288,750.

It should be noted that cost estimates shown in Table 28 are based on the following assumptions:

- ✓ The new facility will be an expansion of and adjacent to the current THWTC premises. Land is assumed to be provided by the Tianjin Municipal Government or available from the initial construction of THWTC.
- ✓ Two STI Chem-Clave, each with a thru-put rate of 15 tons per day (total 30 TPD), will be operated 24 hrs per day for 350 days.
- ✓ Waste processed per year is 10.5 million kilograms or 10,500 tons.
- ✓ Equipment purchase price includes installation supervision, in service training, and test of equipment.
- ✓ Since the current THWTC has an incinerator and steam disinfection unit, no separate steam generation equipment is assumed to be required.
- ✓ Although THWTC has an existing landfill it is presumed to be used for disposal of hazardous waste instead of MSW. Therefore, the annual operation cost include offsite disposal of treated medical waste, which will be treated as regular MSW.

14.2.2 Annual Costs

Total annual costs are expenses incurred every year over the life of a central medical waste treatment facility, which include both direct and indirect costs. These costs can be offset by recovery credits (such as energy recovered from the treatment system) that are sometimes considered as revenue or income in the cash flow analysis. However, in this case, all treated medical waste will be disposed of as MSW although it may have other beneficial use such as alternative fuel for the existing incinerator. Total annual costs are developed based on the following assumptions:

- ✓ Depreciation for major equipment and accessories occurs over a 10-year period
- ✓ Depreciation for transportation vehicles and medical waste containers occurs over a 10-year period
- ✓ Residual value for fixed assets is estimated at 10%
- ✓ Local average labor costs are RMB $30,000 (US $3,750) and $15,000 (US $1,875) per year per person for administrative staff and working crews, respectively.

Direct costs can be further separated into variables and semi-variables. Variable costs are costs directly associated with the operation of the treatment system, such as utilities (electricity, steam, fuel, water, etc.), waste disposal, and materials (disinfectant/deodorant chemicals). Semi-variables include operating and maintenance labors, maintenance and other consumable

materials, and overhead. Indirect costs include capital equipment depreciation, taxes or permit fees (property tax, vehicle, air and waste discharge permits), and insurance and administrative charges.

Annualized cost for the treatment facility is estimated at 5% of total capital investment (US $2,250,000), or $112,500. Annualized cost for the two shredding/disinfection units is estimated at 5% of total capital investment (US $1,283,000), or $64,150. Annualized cost for operating wastewater treatment plant is estimated at US $14,438 (5% capital investment cost of US$287,500). Annualized cost for vehicles and waste containers includes disinfectant used to clean and disinfect containers and vehicles for reuse (estimated at US $1,425), fuel cost (US $3,750), labor cost (estimated at US $112,500) as well as costs for overhead and insurance/tax (insurance/tax are estimated at 4% of capital cost) or US $91,560, whereas management and overhead are estimated at 15% and 60% of total labor costs, respectively, or US $84,375. Cost estimates for transportation and final disposition of treated medical waste at an off-site MSW landfill facility is estimated at US $141,900. Annualized cost for facility and vehicle maintenance is estimated at $414,000.

As stated before, although the treated waste may be processed onsite as an alternative fuel source for the incinerator and therefore, generates additional revenue, this option was not included as part of the economic analysis. Total annualized cost is calculated at US $1,282,627.

14.3 Economic Analysis

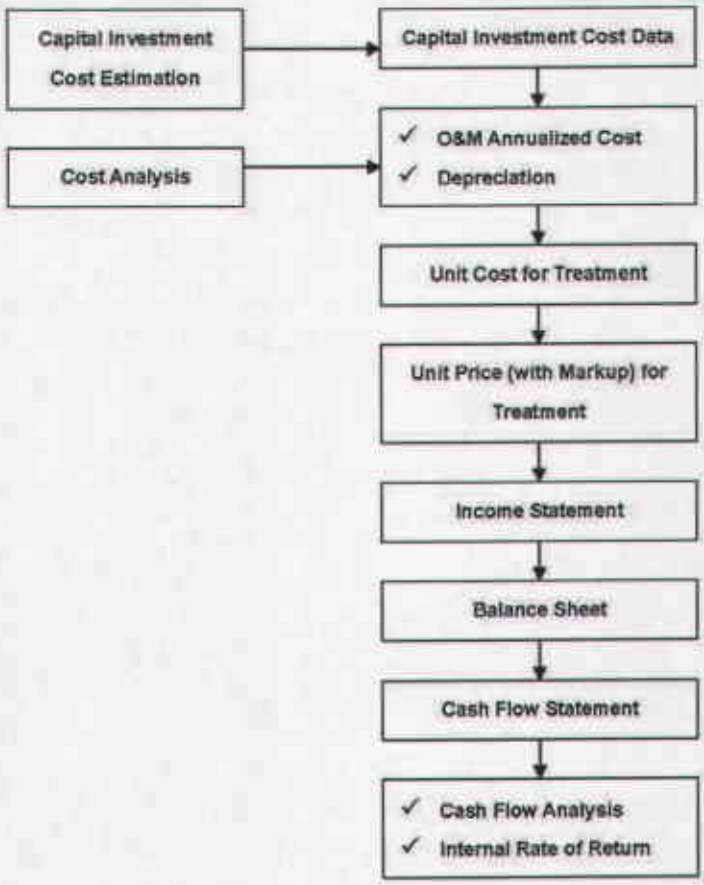
Using capital investment and annualized cost estimates, an economic analysis was conducted for the expanded central medical waste treatment facility to assess its economic feasibility.

Figure 4 shows the conceptual approach of economic analysis, which began with an estimate of capital and auxiliary equipment cost based on the proposed treatment technologies, capacity, and, engineering specifications; followed by calculating depreciation values based on years of equipment service life and annualized cost estimates that take into account of both direct (i.e., utilities, consumables) and indirect (administrative and overhead charges) operating costs.

Economic analysis then proceeds to evaluate feasibility and profitability of the proposed centralized treatment facility, including unit cost calculation, unit price determination, and preparation of Income Statement, Balance Sheet, Statement of Cash Flow, and finally, Cash Flow Analysis and calculation of Internal Rate of Return (Appendix I). The following summarizes essential components of the economic analyses:

- ✓ Total Capital Investment consists of costs associated with facility construction, equipment procurement, and land lease as well as capitalized interest. Equipment procurement cost includes purchase price and installation/testing costs required to prepare the equipment for operation. The land used by the expanded treatment facility is assumed to be owned by the TMG or THWTC and at no cost to the project. Capitalized interest is interest charge incurred during the initial startup period before operation.

Figure 4. Economic Analysis Flow Diagram



- ✓ Annualized Costs are routine costs incurred annually throughout the life span of the treatment system. Annualized costs can be expressed as:

  Total Annualized Costs = Direct Annualized Cost + Indirect Annualized Costs

- ✓ Depreciation is the annual value deduction of depreciable capital investment in service. Normally, land is not considered as depreciable in tax codes. In the following economic analysis, a 10% residual value of fixed assets and the straight line depreciation method are used. Annual depreciation valued can be expressed as:

  Annual Depreciation = Capital Investment x (1-10% Residual Value)/Year of Equipment Service Life Span

- ✓ All equipments are assumed to have a 10-year service life in average. The residual value is written off at the end of the 10-year period and a new set of equipment will be procured at the 11th year. All costs include a 3% annual inflation rate based on the 2005 equipment value.

- ✓ It is assumed that 70% of capital costs will be raised through a 15-year loan with an interest rate of 6.5%. Hence, capitalized interest charge will be factored in during an 8-month construction period. Capitalized interest will be calculated using the following formula:

  Capitalized Interest = Principal x Interest Rate x Number of Periods

- ✓ Annual Cost Analysis is performed using the following assumptions:
  - All costs are adjusted for an annual average inflation rate of 3.0%.
  - The new facility will receive 100% of medical waste (e.g., 25 TPD) immediately after its startup operation.
  - Sales tax is calculated at 5% of annual income and other value-added tax is estimated at 11.55% of the sale tax.
  - Income tax is estimated at 33% and could be adjusted according to actual.
  - Annual operational incomes are incomes from processing medical waste. The current unit charge price is RMB $3.76/kg or US $0.47/kg for transportation, treatment, and disposal of medical waste. However, since the perceived treatment cost using steam disinfection should be less expensive than incineration, a hypothetical combo cost of RMB $3.15/kg (or US $0.394/kg, 84% of the current cost) was assumed for economic analysis. This will result in an annual income of $3.15/kg x 25,000 kg/day x 365 days/year = RMB $28.744 millions or US $3.59 millions.
  - There is no other revenue income derived from this project.
  - Labor costs include fringe benefits.
  - Fixed Expenses = facility maintenance+ vehicle insurance and registration fees + wastewater treatment plant maintenance + insurance + property tax + depreciation.
  - Variable Expenses = Total Annual Expense - Fixed Expense.
  - Unit cost is the cost ($) per bed of medical waste treatment service incurred by the centralized treatment facility.

- ✓ Balance Sheet is prepared based on the following assumptions:

- Assuming one month of inventory supplies for consumable materials for waste treatment processes and equipment maintenance material.
- Appropriated earning is defined as 15% of net income as required by the laws of PRC's for future growth and welfare.

✓ Cash Flow Analysis is performed based on the following assumptions:

- Cash Sales = Annual Sales/12 x 11 (e.g., collect 11 months of cash sales and one month of accounts receivable).
- Annual Operation Cost does not include non-cash expenses, such as depreciation and gain or loss on disposal of fixed assets.

Detailed results and backup of economic analysis are provided in the appendices section. Key findings from the economic analysis are discussed in the following subsections.

14.3.1 Depreciation

Table 29 shows total investment costs, deprecation, and net book values for years 1, 5, 10, 11, 15 and 20.

Table 29. Depreciation Schedule, Tianjin Centralized Medical Waste Treatment Facility

Item	Value (x US $1000)					
	Year					
	1	5	10	11	15	20
Total Cost	$4,544	$4,544	$4,544	$5,853	$5,853	$5,853
Total Depreciation	$409	$409	$409	$981	$527	$527
Total Net Book Value	$4,135	$2,499	$454	$5,326	$3,219	$585

It should be noted that at year 11, the residual value, which is estimated at 10% of the original cost, is written off and a new set of equipment will be installed to replace the existing ones.

14.3.2 Annual Cost Analysis and Income Statement

Results of annual cost analyses and income statements for years 1, 5, 10, 11, and 15, are summarized in Tables 30 and 31, respectively. The time period is set to match the assumed 15-year bank loan.

Table 30. Annual Cost Analysis, Tianjin Centralized Medical Waste Treatment Facility

Item	Value (x US $1000)				
	Year				
	1	5	10	11	15
Total Annual Income	$3,593	$3,593	$3,593	$3,593	$3,593
Total Annual Expense	$2,742	$2,847	$3,005	$3,424	$3,274
Net Annual Income	$852	$746	$588	$170	$319
Profitability (%)	24	21	16	6	9

Similarly, a new set of equipment will be installed in the 11th year to replace the existing ones; the residual values, at 10% of the original costs, will be charged to annual expense. As a result, the net income during the 11th year will significantly decrease. The annual average profitability rate for a 15-year operation is estimated to be 18%.

Table 31. Income Statement, Tianjin Centralized Medical Waste Treatment Facility

Item	Value (x US $1000)				
	Year				
	1	5	10	11	15
Total Income	$3,593	$3,593	$3,593	$3,593	$3,593
Total Cost of Sales (Service)	$2,028	$2,231	$2,521	$3,156	$2,975
Gross Profit	$1,566	$1,363	$1,073	$437	$618
Total Operating Expenses	$84	$95	$110	$113	$128
Total Income from Operation	$1,481	$1,268	$962	$324	$491
Other Expense (Loan Interest)	$210	$154	$84	$70	$14
Income before Tax	$1,271	$1,113	$878	$253	$477
Income Tax	$419	$367	$290	$84	$157
Net Income for the Year	$852	$746	$588	$170	$319

14.3.3 Balance Sheet

Table 32 summarizes the balance sheet results for years 1, 5, 10, 11, and 15. It should be noted that the following cost items are included in the Balance Sheet calculations but can be modified if necessary.

- ✓ Note receivable in current asset.
- ✓ Construction in progress in property, plant and equipment.
- ✓ Intangible asset, such as land acquisition and permit, amortization and other intangibles.
- ✓ Note payable, accrued interest, income tax payable, accrued wages and salaries and deposits received from customers under current liability

14.3.4 Cash-flow Analysis

Cash flow is the net difference of direct investments, loans and revenue collected, and expenditures made during the lifecycle of an operation. Cash flows are typically segregated into financing, investing, and operating. Financing cash flows are the direct investment or repayment of monies to and from investors. Investing cash flows are expenditures to acquire and install technology that will ultimately generate revenue and profits. Operating cash flows represent the excess or deficit revenue received over operating expense paid. A summary of cash flow analysis is presented in Table 33.

The project revenues are derived from treating medical waste and sales of electricity generated by the heat during the incineration process. It is expected that majority of the sales will be collected in cash and only one month of sales will remain in receivable at the end of the year. At a unit charge rate of US $0.39 per kilogram of waste and with an average annual profitability of 18%, it is anticipate that the project will produce sufficient cash flow to fund the operation and service the loan repayment at the same time.

Table 32. Balance Sheet, Tianjin Centralized Medical Waste Treatment Facility

Year	1	5	10	11	15
Assets (x US $1000)					
Current Assets					
Cash	$745	$4,665	$8,900	$3,983	$6,743
Accounts Receivable	299	299	299	299	299
Note Receivable	-	-	-	-	-
Inventory	-	-	-	-	-
Material	33	37	43	44	50
Total Current Assets	1,078	5,002	9,243	4,326	7,093
Long-term Investment					
Property, Plant and Equipment					
Construction in progress	-	-	-	-	-
Acquisition Cost	4,544	4,544	4,544	10,396	10,396
Accumulated Depreciation	(409)	(2,045)	(4,089)	(5,070)	(7,177)
Total Property, Plant and Equipment	4,135	2,499	454	5,326	3,219
Intangible Asset					
Land lease permit	-	-	-	-	-
Amortization	-	-	-	-	-
Other Intangible	-	-	-	-	-
Total Intangible Asset	-	-	-	-	-
Total Assets	**$5,212**	**$7,501**	**$9,697**	**$9,652**	**$10,312**
Liability and Stockholder's Equity					
Accounts Payable	$33	$37	$43	$44	$50
Note Payable	-	-	-	-	-
Accrued Interest	-	-	-	-	-
Income Tax Payable	-	-	-	-	-
Accrued Wages, Salaries	-	-	-	-	-
Deposits Received from Customers	-	-	-	-	-
Total Current Liability	33	37	43	44	50
	-	-	-	-	-
Long-term Debt	3,021	2,158	1,079	863	0
Total Liabilities	3,054	2,195	1,122	908	50
	-	-	-	-	-
Stockholders Equity	-	-	-	-	-
Capital Stock	1,306	1,306	1,306	1,306	1,306
Additional Paid-in-Capital	-	-	-	-	-
Retained Earnings					
Appropriated Earnings	128	600	1,090	1,116	1,343
Un-appropriated Earnings	724	3,399	6,178	6,323	7,612
Total Retained Earnings	852	3,999	7,269	7,438	8,955
Total Liabilities and Stockholder's Equity	**$5,212**	**$7,501**	**$9,697**	**$9,652**	**$10,312**

Table 33. Summary of Cash Flow Analysis

Cash Inflow (x US $1000)					
Item	YEAR				
	1	5	10	11	15
Cash Inflow (x US $1000)					
Cash Sales	$3,294	$3,294	$3,294	$3,294	$3,294
Cash Collection from Receivable	-	$299	$299	$299	$299
Proceeds from Sale of FA	-	-	-	-	-
Total Cash Inflow	$3,294	$3,593	$3,593	$3,593	$3,593
Cash Outflow					
Start-up Investment	-	-	-	-	-
Plant & Equipment Replacement	-	-	-	$5,853	-
Annual Operation Cost Payment	$1,703	$1,917	$2,222	$2,289	$2,576
Interest Payment	$210	$154	$84	$70	$14
Income Tax Payment	$419	$367	$290	$84	$157
Loan Principal Repayment	$216	$216	$216	$216	$216
Total Cash Outflow	$2,549	$2,654	$2,812	$8,511	$2,963
Annual Net Cash Inflow	$745	$939	$782	($4,918)	$630
Accumulated Cash Flow	$745	$4,665	$8,900	$3,983	$6,743

Note: The cash flow assumes no proceeds from disposal of fixed assets.

14.3.5 Financial Internal Rate of Return

Financial internal rate of return (IRR) measures the return to equity on the money it invested. At a charge rate of RMB $3.15 or US $0.394 per kilogram, the internal rate of return is calculated to be approximately 13% at the end of the year of 2020 (year 15). The IRR will likely be at a hefty 25% or greater if the charge rate is maintained at the current RMB $3.76 or US $0.47/kg.

14.4 Analysis of Investment Risks

Investment risks for the centralized medical waste treatment facility may include: (a) construction and sponsor risks; (b) operating and technology risks; (c) economic, inflation, and environmental risks; and (d) country, political, and foreign exchange risks. These investment risks and potential mitigation measures are discussed below.

14.4.1 Construction and Sponsor Risks

The key construction risks for the Tianjin centralized medical waste treatment facility are non-completion, late completion, and cost over-run. These risks will greatly impact the facility's operation, profitability, and investment return. Construction risks are relatively easy to mitigate as the construction schedule is within a fixed time period and can be managed with contract and legal bonding responsibilities. Once construction is completed, the risks no longer exist. The following mechanisms may be considered to minimize or appropriate construction risks:

- ✓ Allocate construction risks, to the extent possible, to the contractors by negotiating a turnkey fixed-price project, with carefully designed and legal binding milestone payment schedules, payment withhold provisions, and other penalties (such as bid bonds or performance bonds) associated with non-completion, late completion, and cost over-run situations. An award fee arrangement may also be built into the contract to reward the contractor for early and successful completion of milestone deliverables or the overall project schedule.
- ✓ Require contractors and/or vendors to commit equity (or potentially secured assets) to ensure its genuine interest in successfully completing the project.
- ✓ Utilize third party/parties to perform independent engineering evaluations and construction management as part of the due diligence process to detect early problems.

Sponsor risks are typically related to the stability and commitment of investment sources. These risks can be mitigated by:

- ✓ Preparing detailed and accurate business plan and economic analysis,
- ✓ Securing a loan from credible lenders or financial institutions,
- ✓ Providing the lenders with a loan guaranty policy, such as the U.S. Ex-Im Bank guarantee service to be described later, and
- ✓ Obtaining favorable and explicit local government policies or written contracts for the services to be provided. In PRC, the local lenders accept policies or contracts as a form of loan guarantees. Hence, government commitment and sponsorship is extremely critical in mitigating any investment concerns. This is typically achieved by having certain collaborated relationships with the enterprises affiliated with or under the local governing regulatory agency or municipal government.

Another level of sponsor risks is directly related to the commitment and ability of the Tianjin EPB/THWTC to secure the land required for the centralized treatment facility and to coordinate with other Tianjin city and district regulatory agencies governing the transportation, public health, and pricing issues. Relationship buildings with relevant local government agencies and communities are the key factor to resolve these political conflicts.

14.4.2 Operation and Technology Risks

Once the centralized medical waste treatment facility is constructed, the actual operations may face the immediate challenges in the availability of qualified and properly trained facility operators, capability of trouble-shooting equipment and operation problems, and how to run a safe and cost effective operation.

As discussed earlier, the proposed medical waste treatment facility will treat infectious medical, hazardous and dangerous wastes directly or indirectly generated from medical treatment practices at hospitals, clinics, and preventive medicine facilities. Radioactive wastes, wastes

containing mercury, explosive materials, and wastes from treating severe contagious diseases would not be handled or treated by this facility; therefore, the operation risks from major environmental or public health and safety issues is relatively low. Most of the operation risks are associated with unexpected equipment/system failures or emergency shutdowns. Contingency plan that provides alternative facilities or use of standby units should be prepared to address these risks.

Perhaps one of the most significant operating risks is that the treatment capacity is based on projected waste generation rates. If the government cannot guarantee the quantity of medical waste for the facility that is designed based on the projected rates, the facility will be at the risk of under-utilization. If the actual waste quantity received is less than the design capacity, which translates to a higher operating cost and less profit.

PRC listed incineration as the only medical waste treatment technology with officially written performance standards in the past. Technology risks from incineration of medical waste, particularly the rotary kiln incinerator, are very low because it is a well developed and proven technology although incineration did suffer from lacking of general public acceptance due to health risks associated with the production of dioxins. Based on its relatively high heating value (averagely 1,800 kcal/kg), medical waste is considered a good waste source for incinerator because it requires less of auxiliary fuel, thereby reducing the operation costs. Nevertheless, there remains uncertainty as to whether incineration provides the best and most cost effective solution to medical waste treatment.

However, in February 2006, PRC promulgated technical specifications for two non-burn medical waste treatment technologies, they are: chemical disinfection (HJ-228-2006) and microwave disinfection (HJ-229-2005). [*Technical Specifications for Chemical Disinfection Centralized Treatment Engineering on Medical Waste (On Trial) (HJ-228-2005), 2-8-2006 Promulgation, 3-15-2006 Implementation, and Technical specifications for Microwave Disinfection Centralized Treatment Engineering on Medical Waste (On Trial) (HJ-229-2005), 2-8-2006 Promulgation, 3-15-2006 Implementation*] This new development demonstrates that the government is considering alternative technology, such as disinfection, in treating medical wastes with less environmental concerns, which are normally associated with traditional incineration technology. The proposed steam disinfection treatment technology is a well-proven technology. The operating principle of steam disinfection is similar to a scale-up autoclave, which is commonly used in the hospital for sterilization of medical apparatus. The proposed technology is an greatly improved version of the conventional steam disinfection with better treatment efficiency (e.g., highly automated system, better steam contact surface area, and greater volume reduction, i.e., >85%) and process control (e.g., less odor problem). The proposed steam disinfection technology will first reduce the waste size down to one inch in diameter to reduce the bulk waste volume and enhance steam contact surface areas. The waste is then treated with steam at 96°C for approximately one hour. The final product is a shredded waste with significant volume reduction and can be handled as the regular waste. Therefore, it is considered as a viable alternative medical waste treatment technology for the THWTC with minimum operational and technological risks.

14.4.3 Economic, Inflation, and Environmental Risks

Economic risk, or economic viability, is an early benchmark used to assess the potential success of a project. The proposed medical waste treatment technology should use financial modeling exercises to evaluate this risk and to assure that the project revenues are sufficient to offset the operation costs and loan obligations. The facility must carefully review and analyze all project assumptions, determine if the projections are reasonable, and assess the likelihood for the project to generate adequate cash flow to meet its obligations. A potentially significant and less controllable economic risk is that the PRC government policies have often superseded legal contractual requirement. For example, when the PRC central government decided to promulgate its national medical waste treatment policy in 2003, all hospitals were required to transport their medical waste to designated treatment facilities regardless of whether these waste generators had contracts in place with the treatment facilities. The treatment facilities were "obligated" to treat the medical waste received although they had no contract protection or funding source commitment from the government. Most of the treatment facilities subsequently suffered from their inability to recover the treatment charge due to absence of legal-binding contracts or agree-upon treatment unit price with the hospitals and the government's unwillingness to be involved in the negotiations between hospital and treatment facility. As a result, most facilities could only recover a portion of their costs one to two years after the treatment had long been completed.

The equity investors will also examine the project's projected economic performance, mostly the Internal Rate of Return (IRR). The IRR measures the return to equity on the money it invested (it is the discount rate which equates the Net Present Value of the cash flows to zero). The IRR also takes into account the time value of money. The IRR for the Tianjin centralized medical waste treatment facility is currently calculated at 13% for a 15-year period.

Economic risks are usually analyzed in 'real terms', such as net of inflation. However, the assumption that the effects of inflation can be dealt with separately does not always hold. For example, if the project expenditures, receipts, and loans are all in the same currency, there is relatively low inflation risk. The facility will be built and financed in China, therefore, the inflation risk is considered low.

There are growing concerns of environmental impacts caused by new projects such as this in PRC. The local government will require proper planning and environmental impact assessment (EIA) prior to the construction of the facility. Waste treatment facility permits and special approval will be required. Normally a facility of this nature will require a baseline environmental assessment to document pre-operation environmental conditions at and within the immediate vicinity of the facility. However, since the proposed technology will only be an add-on treatment process to the existing THWTC, therefore, the effort required to perform environmental impact assessment is greatly reduced.

14.4.4 Country, Political, and Foreign Exchange Risks

There are always risks when doing business in a foreign country due to differences in cultural background, laws and regulations, political environment, and local business conduct. All of which can cause unforeseeable impacts and complications to the project. Besides, both central

and local government agencies can exercise its power to affect the policy, treatment technologies, and project finance even under the pre-agreed conditions. These may include:

- ✓ Encouraging and approving other more cost effective treatment technologies to significantly reduce the competitiveness of incineration process;
- ✓ Implementing mandatory recycling program that significantly reduce the quantities of medical waste for treatment;
- ✓ Amending foreign-exchange or currency-use policy/rules to discourage foreign financial institutes from providing the needed loans;
- ✓ Introducing regulations or constraints that could affect treatment prices/operations; and,
- ✓ Nationalizing or privatizing the project.

Since this project involves the use of US-made equipment products and possibly an US loan; there will be risks associated with fluctuated currency exchange rate. Recently, PRC appreciated its currency and amended the exchange rate from the initial US $1: RMB $8.277 to US $1: RMB $8.00. The financial market anticipates future appreciation of the RMB as a result of the PRC's attempt to balance the trade deficits between the US and PRC. Although country, political, and foreign exchange risks are very difficult to anticipate and mitigate, these risks should be well understood and managed in the same manner as other risks in the broader contest of the economic analysis.

14.5 Summary of Financial Analysis

The overall cost estimate of the centralized medical waste treatment facility is presented in Table 34 and the results of the financial analysis are also summarized below.

Table 34. Estimate of Total Investment, Tianjin Centralized Medical Waste Treatment Facility

Total Investment	
Item	**Value (x US $1000)**
Facility	$2,250
Advanced Shredding/Disinfection Units	$1,283
Dedicated Medical Waste Transport Vehicles	$393
Medical Waste Containers	$141
Wastewater Treatment Plant	$289
Capitalized Interest	$189
Total Initial Investment	$4,544

- ✓ Initial investment is $ 4,543,590 including capitalized interest of $189,000.
- ✓ Loan maturity year is 2020 (15 years from loan origination in the year of 2005).
- ✓ Interest rate is 6.5%.
- ✓ Internal rate of return (IRR) is calculated at 13%.
- ✓ Unit charge rate is calculated at US $0.39 per kilogram of waste, which is already taken into account a 16% discount of the current charge rate.

14.6 EVALUATION OF PROJECT FINANCE ALTERNATIVES

The Tianjin centralized medical waste treatment facility is a large capital undertake that may seek equity partners, issue bonds, offer new stocks in the financial markets, or seek borrowed funds in another fashion. Potential sources of funds may include pension funds, insurance companies, investment trusts, commercial banks, and others.

The medical waste treatment facility will be developed and constructed in China where public projects may be funded by tax revenues, general revenue bonds, or special bonds with income dedicated to the specified facilities. General revenue bonds would be repaid from general taxes or other revenue sources, while special bonds would be redeemed either by special taxes or user fees collected for the project. Grants from the PRC central government are also an important and potential source of funds for similar projects.

In most cases, financing plans will typically include a reserve amount to cover unforeseen expenses, cost increases, or cash flow shortages. A reserve for the medical waste treatment facility can be represented by a special reserve or a contingency amount in the project budget. In the simplest case, this reserve might represent a borrowing agreement with a financial institution to establish a line of credit in case of need. For publicly traded bonds, specific reserve funds administered by a third party may be established. The cost of these reserve funds is the difference between the interest paid to bondholders and the interest received on the reserve funds plus any administrative costs.

Financing can be accomplished by issuing public traded bonds; however, this is not a common practice in PRC since only central government has the authority to issue bonds. Although there have been discussions about local government administrated public traded bonds, financing through bond issuance may involve a lengthy period of negotiation, review, and approval. As far as revenue bonds are concerned, a typical 7-month period involving various approval hurdles may be required for the issuance of such bonds. In general, the time and efforts required to obtain the necessary funding will often determine the final project financing mechanism. Presented below are several potential financing options for the Tianjin centralized medical waste treatment facility:

- ✓ Use of corporate equity and retain earnings – The costs for constructing the buildings or infrastructures of the treatment facility may be committed directly through corporate funding. In this case, no other institutional parties or loans would be involved in the financing and the cost will be recovered by retaining the earning.
- ✓ Build-Operate-Transfer (BOT) – In this plan, owners prescribe functional requirements and a contractor handles financing. Contractors are repaid over a specified period of time from project revenues or government payments. At the end of the operational period granted, the equipment and facility are turned over to the Tianjin Municipal Government.
- ✓ Construction loan and long-term mortgage – In this arrangement, a loan is obtained from a bank or other financial institution to finance the cost of construction. Once the building is complete, a variety of institutions may be implemented to supply mortgage or long-term funding for the building. This financing plan could involve both short- and long-

term borrowing as well as different lenders. The long-term funding should offer a greater security and thus more desirable since the building construction would have long been completed. Additionally, this basic financing plan may be supplemented by other funding sources, such as corporate commitments or financial assistance from a local development agency.

- ✓ Joint venture with local government – The private industry can form joint venture with local government or its subsidiary enterprises to obtain critical assistance in the areas of land lease or acquisition, low interest loans from local banks, or property tax reductions. In an extreme case, the local government may seize the project property or force the current leasers to vacate the property for the proposed project through its legal power and authority.

Although not directly related to financing, the U.S. Ex-Im Bank loan services can provide additional leverage for the borrowers and protection for the lenders. The U.S. Ex-Im Bank is a U.S. government agency that aims to promote the United States export business by preventing unfair competitions from overseas lending institutions against U.S. lenders and providing repayment protection for private sector loans to creditworthy buyers of U.S. exports. There are two basic services offered by the U.S. Ex-Im Bank: (1) a direct loan to the borrower, and (2) a guarantee to the lender for repayment in the case of default by the buyer. The direct loan service is only applicable when an overseas export credit agency (ECA) offers the potential borrower better than market financing arrangements. This service is designed to ensure fair competition between the U.S. and foreign vendors during an international tendering, which is not applicable to this case. The other service offered by the Ex-Im Bank is the guarantee. In the guarantee service the Ex-Im Bank is not the lending institution; instead, it provides a loan guarantee, similar to an insurance policy, to the lending institution in the event that the borrower defaults for any reasons. Therefore, the guarantee service offers the financial backup or support of the U.S. government to the lender. The Ex-Im Bank does not have a preference for the origins of the lending institutions - it could be a foreign or domestic institution. But it must practice New York Banking Laws.

If the transaction consists of all US content or product, the borrower will need to put up a 15% cash payment and the Ex-Im Bank will fully guarantee the remaining 85% of the loan. But if the product has foreign content (e.g., non-U.S. product), the Ex-Im Bank will only guarantee the U.S. percentage of the content, thus requiring the cash payment to be higher. If the U.S. content is below 50% of the total loan value, a guarantee cannot be made through the Ex-Im Bank. This arrangement provides more incentives for the lender to use U.S. products should it desires the guarantee services from the Ex-Im Bank or the U.S. government.

According to the planned centralized medical waste treatment facility, only the shredding/steam disinfection treatment devices and deodorizer will be U.S. products. This accounts for approximately 30% of the total estimated investment value and may not qualify the project for an Ex-Im Bank loan guarantee service according to the Ex-Im Bank requirements.

15.0 PROJECT IMPLEMENTATION AND ACTION PLAN

This section presents the implementation schedule and action plan for the feasibility study of Tianjin central medical waste treatment facility. Figure 5 illustrates the proposed implementation schedule based on assumptions discussed in earlier sections.

A total of ten tasks are included in the implementation schedule, the action plan is:

(a) Prepare business and operational plan. The plan will include both technical operational requirements and business (i.e., budget and financial) requirements. It is expected to take approximately one month to prepare using information provided in this feasibility study.

(b) Develop budget scheme and prioritize equipment procurement schedule. Budget scheme will include the discussion of potential funding sources – central government allocated budgets, state-run development bank guarantee loans and private bank investment; and, the appropriation scheme. In addition, it may be necessary to prioritize equipment procurement schedule to ease financial burden. For example, the two shredder/disinfection units could be purchased in the same procurement contract package but the delivery and payment are made in two phases. This task is estimated to take two weeks to complete.

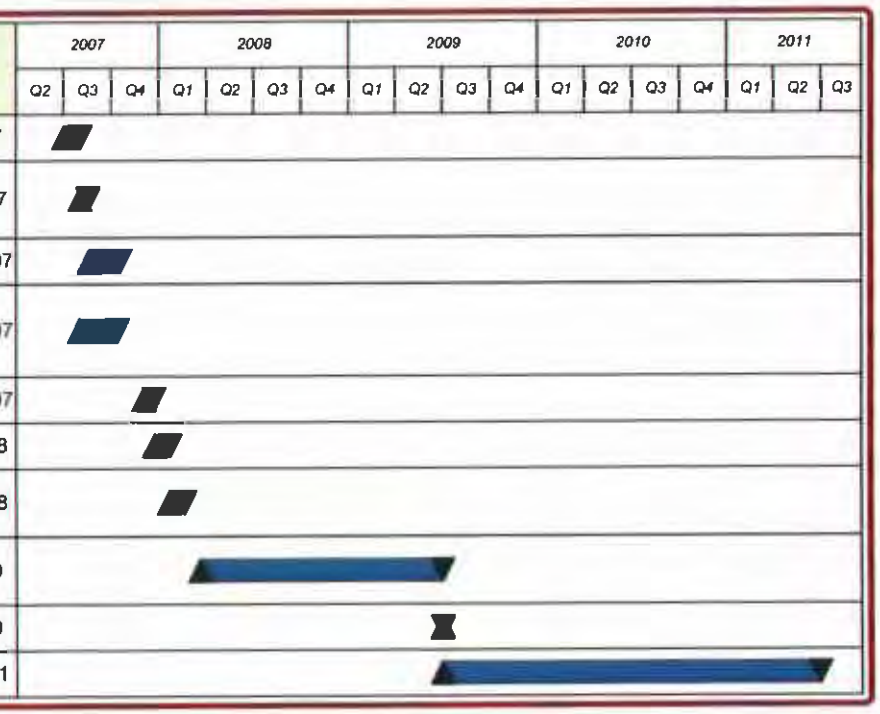
(c) Submit for approval and allocate funds. The plan will be submitted to the Tianjin Municipal Government, and then Central Government for review and approval. Once the plan is approved, the government will provide instructions on fund allocation – either from Central Government annual budget or state-run development bank guarantee loans, or in some cases, private bank investments. It is expected that the governmental approval process will take at least three months to complete.

(d) Prepare bidding document. In fact, the preparation of bidding documents, including technical specifications, contract requirements and bidder qualifications, can be started simultaneously with the development of budget scheme and procurement priority as described in Task 2. This will save the time required for implementation. Detail of candidate U.S. equipment vendor is listed in the previous sections. It is expected that the only the advanced shredder/disinfection unit will be purchase from U.S. suppliers, other items such as container and transportation vehicles which could be purchased locally. The preparation of bidding document is expected to take two and half months to complete.

(e) Announce international and local tenders. Once the tender paperwork is prepared and funds are allocated. The bidding process then can begin. The announcement of tender will follow local and central government international and local tender procedures. The announcement time is estimated to be two weeks.

Figure 5. Proposed Implementation Schedule

ID	Task Name	Start	Finish
1	Prepare Business and Operational Plan	7/2/2007	8/1/2007
2	Develop Budget Scheme and Prioritize Equipment Procurement Schedule	8/2/2007	8/17/2007
3	Submit for Approval and Allocate Funds	8/20/2007	10/17/2007
4	Prepare Bidding Document including Technical Spec., Contract Requirements and Bidder Qualification	8/2/2007	10/12/2007
5	Announce International and Local Tenders	12/3/2007	12/21/2007
6	Receive and Review Proposals	12/24/2007	1/21/2008
7	Select Qualified Vendors, Contract Negotiation and Award	1/21/2008	2/18/2008
8	Deliver and Install Equipment, Test Run, and Final Acceptance Test	3/21/2008	7/1/2009
9	Project Close-out	7/1/2009	7/1/2009
10	Warranty	7/1/2009	6/29/2011



(f) Receive and review proposals. After tender announcement, the bidders will submit their proposals in response to the bidding requirements. One month time is allocated for reviewing and selecting qualified vendors. The proposed equipment and technical specifications as described in the bidder's proposal will be carefully cross checked with the technical specification as listed in the tender document. Bidder's qualification such as relevant experience, equipment provided and cost information will be taken into consideration during the selection process. If necessary, references will be requested and contacted to verify the validity of information submitted.

(g) Select qualified vendor and contract negotiation. As soon as qualified vendors are selected. Contract negotiations will begin to negotiate best offer in price quoted, to verify deliverables and delivery and installation schedule. Also, acceptance criteria and procedures, and training will be discussed and finalized, and then the contract is awarded and signed. It is expected to take one month to complete this task.

(h) Deliver and install equipment, test run and final acceptance. Depending on types of equipment or machinery, the delivery, installation, trial run and acceptance test may vary widely. Therefore, the time allocated for this task is estimated for fifteen months. This includes technical training of technical staff to use and operate various equipments purchased.

(i) Project close-out. It is expected to close out the project in approximately two year period and all accounts payable are paid in full.

(j) Warranty. As soon as the equipment is accepted and the warranty period will begin. Depending on types of equipment, warranty period can range from one year to several years. This will also mark the beginning of operation and maintenance phase of the facility.

16.0 CONCLUSIONS AND RECOMMENDATIONS

This FS is intended to aid a better understanding of the medical waste management and treatment practices currently exist in the U.S. and PRC since there are fundamental differences in medical or healthcare system, social and economic structure, and regulatory/legal perspectives between the two countries. Realizing that there is no single cure for all the problems, the FS focuses on providing information and knowledge that can be used by the TEPB to identify and improve deficiencies of its current medical waste management program, strengthen regulatory infrastructure and enforcement actions, provide technology and information exchange opportunities, promote economic growth, and most importantly, better protect human health and the environment. Table 35 summarizes the comparisons of medical waste management system between the U.S. and PRC from the standpoints of regulatory framework, healthcare practices, waste management, and treatment alternatives.

Contrary to the U.S., in which the state government develops its own medical waste management program, PRC relies on the central government agencies (State Environmental Protection

Administration or SEPA and Ministry of Health) to develop national policies and standards to be adapted by the provincial and local governments. In 2003, the PRC State Department promulgated "Medical Waste Management Guidelines" and required that central medical waste treatment facilities must be established in major cities within one year and in small cities/counties within two years. The guidelines also stated that incineration (whenever possible) and disinfection/landfilling of non-incinerable medical waste as acceptable treatment processes for the rural areas that are unable to develop central treatment facilities. At about the same time, SEPA published "Interim Technical Standards for Medical Waste Incinerator" to regulate the design, manufacturing, and operation of medical incinerators. This led to the general perception that "incineration is the approved technology for centralized medical waste treatment facility" and an overwhelming demand in the incinerator market in China. Although SEPA clarified that it had not endorsed incineration as the only acceptable medical waste treatment technology, lack of performance standards and written policies had made other alternative technologies less attractive to or difficult to be accepted by the local regulatory agencies. Shanghai and Beijing both solicited incineration without considering other treatment alternatives for their first centralized medical waste treatment facilities are typical examples of following the central government's policy. Similar practices have also been tested out in other major cities in smaller pilot-scale programs through the use of existing hazardous/industrial waste incinerators.

There have been constant debates between central treatment versus flexible onsite treatment alternatives. Central treatment ensures better control of the waste streams and treatment performance, both quantity- and quality-wise. It also reduces the potential for illegal disposal or re-use of the untreated medical waste, which is the main reason for PRC to select centralized treatment scheme to maximize the control for the medical waste streams. Based on this concept and the fact that the central treatment facility is directly under the supervision of local regulatory agencies, flexibility should be given to the facility that not all the wastes collected need to be destroyed. From the standpoint of resources conservation, recycling and reuse should be the first consideration for the central treatment facility. For example, plastic syringes and PVE tubing can be recycled into medical waste transfer boxes or sharps containers. Only wastes that can not be technically and economically recycled should be destroyed. This can be easily accomplished since PRC already had medical waste segregation and collection protocols in-place and that the regulatory agency is only required to oversee a limited number of central treatment facilities, making recycling and treatment activities accountable and effective. The disadvantages of a central waste treatment scheme are high capital investments and high treatment throughput rate, which limits the selection of treatment technology. Additionally, large capacity stand-by units could potentially be costly. If not managed properly, the facilities may monopolize the waste treatment market and cause unreasonable cost increase for the waste generators and public.

In the U.S., the regulators only develop and enforce regulations, but do not dictate medical waste management or treatment methods to the healthcare organizations or medical waste generators. Nevertheless, the regulators have the authority to approve alternative treatment technologies and provide a list of approved technology vendors for the public to select appropriate treatment alternatives based on their needs. Technology vendors or treatment facilities are competed for business in a free market environment based on cost and services. Currently, large hospitals/healthcare facilities typically use steam-based (autoclaves, retorts, or their second generation equipment) or microwave technologies to treat majority of their medical waste onsite

Table 35. Summary of Medical Waste Management System Comparisons between the U.S. and PRC/Tianjin

Medical Waste Topics	USA	PRC/Tianjin
Regulatory Bodies	Federal Agencies - USEPA, DOT, OSHA, FDA, USPS State Agencies - State EPA and/or State DHS	Central Government Agencies - State Department, SEPA, MOH, and Provincial and Local Agencies – TEPB, TDHS
Definitions of Regulated Medical Waste	In the 1989 MWTA, USEPA provides initial definition for medical waste, 1997 USEPA re-defines regulated medical waste and provides seven (7) categories including: cultures and stocks of infectious agents and associated biologicals, human pathological waste, human blood and blood products, sharps, animal waste, isolation waste, and unused sharps. Currently, each state has its own definitions of regulated medical waste, these definitions are similar with some variations	PRC's central government agencies (SEPA, State Economic Development Bureau, Foreign Trade Administration, and Public Safety Bureau) included various medical and pharmaceutical wastes in categories HW01, HW02, and HW03 of PRC's National Hazardous Waste List in 1998. The list of medical waste was modified and separated from the national hazardous waste list in 2003 by SEPA and MOH. The current medical waste definition consists of five (5) categories – sharps, pharmaceutical waste, chemical waste, infectious waste and pathological waste. Tianjin uses similar but more detailed classification system
Medical Waste Regulation and Management Program Development	USEPA initiated the MWTA in 1989 and then transferred medical waste management responsibilities to the states. Each state is responsible for developing and implementing its own medical waste management program, including regulations and enforcement actions. Currently there are no federal medical waste acts after the expiration of MWTA in 1991.	Central government agencies (State Department, SEPA, and MOH) develop medical waste management and treatment policies and regulations; which are to be followed by the provincial and local regulatory agencies. Tianjin has developed its own medical waste management program and regulations that are consistent with those promulgated by the central governmental agencies
Roles and Responsibilities of Regulatory Agencies	State regulators develop medical waste regulations that provide "guidance" for handling and managing regulated medical waste, list of approved waste handling/treatment technologies, and enforcement criteria. Regulators cannot dictate or endorse specific waste handling/treatment technologies to the medical waste generators	Central government agencies develop and promulgate specific standards for medical waste handling equipment (transfer box, vehicles) as well as treatment technologies and performance standards (incineration, chemical disinfection – trial, and microwave disinfection – trial, landfilling) for implementation at provincial or local levels.
Medical Waste Handling and Treatment	No preferred medical waste handling/treatment technologies. Cost, safety, and public acceptability are primary considerations that drive the selection of medical waste treatment technology by the generators. Large hospital/healthcare facilities typically use the combination of onsite (for the majority of the routine medical waste) and offsite (small quantities of specialty waste streams) treatment processes to handle their medical waste, whereas small hospitals/private clinics prefer to handle, treat, and dispose of their waste at offsite (centralized) treatment facilities	Centralized medical waste handling and treatment facility with incinerators as the treatment technology is currently advocated (or at least perceived to be) by the central and local regulatory agencies for major cities. New performance standards have been promulgated for chemical and microwave disinfection, which may will lead the way for non-burn alternatives. TEPB and THWTC used incineration as the primary and German-made advanced autoclave as the supporting medical waste treatment technologies. Other alternative technologies are also being considered to augment incineration (steam disinfection, pyrolysis, microwave, chemical/heat)
Establishment, Operation, and Technologies Used in Offsite Centralized Treatment Facilities	Offsite treatment facilities are privately invested and owned without regulatory involvement, except for permitting and technology approval. The business is market-driven by cost and services. Technologies used are primarily non-incineration alternatives such as steam sterilization, chemical/heat, ETD, and microwave. Incineration has been phased out due to difficulty in permitting and public pressure	Offsite centralized treatment facilities are typically built as BOO or BOT projects, directed or administrated by the Tianjin Municipal Government and TEPB with policy incentives (THWTC, a JV between the French company ONYX and TEPB is a typical example). It is a monopolized market controlled by local government and charging rate (currently at $3.76/kg for transport, treatment, and disposal) is determined by TEPB and Tianjin Pricing Bureau based on local living standards and affordability. ROI varies pending on project type and level of government support. Development and implementation of regulatory inspection and enforcement system for the treatment facility are key challenges
Sharps Management System	All healthcare facilities have sharps protection and management system in-place to prevent needlestick and other percutneous injuries to healthcare workers as a result of the 2000 Federal Needlestick Safety and Prevention Act. Used syringes and sharps waste are protected by pre-engineered devices or discarded in non-retrievable sharps containers prior to treatment and disposal	The sharps management system includes separate needles from the syringes, destroy or bend the needles to render it unusable, disinfect the needles and syringes, contain the disinfected disposable medical apparatuses in plastic bags and rigid containers, and transport and treat the waste containers by incineration. No needlestick prevention policy or procedures are in-place
Public Outreach, Training, and Technical Support	State regulator and healthcare organization consortium (typically as non-profit organizations or hospital association) have worked collaborately to develop and implement medical waste regulations, assist healthcare facilities in developing their medical waste management programs, provide training and periodic audits to ensure compliance, launch new initiatives such as medical waste minimization and reduction to lower healthcare operation cost, as well as provide training and certification process to promote long-term sustainability of a healthcare facility	Established communication system and cooperative relationship between TEPB and healthcare facilities. Healthcare facilities showed strong awareness to develop and implement medical waste management program, indicative of a successful outreach, training, and technical support program from TEPB. Current focuses are on technology assessment/selection, regulation interpretation, and enforcement.

to minimize costs for offsite treatment and disposal. Only few facilities still operate incinerators because public oppositions and difficulty in permitting. Medical wastes transported for offsite treatment from large hospitals are either surplus waste exceeding the onsite treatment capacity or small quantities of special waste streams, such as chemotherapy or concentrated pharmaceutical wastes. In contrast, most of the small hospitals and private clinics use offsite or centralized treatment facilities to handle their waste streams since the quantities of waste generated from these facilities are sufficiently small and not cost effective for on-site treatment. Technologies used by offsite centralized treatment facilities include steam sterilization and its variations, microwave, chemical/dry heat (lime), pyrolysis, ETD (electro-thermal deactivation), and to a lesser extent, incineration (again due to public opposition and permit difficulty). Although other high-temperature processes such as plasma-based technologies have also been studied recently for their applications in treating medical waste, most of which are limited by their current level of commercialization, small throughput design, lack of performance data, and perceived high energy and maintenance cost. As such, it is not surprising that these new technologies seems to be better received in the developing countries where the concepts of medical waste management/treatment have just been realized and the technology-based market has not matured or filled with proven, cost effective technologies.

Although Tianjin currently also utilizes the incineration technology for treating its medical waste, TEPB and THWTC have shown their vision and foresight by incorporating other alternative treatment technologies for the central treatment facility or at rural/remote districts. This included the purchase of an autoclave disinfection unit as part of the medical waste treatment scheme and THWTC's interest in developing and marketing an advanced steam disinfection (combined mechanical shredding, steam disinfection, and drying) treatment process in Tianjin and surrounding areas where central treatment facility is not available. This concept is consistent with the U.S. technology development trends for the past 10 years, which focused on non-incineration alternatives and rendered the U.S. vendors less competitive in incinerator technology and cost than the European, Japanese, Korean, and even domestic PRC vendors. With the SEPA recently promulgated interim technical specifications for two non-incineration medical waste treatment technologies [*Technical Specifications for Chemical Disinfection Centralized Treatment Engineering on Medical Waste (On Trial), HJ-228-2005, promulgated on 2-8-2006 and implemented on 3-15-2006; and Technical specifications for Microwave Disinfection Centralized Treatment Engineering on Medical Waste (On Trial), HJ-229-2005, , promulgated on 2-8-2006 and implemented on 3-15-2006*] and the opportunity to regain the medical waste market share, the U.S. government and technology vendors need to develop proper PRC marketing strategies to promote both incineration and non-incineration treatment systems such as those listed in Appendix G (steam-based processes, microwave, chemical disinfection, ETD), or even mobile treatment units that offer the flexibility of onsite treatment for generators who desire to minimize liability associated with transporting regulated medical waste for offsite treatment. Some of these technologies when used in multiple units can also provide sufficiently large throughput rate and serve as a back-up or substitute for the rotary kiln incinerators.

In realty, the FS found that Tianjin has much more stringent, explicit regulations and better established handling and treatment network for its medical waste than the majority of the U.S. states Most of, if not all, the equipment or apparatuses involved in the collection, storage,

transportation, and treatment of medical waste can be produced domestically with a fraction of the costs of the imports. This together with a monopolized market makes it difficult for the U.S. technology vendors to maintain a sustainable business without first developing a meaningful relationship with the local powerhouse. The joint venture of THWTC between the French company CGEA-ONYX and TEPB is a typical example. Our assessment is that THWTC will continue monopolize Tianjin's medical waste treatment market due to its relationship with the TEPB. New central medical waste treatment facility will not likely be built until the waste load exceeds the THWTC's design capacity. During which time, THWTC will likely to: (1) expand its current operation with ONYX, or (2) seek new joint venture partners such as technology vendors, venture capitalists, or both. If the new facility still employs incineration as the primary treatment system, it is with high probability that domestically made incinerators will be in favored over the imported units because of significant cost differentials, unless the vendor is willing to invest its technology/equipment in exchange for part of the facility ownership (or equity) and recover its investment through a portion of the treatment charge. In the event that TEPB and THWTC decide to select non-incineration technologies (such as steam-based disinfection) to treat Tianjin's medial waste, the capital investment of a STI Chem-Clave, Sanitec Microwave, or other similar units with a treatment capacity of 20 to 30 TPD medical waste would be in the range of US $1 to $2 millions, which is about one tenth of that of the incineration units. In which case, the U.S. technology vendors prefer direct sales of their equipment to the THWTC, rather than participate as equity partners unless the partnership or joint venture can result in a sizeable volume of future equipment sales.

When an investment is desired, the FS performed an economic analysis assuming that (1) there is no cost for the land required for the new facility as the land is already owned by THWTC; (2) two 15-TPD, steam-based treatment units with mechanical shredders are to be purchased and used as the primary treatment system for the new facility; (3) the capital investment cost is approximately US $4.35M and the annualized cost is approximately US $1.28M; (4) the major equipment and fixtures are depreciated over a 10-year period; (5) a 15-year loan is secured to cover 70% of the capital cost at an interest rate of 6.5%; and (6) a reduced charge at approximately 84% of the current combo (transport, treatment, and disposal) fee is used in the economic analysis. The results of economic analysis showed that the project will produce adequate cash flow to fund the operation and service the loan repayment. The internal rate of return (IRR) was calculated at 13% even under a reduced charge.

Based on the discussion in this Final Report, it is clear that the healthcare facilities in the U.S. build their business models on the bases of cost effectiveness and competitiveness, from healthcare operation to medical waste management/treatment. This explains why healthcare facilities not only seek low cost treatment processes, but also focused on waste minimization and reduction opportunities. By reducing the amount of waste generated and selecting the most cost effective treatment process, significant cost savings can be translated to lower the patient care cost, better service, and positive image. As PRC's healthcare system begin to reform and government's medical subsidization becomes limited, the burden of medical care will be shifted to the public. Some of the TEPB's future challenge includes collaboration with other responsible agencies and healthcare/hospital associations to develop and implement effective medical waste management and training program, including waste reduction and minimization, to comply with medical waste regulations, and reduce waste handling/treatment/disposal cost.

Another area that may soon be changed in the PRC's medical waste management system is occupational health and safety protection of healthcare workers from needlestick injuries. Sharps with engineered sharps injury protection devices (needless injection system, retractable or blunt needles, or build-in safety devices) and sharps waste management technologies (non-retrievable collection devices or onsite needle destruction units) may replace the current standard operating procedures of physically removing, destroying, and disinfecting the waste needles by the nurses. Information of U.S. product vendors has been provided in this FS report.

Last but not the least are governmental support and legal protection of BOT/BOO type infrastructure investments. In the last few years, PRC has opened its door to foreign and local investors on selected infrastructure projects using the BOT/BOO approach. Typically, the return of investment (ROI) for a BOT/BOO project is negotiated based on the investor's financial plan. However, ROI in PRC is determined primarily by the local pricing and finance bureau based on local living standards and affordability. Besides, there may or may not be governmental guarantee available on payment terms/conditions, waste characteristics, or quantity. The concern for lacking of attractive ROI is further compounded by the uncertainty associated with government changing treatment practices or approval of other cost-effective alternative technologies (in which case, the healthcare providers will select treatment options based on cost competitiveness to reduce healthcare expenditures). Since most of the U.S. technology vendors are more interested in equipment sale, rather than invest in long-term ROI, BOT and BOO may not be the best entry project, with the exception of large medical waste treatment/operation companies (such as Stericycle or SANITEC) that already had extensive U.S. and international investment and operation experience. In those types of projects, teaming or joint venture with the "right" local companies, prior success in PRC or similar country region, cost, and investment conditions are essential to the winning bid. In summary, foreign investment is always a challenge and requires the right strategy, mentality, and financial commitments. There are tremendous marketing potentials in the PRC's medical waste treatment market, but the U.S. vendors need to realize that it is also a highly competitive, imitative, and monopolized market, driven by constant changing policies and politics.

APPENDIX A

SAMPLES OF MEDICAL WASTE MANAGEMENT ACT/PROGRAMS DEVELOPED AND PROMULGATED BY THE STATES OF CALIFORNIA, NEW JERSEY, AND NORTH CAROLINA

department of health services

Medical Waste Management Act

California Health and Safety Code
Sections 117600 – 118360

DEPARTMENT OF HEALTH SERVICES

Medical Waste Management Program
MS7405
P. O. Box 997413
Sacramento, CA 95899-7413

http://www.dhs.ca.gov/MedicalWaste

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Medical Waste Management Act

California Health and Safety Code
Sections 117600 – 118360

Includes SB 1034
(Chapter 732, Statutes of 1997)

Chapter 1 — General Provisions

117600. This part shall be known and may be cited as the Medical Waste Management Act.

117600
Citation of part

117605. This part does not preempt any local ordinance regulating infectious waste, as that term was defined by Section 25117.5 as it read on December 31, 1990, if the ordinance was in effect on January 1, 1990, and regulated both large and small quantity generators. Any ordinance may be amended in a manner that is consistent with this part.

117605
Preemption of local laws

117610. The department shall adopt regulations that will establish and ensure statewide standards for uniformity in the implementation and administration of this part and that will promote waste minimization and source reduction.

117610
Adoption of regulations

117615. Notwithstanding Section 117605, with the approval of the director, and in the interest of public health, a local ordinance providing more stringent requirements than specified in this part may be implemented for a specified time period.

117615
Local ordinances

117620. The department and any local enforcement agency initially electing to implement a medical waste management program pursuant to this part shall initiate that program and begin enforcement of its provisions on or before April 1, 1991, except for medical waste programs operating under Section 117605.

117620
Initiation of program and enforcement

Chapter 2 — Definitions

117625. Unless the context requires otherwise, the definitions in this article govern the construction of this part.

117625
Governing definitions

117630. "Biohazard bag" means a disposable red bag that is impervious to moisture and has a strength sufficient to preclude ripping, tearing, or bursting under normal conditions of usage and handling of the waste-filled bag. A biohazard bag shall be constructed of material of sufficient single thickness strength to pass the 165-gram dropped dart impact resistance test as prescribed by Standard D 1709-85 of the American Society for Testing and Materials and certified by the bag manufacturer.

117630
Biohazard bag

117635. "Biohazardous waste" means any of the following:

117635
Biohazardous waste

(a) Laboratory waste, including, but not limited to, all of the following:

(1) Human or animal specimen cultures from medical and pathology laboratories.

(2) Cultures and stocks of infectious agents from research and industrial laboratories.

(3) Wastes from the production of bacteria, viruses, spores, discarded live and attenuated vaccines used in human health care or research, discarded animal vaccines, including Brucellosis and Contagious Ecthyma, as identified by the department, and culture dishes and devices used to transfer, inoculate, and mix cultures.

(b) Human surgery specimens or tissues removed at surgery or autopsy, which are suspected by the attending physician and surgeon or dentist of being contaminated with infectious agents known to be contagious to humans.

(c) Animal parts, tissues, fluids, or carcasses suspected by the attending veterinarian of being contaminated with infectious agents known to be contagious to humans.

(d) Waste, which at the point of transport from the generator's site, at the point of disposal, or thereafter, contains recognizable fluid blood, fluid blood products, containers or equipment containing blood that is fluid, or blood from animals known to be infected with diseases which are highly communicable to humans.

(e) Waste containing discarded materials contaminated with excretion, exudate, or secretions from

humans or animals that are required to be isolated by the infection control staff, the attending physician and surgeon, the attending veterinarian, or the local health officer, to protect others from highly communicable diseases or diseases of animals that are highly communicable to humans.

(f)

(1) Waste which is hazardous only because it is comprised of human surgery specimens or tissues which have been fixed in formaldehyde or other fixatives, or only because the waste is contaminated through contact with, or having previously contained, chemotherapeutic agents, including, but not limited to, gloves, disposable gowns, towels, and intravenous solution bags and attached tubing which are empty. A biohazardous waste which meets the conditions of this paragraph is not subject to Chapter 6.5 (commencing with Section 25100) of Division 20.

(2) For purposes of this subdivision, "chemotherapeutic agent" means an agent that kills or prevents the reproduction of malignant cells.

(3) For purposes of this subdivision, a container, or inner liner removed from a container, which previously contained a chemotherapeutic agent, is empty if the container or inner liner removed from the container has been emptied by the generator as much as possible, using methods commonly employed to remove waste or material from containers or liners, so that the following conditions are met:

(A) If the material which the container or inner liner held is pourable, no material can be poured or drained from the container or inner liner when held in any orientation, including, but not limited to, when tilted or inverted.

(B) If the material which the container or inner liner held is not pourable, no material or waste remains in the container or inner liner that can feasibly be removed by scraping.

(g) Waste that is hazardous only because it is comprised of pharmaceuticals, as defined in Section 117747. Notwithstanding subdivision (a) of Section 117690, medical waste includes biohazardous waste that meets the conditions of this subdivision. Biohazardous waste that meets the conditions of this subdivision is not subject to Chapter 6.5 (commencing with Section 25100) of Division 20.

117640. "Common storage facility" means any designated accumulation area that is onsite and is used by small quantity generators otherwise operating independently for the storage of medical waste for collection by a registered hazardous waste hauler.

117640
Common storage facility

117645. "Container" means the rigid container in which the medical waste is placed prior to transporting for purposes of storage or treatment.

117645
Container

117650. "Enforcement agency" means the department or the local agency administering this part.

117650
Enforcement agency

117655. "Enforcement officer" means the director, or agents or registered environmental health specialists appointed by the director, and all local health officers, directors of environmental health, and their duly authorized registered environmental health specialists and environmental health specialist trainees, or the designees of the director, local health officers, or the directors of environmental health.

117655
Enforcement officer

117657. "Fund" means the Medical Waste Management Fund created pursuant to Section 117885.

117657
Fund

117660. "Hazardous waste hauler" means a person registered as a hazardous waste hauler pursuant to Article 6 (commencing with Section 25160) and Article 6.5 (commencing with Section 25167.1) of Chapter 6.5 of Division 20 and Chapter 30 (commencing with Section 66001) of Division 4 of Title 22 of the California Code of Regulations.

117660
Hazardous waste hauler

117662. "Health care professional" means any person licensed or certified pursuant to Division 2 (commencing with Section 500) of the Business and Professions Code; any person licensed pursuant to the Osteopathic Initiative Act, as set forth in Chapter 8 (commencing with Section 3600) of Division 2 of the Business and Professions Code, or pursuant to the Chiropractic Initiative Act, as set forth in Chapter 2 (commencing with Section 1000) of Division 2 of the Business and Professions Code; and any person certified pursuant to Division 2.5 (commencing with Section 1797).

117662
Health care professional

117665. "Highly communicable diseases" means diseases, such as those caused by organisms classified by the federal Centers for Disease Control as Biosafety Level IV organisms, that, in the opinion of the infection control staff, the department, local health officer, attending physician and surgeon, or

117665
Highly communicable diseases

attending veterinarian, merit special precautions to protect staff, patients, and other persons from infection. "Highly communicable diseases" does not include diseases such as the common cold, influenza, or other diseases not representing a significant danger to nonimmunocompromised persons.

117670. "Household waste" means any material, including garbage, trash, and sanitary wastes in septic tanks and medical waste, that is derived from households, farms, or ranches. Household waste does not include trauma scene waste.

117670
Household waste

117672. "Industrial hygienist" means a person who has met the educational requirements of an industrial hygiene certification organization, as defined in subdivision (c) of Section 20700 of the Business and Professions Code, and who has had at least one year in the comprehensive practice of industrial hygiene, as defined in subdivision (a) of Section 20700 of the Business and Professions Code.

117672
Industrial hygienist

117675. "Infectious agent" means a type of microorganism, bacteria, mold, parasite, or virus that normally causes, or significantly contributes to the cause of, increased morbidity or mortality of human beings.

117675
Infectious agent

117680. "Large quantity generator" means a medical waste generator, other than a trauma scene waste management practitioner, that generates 200 or more pounds of medical waste in any month of a 12-month period.

117680
Large quantity generator

117685. "Local agency" means the local health department, as defined in Section 101185, or the local comprehensive environmental agency established in accordance with Section 101275, of a county that has elected to adopt a local ordinance to administer and enforce this part, pursuant to Chapter 3 (commencing with Section 117800).

117685
Local agency

117690

(a) "Medical waste" means waste which meets both of the following requirements:

(1) The waste is composed of waste which is generated or produced as a result of any of the following actions:

(A) Diagnosis, treatment, or immunization of human beings or animals.

(B) Research pertaining to the activities specified in subparagraph (A).

(C) The production or testing of biologicals.

(D) The accumulation of properly contained home-generated sharps waste that is brought by a patient, a member of the patient's family, or by a person authorized by the enforcement agency, to a point of consolidation approved by the enforcement agency pursuant to Section 117904 or authorized pursuant to Section 118147.

(E) Removal of a regulated waste, as defined in Section 5193 of Title 8 of the California Code of Regulations, from a trauma scene by a trauma scene waste management practitioner.

(2) The waste is either of the following:

(A) Biohazardous waste.

(B) Sharps waste.

(b) For purposes of this section, "biologicals" means medicinal preparations made from living organisms and their products, including, but not limited to, serums, vaccines, antigens, and antitoxins.

(c) Medical waste includes trauma scene waste.

117690
Medical waste

117695. Medical waste that has been treated in accordance with Chapter 8 (commencing with Section 118215) and that is not otherwise hazardous, shall thereafter be considered solid waste as defined in Section 40191 of the Public Resources Code and not medical waste.

117695
Treated medical solid waste

117700. Medical waste does not include any of the following:

(a) Waste generated in food processing or biotechnology that does not contain an infectious agent as defined in Section 117675.

(b) Waste generated in biotechnology that does not contain human blood or blood products or animal blood or blood products suspected of being contaminated with infectious agents known to be communicable to humans.

(c) Urine, feces, saliva, sputum, nasal secretions, sweat, tears, or vomitus, unless it contains fluid blood, as provided in subdivision (d) of Section 117635.

117700
Waste not considered as medical waste

(d) Waste which is not biohazardous, such as paper towels, paper products, articles containing nonfluid blood, and other medical solid waste products commonly found in the facilities of medical waste generators.
(e) Hazardous waste, radioactive waste, or household waste.
(f) Waste generated from normal and legal veterinarian, agricultural, and animal livestock management practices on a farm or ranch.

117705. "Medical waste generator" means any person whose act or process produces medical waste and includes, but is not limited to, a provider of health care, as defined in subdivision (d) of Section 56.05 of the Civil Code. All of the following are examples of businesses that generate medical waste:
(a) Medical and dental offices, clinics, hospitals, surgery centers, laboratories, research laboratories, unlicensed health facilities, those facilities required to be licensed pursuant to Division 2 (commencing with Section 1200), chronic dialysis clinics, as regulated pursuant to Division 2 (commencing with Section 1200), and education and research facilities.
(b) Veterinary offices, veterinary clinics, and veterinary hospitals.
(c) Pet shops.
(d) Trauma scene waste management practitioners.

117705
Medical waste generator

117710. "Medical waste management plan" means a document that is completed by generators of medical waste pursuant to Sections 117935 and 117960, on forms prepared by the enforcement agency.

117710
Medical waste management plan

117715. "Medical waste permit" means a permit issued by the enforcement agency to a medical waste treatment facility.

117715
Medical waste permit

117720. "Medical waste registration" means a registration issued by the enforcement agency to a medical waste generator.

117720
Medical waste registration

117725.
(a) "Medical waste treatment facility" means all adjacent land and structures, and other appurtenances or improvements on the land, used for treating medical waste or for associated handling and storage of medical waste. Medical waste treatment facilities are those facilities treating waste pursuant to subdivision (a) or (c) of Section 118215. A medical waste treatment method approved pursuant to subdivision (d) of Section 118215 may be designated as a medical waste treatment facility by the department.
(b) "Adjacent," for purposes of subdivision (a), means real property within 400 yards from the property boundary of the existing medical waste treatment facility.

117725
Medical waste treatment facility

117730. "Mixed waste" means mixtures of medical and nonmedical waste. Mixed waste is medical waste, except for all of the following:
(a) Medical waste and hazardous waste is hazardous waste and is subject to regulation as specified in the statutes and regulations applicable to hazardous waste.
(b) Medical waste and radioactive waste is radioactive waste and is subject to regulation as specified in the statutes and regulations applicable to radioactive waste.
(c) Medical waste, hazardous waste, and radioactive waste is radioactive mixed waste and is subject to regulation as specified in the statutes and regulations applicable to hazardous waste and radioactive waste.

117730
Mixed waste

117735. "Offsite" means any location that is not onsite.

117735
Offsite

117740.
(a) "Onsite" means a medical waste treatment facility, or common storage facility on the same or adjacent property as the generator of the medical waste being treated.
(b) "Adjacent," for purposes of subdivision (a), means real property within 400 yards from the property boundary of the existing medical waste treatment facility.

117740
Onsite

117742. "Parent organization" means an organization that employs or contracts with health care professionals who provide health care services at a location other than at a health care facility specified in subdivision (a) of Section 117705.

117742
Parent organization

117745. "Person" means an individual, trust, firm, joint stock company, business concern, partner-

117745
Person

ship, association, limited liability company, and corporation, including, but not limited to, a government corporation. "Person" also includes any city, county, district, commission, the state or any department, agency, or political subdivision thereof, the Regents of the University of California, any interstate body, and the federal government or any department or agency thereof to the extent permitted by law.

117747.
(a) "Pharmaceutical" means a prescription or over-the-counter human or veterinary drug, including, but not limited to, a drug as defined in Section 109925 or the Federal Food, Drug, and Cosmetic Act, as amended, (21 U.S.C.A. Sec. 321(g)(1)).
(b) For purposes of this part, "pharmaceutical" does not include any pharmaceutical that is regulated pursuant to either of the following:
(1) The federal Resource Conservation and Recovery Act of 1976, as amended (42 U.S.C.A. Sec. 6901 et seq.).
(2) The Radiation Control Law (Chapter 8 (commencing with Section 114960) of Part 9).

117747
Pharmaceutical

117750. "Sharps container" means a rigid puncture-resistant container that, when sealed, is leak resistant and cannot be reopened without great difficulty.

117750
Sharps container

117755. "Sharps waste" means any device having acute rigid corners, edges, or protuberances capable of cutting or piercing, including, but not limited to, all of the following:
(a) Hypodermic needles, hypodermic needles with syringes, blades, needles with attached tubing, syringes contaminated with biohazardous waste, acupuncture needles, and root canal files.
(b) Broken glass items, such as Pasteur pipettes and blood vials contaminated with biohazardous waste.
(c) Any item capable of cutting or piercing that is contaminated with trauma scene waste.

117755
Sharps waste

117760. "Small quantity generator" means a medical waste generator, other than a trauma scene waste management practitioner, that generates less than 200 pounds per month of medical waste.

117760
Small quantity generator

117765. "Storage" means the holding of medical wastes, in accordance with Chapter 9 (commencing with Section 118275), at a designated accumulation area, offsite point of consolidation, transfer station, other registered facility, or in a vehicle detached from its means of locomotion.

117765
Storage

117770. "Tracking document" means the medical waste tracking document specified in Section 118040.

117770
Tracking document

117775.
(a) "Transfer station" means any offsite location where medical waste is loaded, unloaded, stored, or consolidated by a registered hazardous waste hauler, or a holder of a limited quantity hauling exemption granted pursuant to Section 118030, during the normal course of transportation of the medical waste.
(b) "Transfer station" does not include any onsite facility, including, but not limited to, common storage facilities, facilities of medical waste generators employed for the purpose of consolidation, or onsite treatment facilities.

117775
Transfer station

117776.
(a) "Trauma scene" means a location soiled by, or contaminated with, human blood, human body fluids, or other residues from the scene of a serious human injury, illness, or death.
(b) For purposes of this section, a location may include, but is not limited to, a physical structure that is not fixed geographically, such as mobile homes, trailers, or vehicles.

117776
Trauma scene

117777. "Trauma scene waste" means waste that is a regulated waste, as defined in Section 5193 of Title 8 of the California Code of Regulations, and that has been removed, is to be removed, or is in the process of being removed, from a trauma scene by a trauma scene waste management practitioner.

117777
Trauma scene waste

117778. "Trauma scene waste management practitioner" means a person who undertakes as a commercial activity the removal of human blood, human body fluids, and other associated residues from the scene of a serious human injury, illness, or death, and who is registered with the department pursuant to Chapter 9.5 (commencing with Section 118321).

117778
Trauma scene waste management practitioner

117780. "Treatment" means any method, technique, or process designed to change the biological character or composition of any medical waste so as to eliminate its potential for causing disease, as specified in Chapter 8 (commencing with Section 118215).

117780
Treatment

Chapter 3 — Powers and Duties

117800. A local agency may implement a medical waste management program by the adoption of an ordinance or resolution by the local governing body, in accordance with this part.

117800
Implementation of program by local agency

117805. Except as provided in subdivision (a) of Section 117810, a local agency that elects to implement a medical waste management program shall notify the department within 90 days from the effective date of the act enacting this part.

117805
Notification to department by local agency

117810.

(a) If a local agency does not elect to implement a medical waste management program, the local agency may elect to contract with another local agency to implement a medical waste management program or to implement it at a later date. This election shall be made by the local governing body, that shall take effect 90 days after a notice of election is filed with the department.

(b) A local agency that elects to implement a medical waste management program shall continue to implement that program until the local governing body terminates the election by resolution or ordinance or the department revokes the authority of the local agency to administer a medical waste management program. The local agency shall file the notice of termination with the department at least 180 days prior to the termination date.

117810
Election to contract for management program; Termination of election

117815. Any local agency that has elected to implement a medical waste management program shall maintain a program that is consistent with Section 117820 and the regulations adopted pursuant to that section. With the approval of the department, the local agency may administer or enforce this part with respect to any person.

117815
Compliance with requirements

117820. A medical waste management program shall include, but not be limited to, all of the following:

(a) Issuing medical waste registrations pursuant to Chapter 5 (commencing with Section 117950) and permits pursuant to Chapter 7 (commencing with Section 118130).

(b) Processing and reviewing the medical waste management plans and inspecting onsite treatment facilities in accordance with Chapter 4 (commencing with Section 117925) for all small quantity medical waste generators required to be registered.

(c) Conducting an evaluation, inspection, or records review for all facilities or persons issued a large quantity medical waste registration pursuant to Chapter 5 (commencing with Section 117950) or issued a permit for an onsite medical waste treatment facility pursuant to Section 118130.

(d) Inspecting medical waste generators in response to complaints or emergency incidents, or as part of an investigation or evaluation of the implementation of the medical waste management plan.

(e) Inspecting medical waste treatment facilities in response to a complaint or as part of an investigation or emergency incident.

(f) Taking enforcement action for the suspension or revocation of medical waste permits issued by the local agency pursuant to this part.

(g) Referring or initiating proceedings for civil or criminal prosecution of violations specified in Chapter 10 (commencing with Section 118335).

(h) Reporting in a manner determined by the department so that the statewide effectiveness of the program can be determined.

117820
Elements of a medical waste management program

117825. Each local enforcement agency that elects to implement the medical waste management program may prescribe, by resolution or ordinance, the registration and permit fees necessary to pay its reasonable expenses to administer the program.

117825
Authority to levy fees

117830.

(a) A local agency electing to implement a medical waste management program is the enforcement agency for the jurisdiction where it is located and so designated by the department.

117830
Naming of enforcement agency; authority to bring enforcement action

(b) In any local jurisdiction where the local agency does not elect to implement a medical waste management program, the department is the enforcement agency.
(c) Nothing in this chapter shall prevent a district attorney, city attorney, or city prosecutor from bringing any enforcement action for violation of this chapter.

117835. The department shall establish and maintain a data base of persons registered under Chapter 4 (commencing with Section 117925) and persons registered under Chapter 5 (commencing with Section 117950) for whom the department is the enforcement agency.

117835
Data base of registrants

117840. It is the intent of the Legislature that the program carried out pursuant to this part be fully supported from the fees received pursuant to this part.

117840
Legislative intent regarding funding

117845. The department shall implement this part so as to maximize the funds that may be received from the federal government.

117845
Implementation with federal funding

117850. Information may be shared between the department and the Environmental Protection Agency.

117850
Info. shared with EP

117855. If the department finds that a local enforcement agency is not consistently fulfilling its responsibilities, the department shall notify the agency of the particular reasons for finding that the agency is not fulfilling its responsibilities and of the department's intention to withdraw its designation if, within a time to be specified in that notification, but in no event less than 30 days, the agency does not take the corrective action specified by the department.

117855
Withdrawal of designation from local enforcement agency

117860. If the department withdraws its designation of a local enforcement agency, the department shall become the enforcement agency within the jurisdiction of the local enforcement agency.

117860
Department replacing local enforcement agency

117870. If the department identifies significant violations of minimum requirements that were not identified and resolved through previous inspections by the local enforcement agency, the department shall do all of the following:
(a) Conduct a performance review of the agency within 120 days.
(b) Prepare a written performance report within 60 days of the review.
(c) Require the submission of a plan of correction by the agency within 90 days of receiving the report.

117870
Violations not resolved by local enforcement agency

117875. The department shall withdraw a local enforcement agency's designation pursuant to Section 117860 if it determines that the enforcement agency has failed to submit an adequate plan of correction or has failed to implement the plan.

117875
Withdrawal of designation upon failure to correct violations

117880. If the department becomes the enforcement agency, it may charge the fees specified in this part.

117880
Authority of department to charge local fees

117885.
(a) There is in the State Treasury the Medical Waste Management Fund, that shall be administered by the director. Money deposited in the fund shall be available to the department, upon appropriation by the Legislature, for the purposes of this part.
(b) In addition to any other funds transferred by the Legislature to the Medical Waste Management Fund, the following shall be deposited in the fund:
(1) Fees, penalties, interest earned, and fines collected by, or on behalf of, the department pursuant to this part.
(2) Funds granted by the federal government for purposes of carrying out this part.
(c) This section shall become operative on July 1, 1993.

117885
Medical Wste Management Fund

117890. No large quantity generator shall generate medical waste unless the large quantity generator is registered with the enforcement agency pursuant to this part.

117890
Registration of large quantity generator

117895. A small quantity generator that treats medical waste onsite by steam sterilization, incineration, or microwave technology shall register with the enforcement agency pursuant to this part.

117895
Registration of small quantity generator

117900. No person shall haul medical waste unless the person meets either of the following requirements:

117900
Requirements for transporters of medical waste

(a) The person is registered pursuant to Article 6 (commencing with Section 25160) and Article 6.5 (commencing with Section 25167.1) of Chapter 6.5 of Division 20 and Chapter 30 (commencing with Section 66001) of Division 4 of Title 22 of the California Code of Regulations.
(b) The person has an approved limited-quantity exemption granted pursuant to Section 118030.

117903. No person shall treat medical waste unless the person is permitted by the enforcement agency as required by this part or unless the treatment is performed by a medical waste generator and is a treatment method approved pursuant to subdivision (d) of Section 118215.

117903
Authority to treat medical waste

117904.
(a) In addition to the consolidation points authorized pursuant to Section 118147, the enforcement agency may approve a location as a point of consolidation for the collection of home-generated sharps waste, which, after collection, shall be transported and treated as medical waste.
(b) A consolidation location approved pursuant to this section shall be known as a "home-generated sharps consolidation point."
(c) A home-generated sharps consolidation point is not subject to the requirements of Chapter 9 (commencing with Section 118275), to the permit or registration requirements of this part, or to any permit or registration fees, with regard to the activity of consolidating home-generated sharps waste pursuant to this section.
(d) A home-generated sharps consolidation point shall comply with all of the following requirements:
(1) All sharps waste shall be placed in sharps containers.
(2) Sharps containers ready for disposal shall not be held for more than seven days without the written approval of the enforcement agency.
(e) An operator of a home-generated sharps consolidation point approved pursuant to this section shall not be considered the generator of that waste.
(f) The medical waste treatment facility which treats the sharps waste subject to this section shall maintain the tracking documents required by Sections 118040 and 118165 with regard to that sharps waste.

117904
Home-generated sharps and consolidation points

117905. The department is the enforcement agency for offsite treatment facilities.

117905
Enforce. agency for offsites

117908. The accumulated medical waste of more than one medical waste generator shall not be stored in a common storage facility unless that facility is registered with the enforcement agency.

117908
Registration of common storage facility

117910. The department shall provide ongoing technical assistance and guidance to local enforcement agencies to assist them in their decisionmaking processes. This assistance shall include, but is not limited to, providing all of the following:
(a) Technical studies and reports.
(b) Copies of innovative facility operation plans.
(c) Investigative findings and analysis of new waste management practices and procedures.

117910
Technical assistance to local agencies

Chapter 4 — Small Quantity Generator Requirements

117915. Containment and storage of medical waste shall be in accordance with Chapter 9 (commencing with Section 118275).

117915
Compliance containment and storage

117918. Treatment of medical waste shall be in accordance with Chapter 8 (commencing with Section 118215).

117918
Compliance treatment of waste

117920. The fee schedule specified in Section 117923 shall be for the issuance of medical waste registrations and for conducting inspections pursuant to this chapter when the department serves as the enforcement agency for small quantity generators. This fee schedule shall be adjusted annually in accordance with Section 100425. On or before January 1, 1993, the department may adjust by regulation the fees specified in Section 117923 to reflect the actual costs of implementing this chapter. Local enforcement agencies shall set fees that shall be sufficient to cover their costs in implementing this part with regard to small quantity generators required to be registered pursuant to Section 117925.

117920
Fee schedule where the Department is the enforcement agency

117923.

117923
Common Storage Facility and Registration fees

(a) The registration and inspection fee for small quantity generators using onsite treatment, including an autoclave, incinerator, or microwave technology, to treat medical waste is one hundred dollars ($100), that shall be paid once every two years.

(b) The annual permit fee for a common storage facility permitted pursuant to Section 117928 is the amount specified in the following schedule:

(1) For storage facilities serving 10 or fewer generators, the permit fee is one hundred dollars ($100).

(2) For storage facilities serving 11 or more generators, but not more than 50 generators, the permit fee is two hundred fifty dollars ($250).

(3) For storage facilities serving more than 50 generators, the permit fee is five hundred dollars ($500).

117924.

117924
Annual medical waste generator fee where the Department is the enforcement agency

(a) When the department is the enforcement agency, the department shall impose and cause the collection of an annual medical waste generator fee in an amount not to exceed twenty-five dollars ($25) on small quantity generators of medical waste, except for those small quantity generators that are required to register pursuant to Section 117925 and those generators generating only biohazardous waste as defined in subdivision (g) of Section 117635. Nothing in this part shall prevent the department from contracting with entities other than the department for these fee collection activities or from entering into agreements with medical waste transporters or providers of medical waste mail-back systems for the collection of these fees, if the department determines that such a fee collection arrangement would be cost-effective.

(b) If the department determines to enter into a contract with a medical waste transporter or provider of medical waste mail-back systems for the collection of the fees, the department shall do all of the following:

(1) Establish that not more than 5 percent of the fees collected may be recovered by the medical waste transporter or provider of medical waste mail-back systems as administrative costs for the collection of those fees.

(2) Establish that the administrative costs for the collection of the fees shall be the same for all medical waste transporters and providers of medical waste mail-back systems.

(3) Prohibit any medical waste transporter or provider of medical waste mail-back systems from waiving the generator fee without the written approval of the department and only if the medical waste generator has made a written request for the waiver.

(4) Require the medical waste transporter or provider of medical waste mail-back systems to report the fees collected pursuant to subdivision (a) to the department.

(5) Prohibit the medical waste transporter or provider of medical waste mail-back systems from assuming the role of the department as an enforcement agent for purposes of collecting the medical waste generator fees.

(6) Require medical waste transporters or providers of medical waste mail-back systems to include the following language in at least 12-point type on their invoices to medical waste generators. "Pursuant to Section 117924 of the California Health and Safety Code, the State Department of Health Services has contracted with us to collect your annual medical waste generator fee. The department may offset our costs of collection and administration in an amount that may not exceed 5 percent of the fee collected. We may not waive the fee without written approval of the department, and only if you have made a written request for the waiver."

117925.

117925
Registration requirement with onsite treatment

(a) Each small quantity generator using onsite steam sterilization, incineration, or microwave technology to treat medical waste shall register with the enforcement agency. Small quantity generators owning or operating a medical waste treatment facility shall also apply for a permit for that treatment facility pursuant to Chapter 7 (commencing with Section 118130).

(b) Small quantity generators using onsite treatment, as specified in subdivision (a), that operate as a business in the same building, or that are associated with a group practice in the same building, may register as one generator.

(c) Small quantity generators using onsite treatment, as specified in subdivision (a), as specified in subdivision (b), operating in different buildings on the same or adjacent property, or as approved by the enforcement agency, may register as one generator.

(d) "Adjacent," for purposes of subdivision (c), means real property within 400 yards from the property boundary of the primary registration site.

117928
Common Storage Facility Permits

117928.
(a) Any common storage facility for the collection of medical waste produced by small quantity generators operating independently, but sharing common storage facilities, shall have a permit issued by the enforcement agency.
(b) A permit for any common storage facility specified in subdivision (a) may be obtained by any one of the following:
(1) A provider of health care as defined in subdivision (d) of Section 56.05 of the Civil Code.
(2) The registered hazardous waste transporter.
(3) The property owner.
(4) The property management firm responsible for providing tenant services to the medical waste generators.

117930
Registration required for onsite treatment

117930. Small quantity generators that treat waste onsite, pursuant to subdivision (a) of Section 117925, shall register with the enforcement agency prior to the commencement of treatment.

117933
Permits required prior to use of common storage facility

117933. Common storage facilities subject to Section 117928 shall obtain a permit from the enforcement agency on or before April 1, 1991, where the storage of medical waste in the common storage facility began prior to that date. In those cases where the storage of medical waste begins after April 1, 1991, permits shall be obtained pursuant to this chapter prior to commencement of storage of medical waste in the common storage facility.

117935
Filing of management plan with enforcement agency

117935. Any small quantity generator required to register with the enforcement agency pursuant to Section 117930 shall file with the enforcement agency a medical waste management plan, on forms prescribed by the enforcement agency containing, but not limited to, all of the following:
(a) The name of the person.
(b) The business address of the person.
(c) The type of business.
(d) The types, and the estimated average monthly quantity, of medical waste generated.
(e) The type of treatment used onsite.
(f) The name and business address of the registered hazardous waste hauler used by the generator for backup treatment and disposal, for waste when the onsite treatment method is not appropriate due to the hazardous or radioactive characteristics of the waste, or the name of the registered hazardous waste hauler used by the generator to have untreated medical waste removed for treatment and disposal.
(g) A statement indicating that the generator is hauling the medical waste generated in his or her business pursuant to Section 118030 and the name and any business address of the treatment and disposal facilities to which the waste is being hauled, if applicable.
(h) The name and business address of the registered hazardous waste hauler service provided by the building management to which the building tenants may subscribe or are required by the building management to subscribe and the name and business address of the treatment and disposal facilities used, if applicable.
(i) A statement certifying that the information provided is complete and accurate.

117938
Inspection of onsite facilities; Exemption

117938.
(a) Small quantity generators using onsite steam sterilization, incineration, or microwave technology to treat medical waste are subject to biennial inspection of that onsite treatment facility by the enforcement agency and may be subject to the permitting requirements for onsite medical waste treatment facilities as determined by the enforcement agency.
(b) The inspection and permitting requirements of subdivision (a) do not apply when onsite steam sterilization is not used for the treatment or disposal of medical waste.

117940
Duration of registration; Renewal; Updated information

117940.
(a) Each enforcement agency shall follow procedures consistent with this chapter in registering medical waste generators.
(b) Each medical waste generator registration issued by the enforcement agency shall be valid for two years.
(c) An application for renewal of the registration shall be filed with the enforcement agency on or

before the expiration date.

(d) Generators shall submit within 30 days an updated application form when any of the information specified in subdivisions (a) to (i), inclusive, of Section 117935 changes.

117943
Recordkeeping by generators who treat onsite

117943. A medical waste generator required to register pursuant to this chapter shall maintain individual treatment, and tracking records, if applicable, for three years, or for the period specified in the regulations, and shall report or submit to the enforcement agency, upon request, both of the following:

(a) Treatment operating records.

(b) An emergency action plan complying with regulations adopted by the department.

117945
Recordkeeping by generators who do not treat onsite

117945. Small quantity generators who are not required to register pursuant to this chapter shall maintain on file in their office all of following:

(a) An information document stating how the generator contains, stores, treats, and disposes of any medical waste generated through any act or process of the generator.

(b) Records of any medical waste transported offsite for treatment and disposal, including the quantity of waste transported, the date transported, and the name of the registered hazardous waste hauler or individual hauling the waste pursuant to Section 118030. The small quantity generator shall maintain these records for not more than two years.

Chapter 5 — Large Quantity Generator Requirements

117950
Registration requirement

117950.

(a) Each large quantity generator, except as specified in subdivisions (b) and (c), shall register with the enforcement agency. Large quantity generators owning or operating a medical waste treatment facility shall also apply for a permit for that treatment facility pursuant to Chapter 7 (commencing with Section 118130).

(b) Large quantity generators operating as a business in the same building, or that are associated with a group practice in the same building, may register as one generator.

(c) Large quantity generators as specified in subdivision (a), operating in different buildings on the same or adjacent property, or as approved by the enforcement agency, may register as one generator.

(d) "Adjacent," for purposes of subdivision (c), means real property within 400 yards from the property boundary of the primary registration site.

117955
Registration must precede generation of medical waste

117955. Large quantity generators subject to Section 117950 shall register with the enforcement agency on or before April 1, 1991, if the generation of medical waste began prior to that date. In those cases where the generation of medical waste begins after April 1, 1991, registration shall be completed pursuant to this chapter prior to commencement of the generation of medical waste.

117960
Filing of management plan; Contents

117960. Any large quantity generator required to register with the enforcement agency pursuant to Section 117950 shall file with the enforcement agency a medical waste management plan, on forms prescribed by the enforcement agency containing, but not limited to, all of the following:

(a) The name of the person.

(b) The business address of the person.

(c) The type of business.

(d) The types, and the estimated average monthly quantity, of medical waste generated.

(e) The type of treatment used onsite, if applicable. For generators with onsite medical waste treatment facilities, including incinerators or steam sterilizers or other treatment facilities as determined by the enforcement agency, the treatment capacity of the onsite treatment facility.

(f) The name and business address of the registered hazardous waste hauler used by the generator to have untreated medical waste removed for treatment, if applicable.

(g) The name and business address of the registered hazardous waste hauler service provided by the building management to which the building tenants may subscribe or are required by the building management to subscribe, if applicable.

(h) The name and business address of the offsite medical waste treatment facility to which the medical waste is being hauled, if applicable.

(i) An emergency action plan complying with regulations adopted by the department.

(j) A statement certifying that the information provided is complete and accurate.

117965. Large quantity generators shall be subject to at least annual inspection by the enforcement agency.

117965
Inspections

117970.
(a) Each enforcement agency shall follow procedures consistent with this chapter in registering medical waste generators.
(b) Each medical waste registration issued by the enforcement agency shall be valid for one year.
(c) An application for renewal of the registration shall be filed with the enforcement agency not less than 90 days prior to the expiration date. Failure to meet this requirement shall result in an assessment of a late fee.
(d) Generators shall submit within 30 days an updated application form when any of the information specified in subdivisions (a) to (j), inclusive, of Section 117960 changes.

117970
Duration of registration; Renewal; Updated information

117975. A medical waste generator required to register pursuant to this chapter shall maintain individual treatment, and tracking records, if medical waste is removed from the generator's site for treatment, for three years or for the period specified in the regulations.

117975
Treatment recordsmacking

117980. Containment and storage of medical waste shall be in accordance with Chapter 9 (commencing with Section 118275).

117980
Containment and storage requirements

117985. Treatment of medical waste shall be in accordance with Chapter 8 (commencing with Section 118215).

117985
Waste treatment requirements

117990. The fee schedule specified in Section 117995 shall be for the issuance of medical waste registrations and onsite medical waste treatment facility permits when the department serves as the enforcement agency for large quantity generators. This fee schedule shall be adjusted annually in accordance with Section 100425. On or before January 1, 1993, the department may adjust by regulation the fees specified in Section 117995 to reflect the actual costs of implementing this chapter. Local enforcement agencies shall set fees that shall be sufficient to cover their costs in implementing this part with regard to large quantity generators.

117990
Fees where the Department is enforcement agency

117995. The registration and annual permit fee for large quantity generators shall be set in following amounts:

117995
Fee schedule

(a)
(1) A general acute care hospital, as defined in subdivision (a) of Section 1250, that has one or more beds, but not more than 99 beds, shall pay six hundred dollars ($600), a facility with 100 or more beds, but not more than 199 beds, shall pay eight hundred sixty dollars ($860), a facility with 200 or more beds, but not more than 250 beds shall pay one thousand one hundred dollars ($1,100), and a facility with 251 or more beds shall pay one thousand four hundred dollars ($1,400).
(2) In addition to the fees specified in paragraph (1), a general acute care hospital which is providing onsite treatment of medical waste shall pay an annual medical waste treatment facility inspection and permit fee of three hundred dollars ($300), if the facility has one or more beds but not more than 99 beds, five hundred dollars ($500), if the facility has 100 or more beds but not more than 250 beds, and one thousand dollars ($1,000), if the facility has 251 or more beds.
(b) A specialty clinic, providing surgical, dialysis, or rehabilitation services, as defined in subdivision (b) of Section 1204, shall pay three hundred fifty dollars ($350).
(c) A skilled nursing facility, as defined in subdivision (c) of Section 1250, that has one or more beds, but not more than 99 beds shall pay two hundred seventy-five dollars ($275), a facility with 100 or more beds, but not more than 199 beds shall pay three hundred fifty dollars ($350), and a facility with 200 or more beds shall pay four hundred dollars ($400).
(d) An acute psychiatric hospital, as defined in subdivision (b) of Section 1250, shall pay two hundred dollars ($200).
(e) An intermediate care facility, as defined in subdivision (d) of Section 1250, shall pay three hundred dollars ($300).
(f) A primary care clinic, as defined in Section 1200.1, shall pay three hundred fifty dollars ($350).
(g) A licensed clinical laboratory, as defined in paragraph (3) of subdivision (a) of Section 1206 of the Business and Professions Code, shall pay two hundred dollars ($200).

(h) A health care service plan facility, as defined in subdivision (f) of Section 1345, shall pay three hundred fifty dollars ($350).
(i) A veterinary clinic or veterinary hospital shall pay two hundred dollars ($200).
(j) A large quantity generator medical office shall pay two hundred dollars ($200).
(k) In addition to the fees specified in subdivisions (b) to (j), inclusive, a large quantity generator of medical waste which is providing onsite treatment of medical waste shall pay an annual medical waste treatment facility inspection and permit fee of three hundred dollars ($300).

Chapter 6 — Medical Waste Haulers

118000
Transportation of medical waste

118000.
(a) Except as otherwise exempted pursuant to Section 118030, all medical waste transported to an offsite medical waste treatment facility shall be transported in accordance with this chapter by a registered hazardous waste transporter issued a registration certificate pursuant to Chapter 6 (commencing with Section 118000) and Article 6.5 (commencing with Section 25167.1) of Chapter 6.5 of Division 20. A hazardous waste transporter transporting medical waste shall have a copy of the transporter's valid hazardous waste transporter registration certificate in the transporter's possession while transporting medical waste. The transporter shall show the certificate, upon demand, to any enforcement agency personnel or authorized employee of the Department of the California Highway Patrol.
(b) Except for small quantity generators transporting medical waste pursuant to Section 118030, medical waste shall be transported to a permitted offsite medical waste treatment facility or a permitted transfer station in leak-resistant and fully enclosed rigid secondary containers that are then loaded into an enclosed cargo body.
(c) A person shall not transport medical waste in the same vehicle with other waste unless the medical waste is separately contained in rigid containers or kept separate by barriers from other waste, or unless all of the waste is to be handled as medical waste in accordance with this part.
(d) Medical waste shall only be transported to a permitted medical waste treatment facility, or to a transfer station or another registered generator for the purpose of consolidation before treatment and disposal, pursuant to this part.
(e) Facilities for the transfer of medical waste shall be annually inspected and issued permits in accordance with the regulations adopted pursuant to this part.
(f) Any persons manually loading or unloading containers of medical waste shall be provided by their employer at the beginning of each shift with, and shall be required to wear, clean and protective gloves and coveralls, changeable lab coats, or other protective clothing. The department may require, by regulation, other protective devices appropriate to the type of medical waste being handled.

118005
Transportation of trauma scene waste

118005.
(a) Notwithstanding any other provision of this chapter, trauma scene waste may be transported by a trauma scene management practitioner registered pursuant to Section 118321.1.

(b) The exemption specified in Section 118030 for limited quantity hauling shall not apply to the transportation of trauma scene waste.

(c)

(1) A business that has contracted with, or that currently employs, a person whose services may include the cleanup of trauma scene waste in the manner specified in Section 118321.6 may apply, on forms provided by the department, to the department for an exemption from the requirements of Section 118321.1. This exemption shall be known as an incidental trauma scene waste hauling permit, and shall authorize the person to transport, by herself or himself, trauma scene waste that is collected in the manner specified in Section 118321.6 to a permitted medical waste transfer station or a permitted medical waste offsite treatment facility, or to a health care facility, previously designated by mutual agreement, for consolidation with the facility's existing medical waste stream.

(2) An application for an incidental trauma scene waste hauling permit shall be accompanied by a fee of twenty-five dollars ($25) and the incidental trauma scene waste hauling permit shall be valid for one cleanup event. The application shall identify any person who will transport trauma scene waste for the business pursuant to paragraph (1).

118025. All medical waste shall be hauled by either a registered hazardous waste hauler or by a person with an approved limited-quantity exemption granted pursuant to Section 118030.

118025
Registration requirements; Exemption

118027. Any person who is authorized to collect solid waste, as defined in Section 40191 of the Public Resources Code, who unknowingly transports medical waste to a solid waste facility, as defined in Section 40194 of the Public Resources Code, incidental to the collection of solid waste is exempt from this chapter with regard to that waste.

118027
Exemption of unknowing transporter of medical waste

118029.

(a) On or before September 1, 1993, and each year thereafter on or before July 1, a registered hazardous waste transporter which transports medical waste shall so notify the department, and provide the following information:

(1) Business name, address, and telephone number.

(2) Name of owner, operator, and contact person.

(3) Hazardous waste transporter registration number.

(4) Vehicle manufacturer name, vehicle model year, vehicle identification number, and the license plate number of each vehicle transporting medical waste.

(b) For transporters that begin transporting medical waste after September 1, 1993, notification to the department, and provision of the information required by subdivision (a) shall be provided to the department prior to transporting medical waste.

(c) On or before September 1, 1993, each registered hazardous waste transporter, and each provider of medical waste mail back systems, as defined in subdivision (b) of Section 118245, shall provide to the department a list of all medical waste generators serviced by that person during the previous 12 months. That list shall include the business name, business address, mailing address, telephone number, and other information as required by the department to collect annual fees pursuant to Section 117924. When the transportation of registered hazardous waste by a medical waste transporter or the provision of a medical waste mail back system begins after September 1, 1993, the initial list shall be provided to the department within 10 days of the close of the earliest calendar quarter ending September 30, December 31, March 31, or June 30, or as otherwise required by the department.

(d) Subsequent to providing the initial list pursuant to subdivision(c), registered hazardous waste transporters and providers of medical waste mail back systems shall submit to the department any changes made to the most recent list every three months, within 10 days of the close of the calendar quarters ending September 30, December 31, March 31, and June 30, or as otherwise required by the department.

118029
Information requirements for hazardous waste transporters handling medical waste and for providers of medical waste mail back systems

118030.

(a) A medical waste generator or parent organization that employs health care professionals who generate medical waste may apply to the enforcement agency for a limited-quantity hauling exemption, if the generator or health care professional meets all of the following requirements:

(1) The generator or health care professional generates less than 20 pounds of medical waste per week, transports less than 20 pounds of medical waste at any one time, and the generator or parent organization has on file one of the following:

(A) If the generator or parent organization is a small quantity generator required to register pursuant to Chapter 4 (commencing with Section 117915), a medical waste management plan prepared pursuant to Section 117935.

(B) If the generator or parent organization is a small quantity generator not required to register pursuant to Chapter 4 (commencing with Section 117915), the information document maintained pursuant to subdivision (a) of Section 117945.

(C) If the parent organization is a large quantity generator, a medical waste management plan prepared pursuant to Section 117960.

(2) The generator or health care professional who generated the medical waste transports the medical waste himself or herself, or directs a member of his or her staff to transport the medical waste, to a permitted medical waste treatment facility, a transfer station, a parent organization, or another health care facility for the purpose of consolidation before treatment and disposal.

(3) Except as provided in paragraph (4), the generator maintains a tracking document, as specified in Section 118040.

(4)

118030
Limited Quantity Hauling Exemptions

(A) Notwithstanding paragraph (3), if a health care professional who generates medical waste returns the medical waste to the parent organization, a single-page form or multiple entry log may be substituted for the tracking document, if the form or log contains all of the following information:

(i) The name of the person transporting the medical waste.

(ii) The number of containers and type of medical waste. This subparagraph does not require any generator to maintain a separate medical waste container for every patient or to maintain records as to the specified source of the medical waste in any container.

(iii) The date that the medical waste was returned.

(B) This paragraph does not prohibit the use of a single document to verify the return of more than one container over a period of time, if the form or log is maintained in the files of the parent organization once the page is completed.

(b) The limited-quantity hauling exemption authorized by this section is valid for a period of one year.

(c) An application for an initial or a renewal of a limited-quantity hauling exemption shall be accompanied by a fee of twenty-five dollars ($25). The application shall identify each person who will transport medical waste for the transporter. If the generator or parent organization identifies more than four persons who will be transporting medical waste, the generator or parent organization shall pay an additional fee of five dollars ($5) for each person, up to a maximum additional fee of twenty-five dollars ($25).

118035
Transfer of waste prior to reaching treatment facility

118035. For the purpose of transferring medical waste prior to reaching a permitted medical waste treatment facility, medical waste shall not be unloaded, reloaded, or transferred to another vehicle at any location, except at a permitted medical waste transfer station or in the case of a vehicle breakdown or other emergency.

118040
Tracking Documents

118040.

(a) Except with regard to sharps waste consolidated by a home-generated sharps consolidation point approved pursuant to Section 117904, a hazardous waste transporter or generator transporting medical waste shall maintain a completed tracking document of all medical waste removed for treatment or disposal. A hazardous waste transporter or generator who transports medical waste to a facility, other than the final medical waste treatment facility, shall also maintain tracking documents which show the name, address, and telephone number of the medical waste generator, for purposes of tracking the generator of medical waste when the waste is transported to the final medical waste treatment facility. At the time that the medical waste is received by a hazardous waste transporter, the transporter shall provide the medical waste generator with a copy of the tracking document for the generator's medical waste records. The transporter or generator transporting medical waste shall maintain its copy of the tracking document for three years.

(b) The tracking document shall include, but not be limited to, all of the following information:

(1) The name, address, telephone number, and registration number of the transporter, unless transported pursuant to Section 118030.

(2) The type and quantity of medical waste transported.

(3) The name, address, and telephone number of the generator.

(4) The name, address, telephone number, permit number, and the signature of an authorized representative of the permitted facility receiving the medical waste.

(5) The date that the medical waste is collected or removed from the generator's facility, the date that the medical waste is received by the transfer station, the registered large quantity generator, or point of consolidation, if applicable, and the date that the medical waste is received by the treatment facility.

(c) Any hazardous waste transporter or generator transporting medical waste in a vehicle shall have a tracking document in his or her possession while transporting the medical waste. The tracking document shall be shown upon demand to any enforcement agency personnel or officer of the Department of the California Highway Patrol. If the medical waste is transported by rail, vessel, or air, the railroad corporation, vessel operator, or airline shall enter on the shipping papers any information concerning the medical waste that the enforcement agency may require.

(d) A hazardous waste transporter or a generator transporting medical waste shall provide the facility receiving the medical waste with the original tracking document.

(e) Each hazardous waste transporter and each medical waste treatment facility shall provide

tracking data periodically and in a format as determined by the department.

(f) Medical waste transported out of state shall be consigned to a permitted medical waste treatment facility in the receiving state. If there is no permitted medical waste treatment facility in the receiving state or if the medical waste is crossing an international border, the medical waste shall be treated in accordance with Chapter 8 (commencing with Section 118215) prior to being transported out of the state.

118045.

(a) The department shall charge an application fee for a permit for a transfer station equal to one hundred dollars ($100) for each hour which the department spends on processing the application, but not more than ten thousand dollars ($10,000), or as provided in the regulations adopted by the department.

(b) In addition to the fee specified in subdivision (a), the annual permit fee for a transfer station issued a permit pursuant to subdivision (e) of Section 118000 is two thousand dollars ($2,000), or as provided in the regulations adopted pursuant to this part.

118045
Transfer Station Permit fees

Chapter 7 — Medical Waste Treatment Facility Permits

118130. All offsite medical waste treatment facilities and transfer stations shall be permitted and inspected by the department. All onsite medical waste treatment facilities shall be permitted and inspected by the enforcement agency.

118130
Permits; Inspections by department

118135. On or before April 1, 1991, each person operating a medical waste treatment facility shall obtain a permit pursuant to this chapter from the department. If the medical waste treatment facility begins operation after April 1, 1991, the permit shall be obtained pursuant to this article prior to commencement of the treatment facility's operation.

118135
Deadlines to obtain permits

118140. A health care facility accepting medical waste for treatment from the physicians and surgeons who are on the staff of the facility and who are small quantity generators shall be classified as an onsite treatment facility and shall be permitted and inspected by the enforcement agency.

118140
Health care facilities accepting medical waste from staff; Onsite treatment facility classification

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118145. A health care facility accepting medical waste for treatment from small quantity generators that are adjacent to the facility shall be classified as an onsite treatment facility and shall be permitted and inspected by the enforcement agency.

118145
Medical waste from adjacent small quantity generators

118147. Notwithstanding any other provision of this chapter, a registered medical waste generator, which is a facility specified in subdivisions (a) and (b) of Section 117705, may accept home-generated sharps waste, to be consolidated with the facility's medical waste stream, subject to all of the following conditions:

(a) The generator of the sharps waste, a member of the generator' s family, or a person authorized by the enforcement agency transports the sharps waste to the medical waste generator's facility.

(b) The sharps waste is accepted at a central location at the medical waste generator's facility.

(c) A reference to, and a description of, the actions taken pursuant to this section are included in the facility's medical waste management plan adopted pursuant to Section 117960.

118147
Consolidation of home-generated sharps waste with medical waste

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118150.

(a) Each enforcement agency shall follow procedures that are consistent with this chapter, and the regulations adopted pursuant to this chapter, when issuing medical waste permits.

(b) Each person operating a medical waste treatment facility pursuant to a hazardous waste facilities permit or grant of interim status pursuant to Article 9 (commencing with Section 25200) of Chapter 6.5 of Division 20, as of January 1, 1991, shall be considered to have the medical waste permit required by this article until January 1, 1992, unless the enforcement agency with jurisdiction over its activities has taken final action prior to January 1, 1992, on an application for a permit pursuant to this article.

(c) Each medical waste facility subject to subdivision (b) shall operate in accordance with the standards and procedures contained in this chapter, and on and after January 1, 1991, is not subject to the standards and procedures contained in Chapter 6.5 (commencing with Section

118150
Compliance by enforcement agencies and facilities; Exemption from Chapter 6.5, Hazardous Waste Control

25100) of Division 20.

118155. Any person required to obtain a permit pursuant to this part shall file with the enforcement agency an application, on forms prescribed by the department, containing, but not limited to, all of the following:

118155
Medical Waste Permit Application

(a) The name of the applicant.
(b) The business address of the applicant.
(c) The type of treatment provided, the treatment capacity of the facility, a characterization of the waste treated at this facility, and the estimated average monthly quantity of waste treated at the facility.
(d) A disclosure statement, as provided in Section 25112.5, except for onsite medical waste treatment facilities.
(e) Evidence satisfactory to the enforcement agency that the operator of the medical waste treatment facility has the ability to comply with this part and the regulations adopted pursuant to this part.
(f) Any other information required by the enforcement agency for the administration or enforcement of this part or the regulations adopted pursuant to this part.

118160.

118160
Requirements for issuance or renewal of permits; Grounds for denial

(a) Prior to issuing or renewing a permit for an offsite medical waste treatment facility pursuant to Section 118130, the department shall review the compliance history of the applicant, under any local, state, or federal law or regulation governing the control of medical waste or pollution, including, but not limited to, the Clean Air Act (42 U.S.C. Sec. 7401 et seq.).
(b) The department shall, pursuant to this section, deny a permit, or specify additional permit conditions, to ensure compliance with applicable regulations, if the department determines that in the three-year period preceding the date of application the applicant has violated laws or regulations identified in subdivision (a) at a facility owned or operated by the applicant, and the violations demonstrate a recurring pattern of noncompliance or pose, or have posed, a significant risk to public health and safety or to the environment.
(c) In addition to any other information required to be submitted for the permitting of a facility pursuant to Section 118130, an applicant who has owned or operated a facility regulated by the department shall provide a description of all violations described in subdivision (a), that occurred at any facility permitted and owned or operated by the applicant in the state in the three years prior to the date of application.
(d) In making the determination of whether to deny a permit or to specify additional permit conditions pursuant to subdivision (b), the department shall take both of the following into consideration:
(1) Whether a permit denial or permit condition is appropriate or necessary given the severity of the violation.
(2) Whether the violation has been corrected in a timely fashion.

118165. On and after April 1, 1991, all persons operating a medical waste treatment facility shall maintain individual records for a period of three years and shall report or submit to the enforcement agency upon request, all of the following information:

118165
Recordkeeping requirements

(a) The type of treatment facility and its capacity.
(b) All treatment facility operating records.
(c) Copies of the tracking documents for all medical waste it receives for treatment from offsite generators or from hazardous waste haulers.

118170.

118170
Duration of permit; Application for renewal

(a) A medical waste permit issued by the enforcement agency to a medical waste treatment facility shall be valid for five years.
(b) An application for renewal of the permit shall be filed with the enforcement agency not less than 90 days prior to the expiration date. If a permittee fails to make a timely application for renewal, the medical waste permit shall expire on the expiration date.

118175.

118175
Conditions for granting renewal; transfer of permit

(a) A medical waste permit may be renewed if the enforcement agency finds the permittee has been in substantial compliance with this part and the regulations adopted pursuant to this part during the preceding permitted period or that the permittee corrected previous violations in a

timely manner.

(b) Upon approval of the enforcement agency, a permit may be transferred from one subsidiary to another subsidiary of the same corporation, from a parent corporation to one of its subsidiaries, or from a subsidiary to a parent corporation.

118180. A person required to obtain a medical waste permit shall, at all times, possess a valid permit for each facility in operation. A medical waste permit shall terminate prior to its expiration date if suspended or revoked pursuant to Section 118350 or, notwithstanding Section 118355, if either of the following occurs:

(a) The permittee sells or otherwise transfers the facility, except as specified in subdivision (b) of Section 118175.

(b) The permittee surrenders the permit to the enforcement agency because the permittee ceases operation.

118180
Valid permit requirements; Permit suspension or revocation

118185. The enforcement agency shall issue a medical waste permit upon evaluation, inspection, or records review of the applicant if the applicant is in substantial compliance with this part and the regulations adopted pursuant to this part and the applicant has corrected any previous violations. A decision to issue or not to issue the permit shall be made by the enforcement agency within 180 days of the time that the application is deemed complete, unless waived by the applicant.

118185
Procedures for issuance of permit

118190. When issuing, renewing, or revising any treatment facility permit, the enforcement agency may prohibit or condition the handling or treatment of medical waste to protect the public health and safety.

118190
Permit conditions

118195. An enforcement agency shall inform an applicant for a medical waste permit, in writing, upon the denial of any application for the permit. Within 20 days after the enforcement agency mails the notice, the applicant may present a written petition for a hearing to the enforcement agency. Upon receipt by the enforcement agency of the petition in proper form, the petition shall be set for hearing. If the department is the enforcement agency, the proceedings shall commence with the filing of a statement of issues and shall be conducted in accordance with Chapter 5 (commencing with Section 11500) of Part 1 of Division 3 of Title 2 of the Government Code, and the department has all the powers granted to a department in that chapter. If the department is not the enforcement agency, the hearings shall be held in accordance with the ordinance adopting the medical waste management program.

118195
Denial of permit; Hearing to contest denial

118200. The enforcement agency shall evaluate, inspect, and review the records of medical waste treatment facilities for compliance with this part.

118200
Facility inspection

118205. The fee schedule specified in Section 118210 shall cover the issuance of medical waste treatment facility permits and an inspection program, when the department serves as the enforcement agency. This fee schedule shall be adjusted annually in accordance with Section 100425. On or before January 1, 1993, the department may adjust by regulation the fees specified in Section 118210 to reflect the actual costs of implementing this chapter. Local enforcement agencies shall set fees that shall be sufficient to cover their costs in implementing this part with regard to large quantity generators.

118205
Fees where the Department is enforcement agency

118210.

(a) The department shall charge an annual permit fee for an offsite medical waste treatment facility equal to either two-tenths of a cent($0.002) for each pound of medical waste treated or ten thousand dollars ($10,000), whichever is greater.

(b) The department shall charge an initial application fee for each type of treatment technology at an offsite medical waste treatment facility equal to one hundred dollars ($100) for each hour the department spends processing the application, but not more than fifty thousand dollars ($50,000), or as provided in the regulations adopted by the department.

118210
Application and annual permit fees

118215. (a) Except as provided in subdivisions (b) and (c), a person generating or treating medical

118215
Methods of treatment

waste shall ensure that the medical waste is treated by one of the following methods, thereby rendering it solid waste, as defined in Section 40191 of the Public Resources Code, prior to disposal:

(1) (A) Incineration at a permitted medical waste treatmentfacility in a controlled-air, multichamber incinerator, or othermethod of incineration approved by the department which provides complete combustion of the waste into carbonized or mineralized ash.

(B) Treatment with an alternative technology approved pursuant to paragraph (3), which, due to the extremely high temperatures of treatment in excess of 1300 degrees Fahrenheit, has received express approval from the department.

(2) Steam sterilization at a permitted medical waste treatment facility or by other sterilization, in accordance with all of the following operating procedures for steam sterilizers or other sterilization:

(A) Standard written operating procedures shall be established for biological indicators, or for other indicators of adequate sterilization approved by the department, for each steam sterilizer, including time, temperature, pressure, type of waste, type of container, closure on container, pattern of loading, water content, and maximum load quantity.

(B) Recording or indicating thermometers shall be checked during each complete cycle to ensure the attainment of 121* Centigrade (250* Fahrenheit) for at least one-half hour, depending on the quantity and density of the load, to achieve sterilization of the entire load. Thermometers shall be checked for calibration annually. Records of the calibration checks shall be maintained as part of the facility's files and records for a period of three years or for the period specified in the regulations.

(C) Heat-sensitive tape, or another method acceptable to the enforcement agency, shall be used on each biohazard bag or sharps container that is processed onsite to indicate the attainment of adequate sterilization conditions.

(D) The biological indicator Bacillus stearothermophilus, or other indicator of adequate sterilization as approved by the department, shall be placed at the center of a load processed under standard operating conditions at least monthly to confirm the attainment of adequate sterilization conditions.

(E) Records of the procedures specified in subparagraphs (A), (B), and (D) shall be maintained for a period of not less than three years.

(3) (A) Other alternative medical waste treatment methods which are both of the following:

(i) Approved by the department.

(ii) Result in the destruction of pathogenic micro-organisms.

(B) Any alternative medical waste treatment method proposed to the department shall be evaluated by the department and either approved or rejected pursuant to the criteria specified in this subdivision

(b) A medical waste may be discharged to a public sewage system without treatment if it is not a biohazardous waste of a type described in either subdivision (a) or (b) of Section 117635, it is liquid or semiliquid, and its discharge is consistent with waste discharge requirements placed on the public sewage system by the California regional water quality control board with jurisdiction.

(c) (1) A medical waste that is a biohazardous waste of a type described in subdivision (a) of Section 117635 may be treated by a chemical disinfection if the medical waste is liquid or semiliquid and the chemical disinfection method is recognized by the National Institutes of Health, the Centers for Disease Control and Prevention, or the American Biological Safety Association, and if the use of chemical disinfection as a treatment method is identified in the site's medical waste management plan.

(2) If the waste is not treated by chemical disinfection, in accordance with paragraph (1), the waste shall be treated by one of the methods specified in subdivision (a).

(3) Following treatment by chemical disinfection, the medical waste may be discharged to the public sewage system if the discharge is consistent with waste discharge requirements placed on the public sewage system by the California regional water control board, and the discharge is in compliance with the requirements imposed by the owner or operator of the public sewage system. If the chemical disinfection of the medical waste causes the waste to become a hazardous waste, the waste shall be managed in accordance with the requirements of Chapter 6.5 (commencing with Section 25100) of Division 20.

118220
Human anatomical parts

118220. Recognizable human anatomical parts, with the exception of teeth not deemed infectious by the attending physician and surgeon or dentist, shall be disposed of by interment or in accordance with subdivision (a) of Section 118215, unless otherwise hazardous.

118222
Wastes requiring specified treatments

118222.
(a) Biohazardous waste that meets the conditions of paragraph (1) of subdivision (f) of Section 117635 shall be treated pursuant to subdivision (a) of Section 118215 prior to disposal.
(b) Biohazardous waste that meets the conditions specified in subdivision (g) of Section 117635 shall be treated pursuant to subdivision (a) or (d) of Section 118215 prior to disposal.

118225
Treatment of sharps waste

118225.
(a) Sharps waste shall be rendered noninfectious prior to disposal by one of the following methods:
(1) Incineration.
(2) Steam sterilization.
(3) Disinfection using an alternative treatment method approved by the department.
(b) Sharps waste rendered noninfectious pursuant to this section may be disposed of as solid waste if the waste is not otherwise hazardous.
(c) Onsite medical waste treatment facilities treating sharps waste pursuant to paragraph (2) or (3) of subdivision (a) shall ensure that, prior to disposal, the treated sharps waste is destroyed or that public access to the treated sharps waste is prevented.

118230
Hazardous waste incinerator may accept medical waste

118230. An operator of a hazardous waste incinerator permitted pursuant to Section 25200 may also accept medical waste for incineration.

118235
Emergency action plan

118235. Each medical waste treatment facility issued a medical waste permit shall provide the enforcement agency with an emergency action plan that the facility shall follow to ensure the proper disposal of medical waste in the event of equipment breakdowns, natural disasters, or other occurrences.

118240
Animal carcasses

118240. Notwithstanding Section 9141 of the Food and Agricultural Code, animals that die from infectious diseases shall be treated in accordance with Section 118215 if, in the opinion of the attending veterinarian or local health officer, the carcass presents a danger of infection to humans.

118245
Application fee for alternative technologies/ Mail back

118245.
(a) The department shall charge an application fee for evaluation of an alternative treatment technology pursuant to subdivision (d) of Section 118215 of two thousand five hundred dollars ($2,500) and shall charge an additional fee equal to one hundred dollars ($100) per hour for each hour which the department spends on processing the application, but not more than a total of five thousand dollars ($5,000), or as provided in the regulations adopted by the department.
(b) The department shall charge an application fee of one thousand dollars, ($1,000) for evaluation and approval of the use of a medical waste mail back system, which sends medical waste generated in this state to an out-of-state facility for treatment and disposal pursuant to subdivision (f) of Section 118040.

Chapter 9 — Containment and Storage

118275
Storage of medical waste; waste separation

118275. To containerize or store medical waste, a person shall do all of the following:

(a) Medical waste shall be contained separately from other waste at the point of origin in the producing facility. Sharps containers may be placed in biohazard bags or in containers with biohazard bags.
(b) Biohazardous waste, except biohazardous waste as defined in subdivision (g) of Section 117635, shall be placed in a red biohazard bag conspicuously labeled with the words "Biohazardous Waste" or with the international biohazard symbol and the word "BIOHAZARD."
(c) Sharps waste shall be contained in a sharps container pursuant to Section 118285.
(d)
(1) Biohazardous waste, which meets the conditions of subdivision (f) of Section 117635 because it is contaminated through contact with, or having previously contained, chemotherapeutic agents, shall be segregated for storage, and, when placed in a secondary container, that container shall be labeled with the words "Chemotherapy Waste", "CHEMO", or

other label approved by the department on the lid and on the sides, so as to be visible from any lateral direction, to ensure treatment of the biohazardous waste pursuant to Section 118222.

(2) Biohazardous waste, which meets the conditions of subdivision (f) of Section 117635 because it is comprised of human surgery specimens or tissues which have been fixed in formaldehyde or other fixatives, shall be segregated for storage and, when placed in a secondary container, that container shall be labeled with the words "Pathology Waste", "PATH", or other label approved by the department on the lid and on the sides, so as to be visible from any lateral direction, to ensure treatment of the biohazardous waste pursuant to Section 118222.

(e) Sharps waste, which meets the conditions of subdivision (f) of Section 117635, shall be placed in sharps containers labeled in accordance with the industry standard with the words "Chemotherapy Waste", "Chemo", or other label approved by the department, and segregated to ensure treatment of the sharps waste pursuant to Section 118222.

(f) Biohazardous waste, which are recognizable human anatomical parts, as specified in Section 118220, shall be segregated for storage and, when placed in a secondary container for treatment as pathology waste, that container shall be labeled with the words "Pathology Waste", "PATH", or other label approved by the department on the lid and on the sides, so as to be visible from any lateral direction, to ensure treatment of the biohazardous waste pursuant to Section 118222.

(g) Biohazardous waste, which meets the conditions specified in subdivision (g) of Section 117635, shall be segregated for storage and, when placed in a container or secondary container, that container shall be labeled with the words "INCINERATION ONLY" or other label approved by the department on the lid and on the sides, so as to be visible from any lateral direction, to ensure treatment of the biohazardous waste pursuant to Section 118222.

118280
Containment of biohazard bags; storage requirements

118280. To containerize biohazard bags, a person shall do all of the following:

(a) The bags shall be tied to prevent leakage or expulsion of contents during all future storage, handling, or transport.

(b) Biohazardous waste, except biohazardous waste as defined in subdivision (g) of Section 117635, shall be bagged in accordance with subdivision (b) of Section 118275 and placed for storage, handling, or transport in a rigid container which may be disposable, reusable, or recyclable. Containers shall be leak resistant, have tight-fitting covers, and be kept clean and in good repair. Containers may be recycled with the approval of the enforcement agency. Containers may be of any color and shall be labeled with the words "Biohazardous Waste" or with the international biohazard symbol and the word "BIOHAZARD" on the lid and on the sides so as to be visible from any lateral direction. Containers meeting the requirements specified in Section 66840 of Title 22 of the California Code of Regulations, as it read on December 31, 1990, may also be used until the replacement of the containers is necessary or existing stock has been depleted.

(c) Biohazardous waste shall not be removed from the biohazard bag until treatment as prescribed in Chapter 8 (commencing with Section 118215) is completed, except to eliminate a safety hazard, or by the enforcement officer in performance of an investigation pursuant to Section 117820. Biohazardous waste shall not be disposed of before being treated as prescribed in Chapter 8 (commencing with Section 118215).

(d)

(1) Except as provided in paragraph (5), a person generating biohazardous waste shall comply with the following requirements:

(A) If the person generates 20 or more pounds of biohazardous waste per month, the person shall not contain or store biohazardous or sharps waste above 0 degrees Centigrade (32 degrees Fahrenheit) at any onsite location for more than seven days without obtaining prior written approval of the enforcement agency.

(B) If a person generates less than 20 pounds of biohazardous waste per month, the person shall not contain or store biohazardous waste above 0 degrees Centigrade (32 degrees Fahrenheit) at any onsite location for more than 30 days.

(2) A person may store biohazardous or sharps waste at or below 0 degrees Centigrade (32 degrees Fahrenheit) at an onsite location for not more than 90 days without obtaining prior written approval of the enforcement agency.

(3) A person may store biohazardous or sharps waste at a permitted transfer station at or below 0 degrees Centigrade (32 degrees Fahrenheit) for not more than 30 days without obtaining prior written approval of the enforcement agency.

(4) A person shall not store biohazardous or sharps waste above 0 degrees Centigrade (32 degrees Fahrenheit) at any location or facility which is offsite from the generator for more than seven days before treatment.

(5) Notwithstanding paragraphs (1) to (4), inclusive, if the odor from biohazardous or sharps waste stored at a facility poses a nuisance, the enforcement agency may require more frequent removal.

(e) Waste that meets the definition of biohazardous waste in subdivision (g) of Section 117635 shall not be subject to the limitations on storage time prescribed in subdivision (d). A person may store that biohazardous waste at an onsite location for not longer than 90 days without obtaining prior written approval from the enforcement agency or the department, except that persons generating not more than 10 pounds of that biohazardous waste per calendar year may store less than 10 pounds of the biohazardous waste at any onsite location for not longer than one year without obtaining prior written approval from the enforcement agency or the department. A person may store that biohazardous waste at a permitted transfer station for not longer than 30 days without obtaining prior written approval from the enforcement agency or the department. A person shall not store that biohazardous waste at any location or facility that is offsite from the generator for more than 30 days before treatment.

118285
Containment or storage of sharps waste

118285. To containerize sharps waste, a person shall do all of the following:

(a) Place all sharps waste into a sharps container.

(b) Tape closed or tightly lid full sharps containers ready for disposal to preclude loss of contents.

(c) Store sharps containers ready for disposal for not more than seven days without the written approval of the enforcement agency.

(d) Label sharps containers with the words "sharps waste" or with the international biohazard symbol and the word "BIOHAZARD".

118290
Storage in common storage facility

118290. Any small quantity generator who has properly containerized the medical waste according to the requirements of this article may store the waste in a permitted common storage facility.

118295
Reusable containers; Washing and decontamination

118295. A person shall thoroughly wash and decontaminate reusable rigid containers for medical waste by a method approved by the enforcement agency each time they are emptied, unless the surfaces of the containers have been completely protected from contamination by disposable liners, bags, or other devices removed with the waste. These containers shall be maintained in a clean and sanitary manner. Approved methods of decontamination include, but are not limited to, agitation to remove visible soil combined with one of the following procedures:

(a) Exposure to hot water of at least 82 degrees Centigrade (180 degrees Fahrenheit) for a minimum of 15 seconds.

(b) Exposure to chemical sanitizer by rinsing with, or immersion in, one of the following for a minimum of three minutes:

(1) Hypochlorite solution (500 ppm available chlorine).

(2) Phenolic solution (500 ppm active agent).

(3) Iodoform solution (100 ppm available iodine).

(4) Quaternary ammonium solution (400 ppm active agent).

118300
Decontamination of leaks or spills

118300. Any leak or spill of a medical waste by a medical waste generator, hazardous waste hauler, or treatment facility shall be decontaminated by procedures adopted by the department.

118305
Use of containers for solid waste

118305. A person shall not use reusable pails, drums, dumpsters, or bins used for medical waste for the containment of solid waste, or for other purposes, except after being decontaminated by the procedures specified in Section 118295 and removal of all medical waste labels.

118310
Security and warning signs for storage areas

118310. Any enclosure or designated accumulation area used for the storage of medical waste containers shall be secured so as to deny access to unauthorized persons and shall be marked with warning signs on, or adjacent to, the exterior of entry doors, gates, or lids. The storage area may be secured by use of locks on entry doors, gates, or receptacle lids. The wording of warning signs shall be in English, "CAUTION—BIOHAZARDOUS WASTE STORAGE AREA—UNAUTHORIZED PERSONS KEEP OUT," and in Spanish, "CUIDADO—ZONA DE RESIDUOS—BIOLOGICOS PELIGROSOS—PROHIBIDA LA ENTRADA A PERSONAS NO AUTORIZADAS," or in another language, in addition to English, determined to be appropriate by the infection control staff or enforcement agency. A warning sign concerning infectious waste, as that term was defined by Section 25117.5 as it read on December 31, 1990, that sign having been installed before April 1, 1991, meets the requirements of this section, until the sign is changed and as long as the sign is not moved. Warning signs shall be readily legible during daylight from a distance of at least 25 feet. Any enclosure or

designated accumulation area shall provide medical waste protection from animals and natural elements and shall not provide a breeding place or a food source for insects or rodents.

118315. A person shall not use a trash chute to transfer medical waste.

118315
Trash chutes

118320.

118320
Compactors or grinders

(a) Except as provided in subdivision (b), compactors or grinders shall not be used to process medical waste until after the waste has been treated pursuant to Chapter 8 (commencing with Section 118215) and rendered solid waste.

(b)

(1) Grinding or compacting may be used when it is an integral part of an alternative treatment method approved by the department.

(2) A compactor may be used to compact medical waste if the type of medical waste compactor proposed to be used is evaluated by the department, and approved by the department prior to its use pursuant to the following criteria:

(A) The compactor operates without the release of liquids or pathogenic microorganisms from the medical waste during placement of the medical waste into, or removal of the medical waste from, the compactor units, and during the compaction process.

(B) The compacted medical waste will not release liquids or pathogens during any subsequent handling and no residual waste will be left in the compactor unit after the process is completed.

(C) Compactor operations and maintenance personnel will not be at any substantial increased risk of exposure to pathogens.

(D) The compactor has been demonstrated not to have any adverse effects on any treatment method. If only specific treatment methods are compatible with the compaction process, the department shall condition its approval of the compactor for use only in conjunction with treatment methods, with regard to which no adverse effects have been demonstrated.

(c) Medical waste in bags or other containers shall not be subject to compaction by any compacting device and shall not be placed for storage or transport in a portable or mobile trash compactor, except as allowed pursuant to subdivision (b).

Chapter 9.5 — Trauma Scene Waste Management

118321.

118321
Citation of part and findings

(a) This chapter shall be known, and may be cited, as the Trauma Scene Waste Management Act.

(b) The Legislature hereby finds and declares that it is in the interests of the health and safety of the public and the solid waste industry to regulate the handling and treatment of waste that, but for contamination with large quantities of human blood or body fluids as a result of death, serious injury, or illness, would be solid waste.

(c) The Legislature further finds and declares that, in the interest of safe and uniform management of trauma scene waste, practitioners of trauma scene management should be subject to regulation by the department.

118321.1.

118321.1
Trauma scene waste management practitioner registration & fees

(a) A trauma scene waste management practitioner shall register with the department on forms provided by the department.

(b) Notwithstanding subdivision (a), a person who possessed a local business license as of January 1, 1997, and performs trauma scene waste management activities may continue to do so until April 1, 1998, subject to both of the following conditions:

(1) The department has been notified of the trauma scene waste management activities.

(2) Registration as a trauma scene waste management practitioner is completed on or before April 1, 1998.

(c) The department shall register a trauma scene waste management practitioner and issue a trauma scene waste hauling permit to a trauma scene waste management practitioner who submits a completed application form and the registration fee, upon approval of the application by the department.

(d) A registered trauma scene waste management practitioner is exempt from the registration

requirements imposed pursuant to Chapter 6 (commencing with Section 118025) or Article 6.5 (commencing with Section 25167.1) of Chapter 6.5 of Division 20 upon haulers of medical waste.
(e) Registered trauma scene waste management practitioners shall pay an annual fee of two hundred dollars ($200) to the department for deposit in the fund. The fee revenues deposited in the fund pursuant to this subdivision may be expended by the department, upon appropriation by the Legislature, for the implementation of this chapter.

118321.2
List of practitioners

118321.2.
(a) The department shall maintain an inventory of registered trauma scene waste management practitioners.
(b) The department shall submit a list of registered trauma scene waste management practitioners to all local agency health officers and directors of environmental health, county administrators, and county sheriffs, and shall make the list available, upon request, to other public agencies and to the public.

118321.3
Duties of department

118321.3.
(a) Notwithstanding Section 117650, the department shall be the sole enforcement agency with regard to the management of trauma scene waste.
(b) The department, working with the trauma scene waste management industry and the health care industry, shall establish the following standards:
(1) Documentation of personal protection required to be provided for, and used by, workers in accordance with the California Occupational and Safety Administration's bloodborne pathogen standards.
(2) Technologies and chemicals appropriate to the task of cleanup and disinfecting.
(c) The department may adopt regulations pursuant to which trauma scene waste management practitioners shall document both of the following:
(1) Identification of trauma scene waste within the scope of this chapter.
(2) Compliance with disposal requirements, including, but not limited to, tracking the transportation of trauma scene waste.
(d) The department shall adopt procedures to provide information to trauma scene waste management practitioners recommending procedures for removing trauma scene waste from trauma scenes.

118321.4
Transporter deemed generator ofatma Scene Waste

118321.4. As specified in Section 117705, a trauma scene waste management practitioner who transports trauma scene waste shall be deemed the generator of the trauma scene waste for purposes of this part.

118321.5
Removal, transportation and storage

118321.5.
(a) Trauma scene waste shall be removed from the trauma scene immediately upon completion of the removal phase of a trauma scene waste removal operation.
(b) Trauma scene waste shall be transported to a permitted medical waste transfer station or treatment facility pursuant to subdivision (d) of Section 118000, or may be stored in a dedicated freezer at the business location of the trauma scene waste management practitioner for a period of not more than 14 days, or as otherwise approved by the department.

118321.6
Limitations

118321.6.
(a) This chapter does not limit or abridge the jurisdiction of the Division of Occupational Safety and Health of the Department of Industrial Relations.
(b) This chapter does not prohibit a business from employing or contracting with a person to provide cleanup or consultative services, including those services provided by an industrial hygienist, with respect to trauma scene waste if those services are incidental to the principal course and scope of services provided by the person.

Chapter 10 — Enforcement

118325
Injunction for violations

118325. An enforcement agency, district attorney, city attorney, or city prosecutor may bring an action to enjoin the violation, or threatened violation, of this part or the regulations adopted pursuant to this part, in the superior court in the county where the violation occurred or is about to occur. Any proceeding under this section shall be in accordance with Chapter 3 (commencing with Section 525) of Title 7 of Part 2 of the Code of Civil Procedure, except that the enforcement agency, district attorney,

city attorney, or city prosecutor is not required to allege facts necessary to show or tending to show the lack of an adequate remedy at law or irreparable damage or loss. With respect to any action brought pursuant to this section alleging actual violation of this part or the regulations adopted pursuant to this part, the court shall, if it finds the allegations to be true, issue its order enjoining the continuance of the violation.

118330
Order for compliance; Administrative penalty

118330. Whenever the enforcement agency determines that a violation or threatened violation of this part or the regulations adopted pursuant to this part has resulted, or is likely to result, in a release of medical waste into the environment, the agency may issue an order to the responsible person specifying a schedule for compliance or imposing an administrative penalty of not more than one thousand dollars ($1,000) per violation. Any person who, after notice and an opportunity for hearing, violates an order issued pursuant to this section is guilty of a misdemeanor. The department shall adopt regulations that specify the requirements for providing notice to persons to whom orders are issued and for administrative hearings and fines concerning these orders.

118335
Actions by enforcement agency; inspection authority

118335.

(a) In order to carry out the purpose of this part, any authorized representative of the enforcement agency may do any of the following:

(1) Enter and inspect a facility for which a medical waste permit or registration has been issued, for which a medical waste permit or registration application has been filed, or that is subject to registration or permitting requirements pursuant to this part. Enter and inspect a vehicle for which a hazardous waste hauler registration has been issued or a limited-quantity exemption granted, for which an application has been filed for a hazardous waste hauler registration or a limited-quantity exemption, or that is subject to registration requirements pursuant to this part.

(2) Inspect and copy any records, reports, test results, or other information related to the requirements of this part or the regulations adopted pursuant to this part.

(b) The inspection shall be made with the consent of the owner or possessor of the facilities or, if consent is refused, with a warrant duly issued pursuant to Title 13 (commencing with Section 1822.50) of Part 3 of the Code of Civil Procedure. However, in the event of an emergency affecting the public health or safety, an inspection may be made without consent or the issuance of a warrant.

(c) Any traffic officer, as defined in Section 625 of the Vehicle Code, and any peace officer, as defined in Section 830.1 or 830.2 of the Penal Code, may enforce Chapter 6 (commencing with Section 118000) and this chapter, and for purposes of enforcing these chapters, traffic officers and these peace officers are authorized representatives of the department.

118340
Unauthorized transportation, storage, treatment or disposal of medical waste; criminal penalties

118340.

(a) No person shall transport, store, treat, dispose, or cause the treatment or disposal of medical waste in a manner not authorized by his or her permit or registration, this part, or the regulations adopted pursuant to this part.

(b) Any person who stores, treats, disposes, or causes the treatment or disposal of medical waste in violation of this part or the regulations adopted pursuant to this part is guilty of a public offense as follows:

(1) For a small quantity generator, a first offense is an infraction and is punishable by a fine of not more than one thousand dollars ($1,000) .

(2) For a person other than a small quantity generator, a first offense is a misdemeanor punishable by a fine of not less than two thousand dollars ($2,000), or by up to one year in county jail, or by both the fine and imprisonment.

(c) A person who is convicted of a second or subsequent violation of subdivision (a) within three years of the prior conviction shall be punished by imprisonment in the county jail for not more than one year or by imprisonment in state prison for one, two, or three years or by a fine of not less than five thousand dollars ($5,000), or more than twenty-five thousand dollars ($25,000), or by both the fine and imprisonment. This section shall not apply unless any prior conviction is charged in the accusatory pleading and admitted by the defendant or found to be true by the trier of fact. If the defendant is a corporation that operates medical facilities in more than one geographic location, this subdivision shall apply only if the offense involves an adjacent facility involved in the prior conviction.

(d) Any person who knowingly treats or disposes, or causes the treatment or disposal of, medical waste in violation of this part shall be punished by imprisonment in the county jail for not more

than one year or by imprisonment in the state prison for one, two, or three years, or by a fine of not less than five thousand dollars ($5,000), or more than twenty-five thousand dollars ($25,000), or by both the fine and imprisonment.

(e) This section does not apply to a person transporting medical waste who is required to be a registered hazardous waste transporter. Those persons are subject to penalties for violations pursuant to Article 8 (commencing with Section 25180) of Chapter 6.5 of Division 20.

118345
False statements and representations; Failure to register or obtain medical waste permit; Penalties

118345.

(a) Any person who intentionally makes any false statement or representation in any application, label, tracking document, record, report, permit, registration, or other document filed, maintained, or used for purposes of compliance with this part that materially affects the health and safety of the public is liable for a civil penalty of not more than ten thousand dollars ($10,000) for each separate violation or, for continuing violations, for each day that the violation continues.

(b) Any person who fails to register or fails to obtain a medical waste permit in violation of this part, or otherwise violates any provision of this part, any order issued pursuant to Section 118330, or any regulation adopted pursuant to this part, is liable for a civil penalty of not more than ten thousand dollars ($10,000) for each violation of a separate provision of this part or, for continuing violations, for each day that the violation continues.

Chapter 11 — Suspension or Revocation

118350
Grounds for suspension or revocation

118350. The enforcement agency may suspend, amend, or revoke any medical waste permit issued by the enforcement agency for any of the following reasons:

(a) Violation by the permittee of any of the provisions of this part or any regulation adopted pursuant to this part.

(b) Violation of any term or condition of the permit.

(c) Aiding, abetting, or permitting the violation specified in subdivision (a) or (b) or interference in the performance of the duty of the enforcement officer.

(d) Proof that the permittee has intentionally made false statements, or failed to disclose fully all relevant facts, in any material regard, on the application for a medical waste permit.

(e) The conviction of a permittee, or the person in charge of the activity subject to the medical waste permit, of any crime that is substantially related to the qualifications or duties of the permittee or the person in charge of the activity, or that is substantially related to the functions that are subject to the medical waste permit. For purposes of this section, a conviction means a plea or verdict of guilty or a conviction following a plea of nolo contendere. An action to revoke or suspend the medical waste permit may be taken when the time for appeal has elapsed or the judgment of conviction has been affirmed on appeal. That action may also be taken when an order granting probation is made suspending the imposition of sentence, notwithstanding any subsequent order pursuant to Section 1203.4 of the Penal Code. The enforcement agency shall take into account all competent evidence of rehabilitation furnished by the permittee or person in charge of the permitted activity.

(f) A change in any condition that requires either a temporary or permanent modification, reduction, or termination of the permitted operation to bring it into compliance with the requirements of this part and the regulations adopted pursuant to this part.

118355
Proceedings

118355. Proceedings conducted by the department for the suspension or revocation of a medical waste permit shall commence with the filing of any accusation and shall be conducted in accordance with Chapter 5 (commencing with Section 11500) of Part 1 of Division 3 of Title 2 of the Government Code, and the department shall have all the powers granted to a department in that chapter.

118360
Temporary permit suspension to protect public welfare

118360. The enforcement agency may temporarily suspend a medical waste permit prior to any hearing, when it has determined that this action is necessary to protect the public welfare. The enforcement agency shall notify the permittee of the temporary suspension and the effective date thereof and, at the same time, shall serve the permittee with an accusation. Upon receipt of a notice of defense by the permittee, the matter shall, within 15 days, be set for hearing. The hearing shall be held as soon as possible, but not later than 30 days after receipt of the notice. The temporary suspension shall remain in effect until the hearing is completed and the enforcement agency has made a final determination on the merits. However, the temporary suspension is vacated if the enforcement agency fails to make a final determination on the merits within 60 days after the original hearing has been completed.

SOLID WASTE REGULATIONS
N.J.A.C. 7:26
Subchapter 3A. Regulated Medical Wastes

7:26-3A.1 Purpose, scope and applicability

(a) The purpose of this subchapter is to establish a program for regulated medical waste pursuant to the New Jersey Comprehensive Regulated Medical Waste Management Act, N.J.S.A. 13:1E-48.1 et seq.

(b) The rules in this subchapter apply to regulated medical waste as defined at N.J.A.C. 7:26-3A.6 that is generated, stored, transported, collected, transferred, treated, destroyed, disposed of or otherwise managed in New Jersey.

(c) Generators, transporters, collection facilities and owners or operators of intermediate handling facilities (for example, treatment and destruction facilities, incineration facilities, and disposal facilities) that generate, store, transport, collect, transfer, treat, destroy, dispose of or otherwise manage regulated medical waste in New Jersey shall comply with this subchapter.

(d) In addition to the requirements of this subchapter, all applicable requirements of the Department of Health shall be met.

(e) In addition to the requirements of this subchapter, generators, transporters, collection facilities and owners and operators of intermediate handling facilities and destination facilities shall comply with all applicable Federal, State, county and local statutes, rules and ordinances.

(f) Any fee under this subchapter that is subject to N.J.A.C. 7:1L shall be payable in installments in accordance with N.J.A.C. 7:1L.

7:26-3A.2 Construction

This subchapter shall be liberally construed to permit the Department to implement its statutory duties.

7:26-3A.3 Severability

If any section, subsection, provision, clause or portion of this subchapter, or the application thereof to any person, is adjudged unconstitutional or invalid by a court of competent jurisdiction, the remainder of this subchapter shall not be affected thereby.

7:26-3A.4 Record retention

(a) The length of time that parties shall keep records required under this subchapter is automatically extended in the case where EPA, the Department or another State agency initiates an enforcement action, for which those records are relevant, until the conclusion of the enforcement action.

(b) All records, reports, logs and tracking forms required to be made and/or kept in accordance with this subchapter, shall be made available for inspection by the Department.

7:26-3A.5 Definitions

For the purposes of this subchapter, all of the terms defined in N.J.A.C. 7:26-1.4 are hereby incorporated by reference. In addition, the following terms, when used in this subchapter, shall have the following meanings:

"Administrator" means the Administrator of the United States Environmental Protection Agency.

"Alternative or innovative technology"' means any technology, including proprietary or patented methods, that permanently alters the composition, volume, weight, or other relevant waste or material characteristics of regulated medical waste, through chemical, biological, or physical means so as to have a beneficial and long-term effect on the environment by reducing the quantity (volume or weight), infectiousness, toxicity, or constituent mobility of waste or materials generated, recovered, recycled, treated, transported, disposed of or otherwise managed. The term also includes products or production processes that promote or enhance material recovery, recycling or marketing of secondary materials, or that reduce or eliminate waste or emissions at the source of generation.

"Biologicals" means preparations made from living organisms and their products, including vaccines, cultures, etc., intended for use in diagnosing, immunizing or treating humans or animals or in research pertaining thereto.

"Blood products" means any product derived from human blood, including but not limited to blood plasma, platelets, red or white blood corpuscles, and other derived licensed products, such as interferon, etc.

"Body art" means the practice of physical body adornment in permitted establishments by operators utilizing, but not limited to, the following techniques: body piercing, tattooing, and permanent cosmetics.

"Body are establishment" means any place or premise, whether public or private, temporary or permanent in nature or location, wh4ere the practices of body art, whether or not for profit, are performed.

"Body fluids" means liquid emanating or derived from humans and limited to blood; amniotic, cerebrospinal, synovial, pleural, peritoneal and pericardial fluids; and semen and vaginal secretions.

"Central collection point" means a location where a generator consolidates regulated medical waste brought together from original generation points prior to its transport off-site or its treatment on-site (for example, incineration).

"Collection facility" means a facility where individual shipments of packaged, tracked regulated medical waste are assembled and/or consolidated, or transferred between vehicles, but are not opened or unpackaged prior to transport off-site for disposal.

"Commercial facility" means a facility or on-site generator, accepting regulated medical waste from other generators for on-site collection, storage, shipment or disposal, for a fee in excess of the costs actually incurred by the facility or on-site generator for managing the regulated medical waste.

"Consolidated tracking form" means the tracking form on which a transporter consolidates or transfers other tracking forms representing shipments of regulated medical waste.

"Container" means any portable device in which a regulated medical waste is stored, transported, disposed of or otherwise handled. The term "container" does not include items listed in the table at N.J.A.C. 7:26-3A.6(a).

"Decontamination" means the process of reducing or eliminating the presence of harmful substances, such as infectious agents, so as to reduce the likelihood of disease transmission from those substances.

"Departments" means the New Jersey Department of Environmental Protection and the New Jersey Department of Health.

"Destination facility" means the disposal facility, the incineration facility, or the facility that both treats and destroys regulated medical waste, to which a consignment of such is intended to be shipped, specified in Box 8 of the Medical Waste Tracking Form. The term "destination facility" also means any generator or facility that treats and destroys its own regulated medical waste.

"Destroyed regulated medical waste" means regulated medical waste that is no longer generally recognizable as regulated medical waste because all components of the waste have been ruined, torn apart, or mutilated to produce unrecognizable and unusable pieces smaller than three-quarters of an inch, except that all sharps must be smaller than one-half inch. It does not mean compaction or encapsulation except through:

1. Processes such as thermal treatment or melting, during which treatment and destruction occur;

2. Processes such as shredding, grinding, tearing, or breaking, during which only destruction takes place; or

3. Processes that melt plastics and fully encapsulate metallic or other sharps in the melted plastic and, in addition, the resulting melted plastic mass must be completely sealed in a secondary puncture-proof container that will not be opened or penetrated by undestroyed sharps in any circumstance of handling.

"Destruction facility" means a facility that destroys regulated medical waste by ruining or mutilating it, or tearing it apart.

"DHSS " means the New Jersey Department of Health and Senior Services.

"EPA" means the United States Environmental Protection Agency.

"Facility" means all contiguous land and structures, other appurtenances, and improvements on the land, used for treating, destroying, storing, or disposing of regulated medical waste. A facility may consist of several treatment, destruction, storage, or disposal operational units.

"Generator" means any person, by site, whose act or process produces regulated medical waste as defined in N.J.A.C. 7:26-3A.6, or whose act first causes a regulated medical waste to become subject to regulation. Noncontiguous properties owned or operated by the same person are separate sites and in the case where more than one person (for example, doctors with separate medical practices) are located in the same building and office, each individual business entity is a separate generator for the purposes of this subchapter. However, households utilizing home self-care are not generators.

"Home self-care" means the provision of medical care in the home setting (for example, private residence) through either self-administration practices or by a family member or other person who does not receive monetary compensation for their services. Excluded from this definition are direct patient care services provided in the home by

home health agencies as described in N.J.A.C. 8:42-1, durable medical equipment companies, home infusion companies, hospice care companies, and any other services or companies as determined by the State Department of Health that generate regulated medical waste in the home setting.

"Infectious agent" means any organism (such as a virus or a bacteria) that is capable of being communicated by invasion and multiplication in body tissues and capable of causing disease or adverse health impacts in humans.

"Intermediate handler" is a facility that either treats regulated medical waste or destroys regulated medical waste but does not do both. The term does not include transporters.

"Laboratory" means any research, analytical, or clinical facility that performs health care related analysis or service. This includes medical, pathological, pharmaceutical, and other research, commercial, or industrial laboratories.

"Medical waste" means any solid waste that is generated in the diagnosis, treatment (for example, provision of medical services), or immunization of human beings or animals, in research pertaining thereto, in the production or testing of biologicals, or in home self-care. The term does not include any hazardous waste identified or listed under 40 C.F.R. Part 261.

"Mobile treatment and/or destruction equipment" means equipment which treats and/or destroys regulated medical waste and which does not operate from a permanent location but which is capable of being transported form site to site.

"New Jersey medical waste tracking form" means the New Jersey medical waste tracking form available from the Department that must accompany all applicable shipments of regulated medical wastes.

"Noncommercial facility" means a facility or on-site generator accepting regulated medical waste from other generators for on-site collection, storage, shipment or disposal operating in accordance with section 501(c)(3) of the Federal Internal Revenue Service tax code, receiving only a cost-based rate or fee not in excess of the fixed and variable capital and operating costs actually incurred.

"Original generation point" means the location where regulated medical waste is generated. Waste may be taken from original generation points to a central collection point prior to off-site transport or on-site treatment.

"Oversized regulated medical waste" means medical waste that is too large to be placed in a plastic bag or standard container.

"Package" means packaging and/or a container and its contents.

"Packaging" means the assembly of one or more containers and any other components necessary to ensure compliance with N.J.A.C. 7:26-3A.11 and applicable Federal laws and regulations including, but not limited to, 40 C.F.R. Parts 171-180 as amended and supplemented.

"Person" means an individual, trust, firm, joint stock company, corporation (including a government corporation), partnership, association, state, municipality, commission, political subdivision of a state, any interstate body, or any department, agency or instrumentality of the United States.

"Regulated medical waste" or "RMW" means those medical wastes that have been listed or meet the waste characteristic classification criteria described at N.J.A.C. 7:26-3A.6 and that must be managed in accordance with the requirements of this subchapter.

"Storage" means the temporary holding of regulated medical wastes before treatment, disposal, or transport to another location.

"Tracking form" means a medical waste tracking form, including the New Jersey medical waste tracking form, the Federal tracking form, and the tracking form from other states that must accompany all applicable shipments of regulated medical waste.

"Transfer facility" means any transportation-related facility including loading docks, parking areas, storage areas and other similar areas where shipments of regulated medical waste are held (come to rest), during the course of transportation for a period not to exceed 24 hours and are not transferred to other vehicles during the course of transportation. A transfer facility is a "transporter". A location at which regulated medical waste is transferred directly between two vehicles is not a transfer facility but is considered a collection facility if it meets the requirements of N.J.A.C. 7:26-3A.39; if such location does not meet the requirements of N.J.A.C. 7:26-3A.39, the facility must hold a permit as a transfer station pursuant to N.J.A.C. 7:26-2.4.

"Transportation" means the shipment or conveyance of regulated medical waste by air, rail, highway, or water.

"Transporter" means a person engaged in the off-site transportation of regulated medical waste by air, rail, highway, or water, and, for the purposes of N.J.A.C. 7:26-3A.9(h), means a supplier of radioactive medical supplies.

"Treated regulated medical waste" means regulated medical waste that has been treated to substantially reduce or eliminate its potential for causing disease, but has not yet been destroyed.

"Treatment", "treated", or "treats" when used in any section of this subchapter except for N.J.A.C. 7:26-3A.6(a), shall mean to change the biological character or composition of any regulated medical waste to reduce or eliminate its potential for causing diseases through such methods, techniques or processes as incineration, steam sterilization, chemical disinfection, irradiation, thermal inactivation, or any other effective method as approved by the State Department of Health. If antimicrobial chemicals are used in regulated medical waste treatment the chemicals must be registered under the Federal Insecticide Fungicide and Rodenticide Act (FIFRA) program specifically for this purpose. When used in the context of N.J.A.C. 7:26-3A.6(a), treatment means either the provision of medical services or the preparation of human or animal remains for internment or cremation.

"Treatment facility" means a facility which treats regulated medical waste.

"Universal biohazard symbol" means the symbol design that conforms to the design shown in 29 C.F.R. §1910.145(f)(8)(ii).

"Untreated regulated medical waste" that has not been treated to substantially reduce or eliminate its potential for causing disease.

"Waste category" means either untreated regulated medical waste or treated regulated medical waste.

"Waste Class" means the description of Waste Class found at N.J.A.C. 7:26-3A.6(a).

7:26-3A.6 Definition of regulated medical waste

(a) A regulated medical waste is any solid waste, generated in the diagnosis, treatment (for example, provision of medical services), or immunization of human beings

or animals, in research pertaining thereto, or in the production or testing of biologicals, that is not excluded or exempted under (b) below, and that is listed or meets any waste characteristic classification criteria described in the following table:

TABLE REGULATED MEDICAL WASTE

Waste Class	Description
1. Cultures and Stocks	Cultures and stocks of infectious agents and associated biologicals, including: cultures from medical and pathological laboratories; cultures and stocks of infectious agents from research and industrial laboratories; wastes from the production of biologicals; discarded live and attenuated vaccines; and culture dishes and devices used to transfer, inoculate, and mix cultures.
2. Pathological Wastes	Human pathological wastes, including tissues, organs, and body party and body fluids that are removed during surgery or autopsy, or other medical procedures, and specimens of body fluids and their containers.
3. Human Blood and Blood Products	Liquid waste human blood; blood; items saturated and/or dripping with human blood; or items that were saturated and/or dripping with human blood that are now caked with dried human blood; including serum, plasma, and other blood components, and their containers, which were used or intended for use in either patient care, testing and laboratory analysis or the development of pharmaceuticals. Intravenous bags (only if they have come into contact with blood or other regulated body fluid), soft plastic pipettes and plastic blood vials are also included in this category.
4. Sharps	Sharps that were used in animal or human patient care or treatment or in medical research, or industrial laboratories, including sharp, or potentially sharp if broken, items such as, but not limited to, hypodermic needles, all syringes to which a needle can be attached (with or without the attached needle) and their components, including those from manufacturing research, manufacturing and marketing, pasteur pipettes, scalpel blades, blood vials, carpules, needles with attached tubing, acupuncture needles and culture dishes (regardless of presence of infectious

	agents). Also included are other types of broken or unbroken glassware that were in contact with infectious agents, such as used slides and cover slips.
5. Animal Waste	Contaminated animal carcasses, body parts, and bedding of animals that were known to have been exposed to infectious agents during research (including research in veterinary hospitals), production of biologicals, or testing of pharmaceuticals. Carcasses that are not known to have been exposed to agents infectious to humans are considered Waste Type ID 25, and, therefore, are not included in this class.
6. Isolation Wastes	Biological waste and discarded materials contaminated with blood, excretion, exudates, or secretions from humans who are isolated to protect others from certain highly communicable diseases, or isolated animals known to be infected with highly communicable diseases.
7. Unused Sharps	The following unused, discarded sharps, that were intended to be used: hypodermic needles, suture needles, syringes, and scalpel blades.

(b) The following are excluded from the definition of regulated medical waste:

1. Hazardous waste identified or listed under the regulations in 40 C.F.R. Part 261;

2. Household waste, generated in households utilizing home self-care as defined in N.J.A.C. 7:26-3A.5(b);

3. Ash from incineration of regulated medical waste once the incineration process has been completed;

4. Residues from treatment and destruction processes once the regulated medical waste has been both treated and destroyed;

5. Human corpses, remains and anatomical parts that are intended for interment or cremation;

6. Biological materials, including, but not limited to, those blood or blood products and pathological waste listed at (a)2 and 3 above, intended for use, reuse or recycling as raw materials or products, except materials classified as Class-6, Isolation Waste pursuant to (a)6 above if the following conditions are met:

i. The materials are used, reused or recycled in accordance with all applicable Federal, State and local statutes and regulations for handling and managing the materials;

ii. The materials and their by-products are managed as regulated medical waste when discarded after use, reuse or recycling if not treated and destroyed as those terms are defined at N.J.A.C. 7:26-3A.5; and

iii. The generator of the materials reports the type, destination, and method of use, reuse or recycling of the materials to the Bureau of Medical Waste and Technical

Assistance in the Department at the address given at N.J.A.C. 7:26-3A.8(e)4 and the district solid waste coordinator of the district where the material originated at least once per year, or on request of the Department or any other agency;

7. Nonbiological materials intended for use, reuse or recycling, except materials classified as Class-6, Isolation Waste pursuant to (a)6 above, if the following conditions are met:

i. The generator treats all used materials, or any unused materials, that have come into contact with a regulated body fluid or blood, or pathological waste as defined at (a) above at the site of generation before shipping the materials off site:

ii. The generator destroys all sharps at the site of generation before shipping the destroyed sharps off site for recycling of the devices' component raw materials; and

iii. The generator of the materials reports the type, quantity, destination, and method of use, reuse or recycling of the materials to the Bureau of Medical Waste and Technical Assistance in the Department at the address given at N.J.A.C. 7:26-3A.8(e)4 and the district solid waste coordinator of the district where the material originated at least once per year, or on request of the Department or any other agency; and

8. RMW, or non-regulated medical waste managed as RMW, that is either generated by a person and is less than 100 pounds or has become the property of a person other than the original generator except through the sale or transfer of assets, and where such person has not generated RMW within a two year period prior to requesting the exemption nor to the best of their knowledge plans to generate RMW in the future, may have a "one-time only" exemption from registering as a generator and may offer RMW to a licensed RMW transporter using its own number as the generator number. The Department shall issue an authorization for this exemption in response to written notification sent to the address listed at N.J.A.C. 7:26-3A.8(f)4 prior to the disposal of the RMW in order for a one-time exemption of this type to be valid. Authorizations for registration exemption will not be granted to persons the Department expects will generate RMW in the future.

(c) The following are exempted from the definition of regulated medical waste:

1. Etiologic agents being transported interstate pursuant to the requirements of the U.S. Department of Transportation, U.S. Department of Health and Human Services, and all other applicable shipping requirements are exempt from the requirements of this subchapter; and

2. Samples of regulated medical waste transported off-site by the EPA, the Department, the Department of Health or the New Jersey Department of Law and Public Safety for enforcement purposes are exempt from the requirements of this subchapter during the enforcement proceeding.

(d) In accordance with DHSS rules (N.J.A.C. 8:27), body art establishments shall comply with the provisions of N.J.S.A. 13:1E-48.1 et seq., the Comprehensive Regulated Medical Waste Management Act, and all rules promulgated pursuant to the aforementioned Act.

(e) Acupuncturists shall comply with the provisions of N.J.S.A. 13:1E-48.1 et seq., the Comprehensive Regulated Medical Waste Act, and all rule promulgated pursuant to the aforementioned Act.

7:26-3A.7 Mixtures

(a) Except as provided in (b) below, mixtures of solid waste and regulated medical waste listed in N.J.A.C. 7:26-3A.6(a) are a regulated medical waste.

(b) Mixtures of hazardous waste identified or listed in 40 C.F.R. Part 261 and regulated medical waste listed in N.J.A.C. 7:26-3A.6(a) are subject to the requirements in this subchapter, unless the mixture is subject to the hazardous waste manifest requirements in 40 C.F.R. Part 262 or 40 C.F.R. Part 266. In addition, the applicable hazardous waste requirements of N.J.A.C. 7:26-1 also apply.

7:26-3A.8 Registration and fees for regulated medical waste generators, transporters, and owners and operators of collection facilities, transfer stations, intermediate handlers and destination facilities

(a) Any person that generated regulated medical waste in this State shall register with the Department as a regulated medical waste generator in accordance with (e) below, and shall pay annual fees in accordance with the following:

1. For computation of the annual regulated medical waste generator fee, generators of regulated medical waste are divided, according to the amount of waste generated into five categories as explained in the following table:

Generator Category	Pounds Generated Per Year	Base Fee Category
1	less than 50	$ 85.00
2	50-200	$ 255.00
3	greater than 200-300	$425.00
4	greater than 300-1,000	$ 850.00
5	greater than 1,000	$2,950.00

i. For annual regulated medical waste generator fee purposes only, quantities of body fluids and blood and blood products that are discharged or removed from a human and are disposed of into a sanitary sewer system, which shall be in compliance with all applicable Federal, State, and county and local statutes, rules and ordinances, shall not be included in a generator's annual calculation of regulated medical waste generated, but at a minimum, if the generator generates no other regulated medical waste, the generator shall be included in generator category 1.

(b) Any person that engages or continues to engage in the transportation of regulated medical waste in this State, except generators that transport their own waste and that meet the requirements of N.J.A.C. 7:26-3A.17(a), shall register with the Department as a regulated medical waste transporter in accordance with (e) below, and pay annual fees in accordance with the following:

1. All regulated medical waste commercial transporters shall pay an annual fee of $3,950.00.

2. All noncommercial generator transporters of RMW (except radiopharmacies listed at (b)3 below) shall pay an annual fee of $650.00.

3. All noncommercial generator transporters of RMW that transport solely spent radiopharmaceuticals back to a radiopharmacy to allow for the safe decay of the radioactive material prior to disposal as RMW shall pay an annual fee of $200.00

(c) Commercial intermediate handlers, intermediate handlers treating, destroying or disposing of their RMW on-site and owners and operators of destination facilities shall register with the Department as a regulated medical waste intermediate handler or destination facility in accordance with (e) below, and pay annual fees in accordance with the following:

1. All regulated medical waste intermediate handlers and destination facilities shall register with the Department and pay an annual registration, compliance inspection, technical advisement and report analysis fee in accordance with the following:

i. A destination facility that treats and destroys less than 1,000 pounds of regulated medical waste produced shall pay a registration fee of $50.00 per year.

ii. A destination facility that treats and destroys from 1,000 pounds up to and including 10,000 pounds of, regulated medical waste produced per year shall pay a registration fee of $500.00 per year.

iii. A destination facility that treats and destroys more than 10,000 pounds of regulated medical waste per year shall pay a registration fee of $2,000 per year.

2. A commercial intermediate handler shall pay an annual registration fee of $1,500.

3. A noncommercial intermediate handler, or an intermediate handler treating only its own waste that treats any quantity of liquid regulated medical waste that is disposed of into the sanitary sewer system, and treats less than 10,000 pounds of nonliquid regulated medical waste per year and sends that waste off-site as RMW for treatment, destruction or disposal is exempt from the intermediate handler annual registration fee but shall register as an intermediate handler pursuant to this section.

4. Persons that only dispose of regulated medical waste that they generate by placing body fluids or blood and blood products into the sanitary sewer system, in compliance with all applicable Federal, State, county and local statutes, rules and ordinances, shall not be considered an intermediate handler or destination facility.

(d) Each person authorized by the Department pursuant to N.J.A.C. 7:26-3A.39 to operate a collection facility for medical wastes shall pay fees in accordance with the following:

1. Commercial collection facilities shall pay an application fee of $500.00. The application fee shall be submitted with the application required pursuant to N.J.A.C. 7:26-3A.39(c).

2. Commercial collection facilities shall pay an annual fee of $350.00 for the costs of registration, quarterly compliance monitoring, and review and maintenance of the quarterly reports submitted pursuant to N.J.A.C. 7:26-3A.39(j) and the annual reports submitted pursuant to N.J.A.C. 7:26-3A.44.

3. Collection facilities shall pay the costs of any other inspections or activities conducted by the Department for the authorization, inspection, and revocation of authorization to operate a collection facility. Such costs shall be in accordance with the fee schedule set forth at (f) below and N.J.A.C. 7:26-4.3.

4. Commercial collection facilities shall pay a fee of $250.00 for an authorization modification issued pursuant to N.J.A.C. 7:26-3A.39(o), which shall be paid on issuance of the authorization modification.

5. Noncommercial collection facilities collecting up to 2,000 pounds of medical wastes per year shall not pay an annual fee.

6. Noncommercial collection facilities collecting more than 2000 pounds of medical wastes per year shall pay an annual fee of $150.00 for the cost of registration.

(e) Each person operating a transfer station and authorized by the Department to manage medical waste pursuant to N.J.A.C. 7:26-3A.39 shall pay an annual fee of $2,000 in addition to all other solid waste transfer station facility-related fees pursuant to N.J.A.C. 7:26-4, for the costs of registration under this subchapter, review and maintenance of reports, and compliance monitoring.

(f) Each generator, transporter, intermediate handler, collection facility, transfer station and destination facility shall register with the Department on regulated medical waste registration forms prescribed by and available from the Department at the address listed below and shall state such information as necessary and proper to the enforcement of this subchapter, as the Department may require. No pro rata adjustment or refund for prior registration year payment of fees shall be made by the Department. Fees shall be payable to the Department 30 days after the beginning of each respective registration year in accordance with the following schedule:

1. The registration year for generators shall extend from July 22 through July 21 of each calendar year and fees shall be payable by August 20 of each calendar year;

2. The registration year for transporters shall extend from May 1 through April 30 of each calendar year and fees shall be payable by May 30 of each calendar year;

3. The registration year for intermediate handlers, collection facilities and destination facilities shall extend from January 1 through December 30 of each calendar year and fees shall be payable by January 29 of each calendar year; and

4. The Department's address for regulated medical waste is:

Bureau of Resource Recovery and Technical Prgrams
Division of Solid and Hazardous Waste
New Jersey Department of Environmental Protection
P.O. Box 414
Trenton, New Jersey 08625-0414

(g) The Department shall charge fees for regulated medical waste program services as follows:

1. Any person not registered for regulated medical waste activities in accordance with the requirements of this subchapter that requests a written interpretation of any solid waste regulation from the Department shall submit a fee of $150.00 with the request for interpretation.

2. Any person that requests the authorization of an alternative or innovative technology pursuant to N.J.A.C. 7:26-3A.47(a) shall submit a fee of $1,500 with the request for the authorization; and

3. Any person that requests the authorization of an alternative or innovative technology demonstration program pursuant to N.J.A.C. 7:26-3A.47(c) shall submit a fee of $2,000 with the request for authorization of the demonstration program.

(h) The omission of any type of Department service from the fee schedule set forth in (f) above shall not prevent the Department from assessing a reasonable fee for such service. Any person that requests a Department service not listed at (f) above shall request an initial review of the service for purposes of determining the fee for performing such service.

1. If the Department determines that the service is of a type listed in (g)1 through 3 above, the fee shall be the applicable fee specified at (g) above.

2. If the Department determines that the service is not one of those listed in (g)1 through 3 above, the fee shall be equal to the Department's estimate of the number of person-hours required to perform such activity, multiplied by the hourly rate of $74.73.

(i) The Department shall charge an excess fee at the hourly rate of $55.88 for excess person-hours required to perform any service for which a fee is established pursuant to (a) through (g) above. The Department shall notify the applicant or permittee of such excess fee in writing before performing the additional work.

(j) The determination of a fee pursuant to (h) above shall expire 90 days after the date such determination was issued, unless the applicant or permittee has paid such fee to the Department in full before expiration. If the applicant or permittee desires to continue to pursue the request for services for which the fee determination has expired, such applicant or permittee shall request a redetermination of the fee in writing, and the Department shall redetermine the fee in accordance with (h) above, as applicable.

(k) The Department may refrain from commencing work on the service for which a fee is established pursuant to (g) through (i) above until the Department receives full payment of such fee. If the Department has commenced work on the service the Department may suspend such work until it receives full payment of such fee.

(l) Any generator that fails to register pursuant to this section and that submits the annual fee pursuant to (a) above later than August 20 of each calendar year shall pay a late fee in the amount of 25 percent of the annual fee up to 15 days, 50 percent up to six months, and 100 percent up to one year, in addition to the annual fee. Neither the assessment of a late fee nor the payment of a late fee shall prevent the Department from taking any appropriate enforcement action.

(m) Any generator that submits the annual generator report required by N.J.A.C. 7:26-3A.21(g)30 or more days after such report is due shall pay a late fee of $50.00. Neither the assessment nor the payment of a late fee shall prevent the Department from taking any appropriate enforcement action.

7:26-3A.9 Education

The supervisory personnel of all transporters, except generators that transport their own regulated medical waste and satisfy the requirements of N.J.A.C. 7:26-3A.17(a), collection facilities, intermediate handlers and destination facilities shall attend education and training sessions provided by the Department, and shall also be required to disseminate the information obtained at the sessions to all employees.

7:26-3A.10 Segregation requirements

(a) Generators shall segregate regulated medical waste intended for transport off-site to the extent practicable prior to placement in containers according to (b) below.

(b) Generators shall segregate regulated medical waste into:

1. Sharps (Classes 4 and 7 as defined at N.J.A.C. 7:26-3A.6(a)) including sharps containing residual fluid;

2. Fluids (quantities greater than 20 cubic centimeters); and

3. Other regulated medical waste.

(c) Other regulated medical waste described at (b)3 above may be included in sharps containers. Such containers shall be managed at all times as sharps containers in accordance with N.J.A.C. 7:26-3A.11. The waste in these containers shall not be allowed to putrefy or be malodorous in any detectable manner.

(d) If other nonregulated medical waste and/or solid waste is placed in the same container(s) as regulated medical waste, or if regulated medical waste cannot be initially segregated from other solid waste, then the generator shall package, label, and mark the container(s) and manage its entire contents according to the requirements for regulated medical waste in this subchapter.

7:26-3A.11 Packaging requirements

(a) Generators shall ensure that all of their regulated medical waste is packaged in accordance with the requirements of (b) through (d) below, before transporting or offering such regulated medical waste for transport off-site. Generators may use one or more containers to meet these requirements for regulated medical waste packaging.

(b) Generators shall ensure that all regulated medical waste is placed in a container or containers that are:

1. Rigid;

2. Leak-resistant;

3. Impervious to moisture;

4. Sufficiently strong to prevent tearing or bursting under normal conditions of use and handling; and

5. Sealed to prevent leakage during transport.

(c) In addition to the requirements above, generators shall:

1. Package sharps and sharps with residual fluids in packaging or containers that are puncture-resistant; and

2. Package fluids (quantities greater than 20 cubic centimeters) in packaging or containers that are break-resistant and tightly lidded or stoppered.

(d) Generators need not place oversized regulated medical waste in containers. Generators shall note any special handling instructions for these items in Box 14 of the medical waste tracking form.

(e) Solid waste that is not being managed as regulated medical waste shall not be packaged for shipment inside a regulated medical waste container or in containers attached to, or part of, a regulated medical waste container.

(f) All waste packaged in "Biohazard" labeled bags or bags with the universal biohazard symbol on them will be presumed to be potentially infectious and shall be managed as RMW for transport and disposal.

7:26-3A.12 Storage of regulated medical waste prior to transport, treatment, destruction, or disposal

(a) Any person who stores regulated medical waste prior to treatment or disposal on-site (for example, interment, treatment and destruction, or incineration), or transport off-site, shall comply with the following storage requirements:

1. Store the regulated medical waste in a manner and location that maintains the integrity of the packaging and provides protection from water, rain and wind;

2. Maintain the regulated medical waste in a nonputrescent state, using refrigeration when necessary;

3. Lock the outdoor storage areas containing regulated medical waste (for example, dumpsters, sheds, tractor trailers, or other storage areas) to prevent unauthorized access;

4. Limit access to on-site storage areas to authorized employees; and

5. Store the regulated medical waste in a manner that affords protection from animals and does not provide a breeding place or a food source for insects and rodents.

(b) The storage period for regulated medical waste is limited as follows:

1. Regulated medical waste shall be disposed of immediately if it becomes putrescent or emits any odors;

2. All regulated medical waste shall be disposed of within one year of the date of generation, or sooner as determined by the generator, except that:

i. The storage period may exceed one year for regulated medical wastes that must be stored for longer periods to provide for the decay of radioactive materials in accordance with applicable Federal or State statutes and regulations.

(c) Any container that is being used to accumulate or store sharps shall be secured so that the contents are not accessible to any unauthorized person.

7:26-3A.13 Decontamination standards for reusable containers

(a) Generators, transporters, intermediate handlers and destination facility owners and operators shall comply with the following requirements with respect to reusing containers:

1. All non-rigid containers and inner liners shall be managed as regulated medical waste under this subchapter and shall not be decontaminated or reused;

2. Any container used for the storage and/or transport of regulated medical waste and designated for reuse once emptied, shall be decontaminated if the container shows signs of visible contamination;

3. If any container used for the storage and/or transport of regulated medical waste is for any reason not capable of being rendered free of visible signs of contamination on its outer surface in accordance with (a)2 above, the container must be managed (labeled, marked and treated and/or disposed of) as regulated medical waste under this subchapter; and

4. Decontaminated containers shall be free of all removable contaminating material from the inner and outer surfaces.

7:26-3A.14 Labeling requirements

(a) Generators shall label each package of regulated medical waste and each individual container used at the specific location of initial generation immediately on use, to meet the packaging requirements of N.J.A.C. 7:26-3A.11 and in accordance with all applicable Federal regulations including, but not limited to, 49 C.F.R. Parts 171-180 as

amended and supplemented, before the waste is transported or offered for transport off-site as follows:

1. Each container of untreated regulated medical waste shall have a water-resistant label affixed to or printed on the outside of the container. The label shall include the words "Medical Waste," or "Infectious Waste," or display the universal biohazard symbol. Red plastic bag(s) used as an inner container need not display a label; and

2. Packages containing treated regulated medical wastes are not required to be labeled under this section but are required to be marked in accordance with the requirements of N.J.A.C. 7:26-3A.15.

7:26-3A.15 Marking (identification) requirements

(a) Generators (including intermediate handlers) shall mark each individual container of regulated medical waste in accordance with all applicable Federal regulations including, but not limited to, 49 C.F.R. Parts 171-180 as amended and supplemented and according to the following marking requirements before the waste is removed from the generator's storage area and is transported or offered for transport off-site:

1. The outermost surface of the outer container or any inner container used to meet the packaging requirements at N.J.A.C. 7:26-3A.11 shall be marked with a water-resistant identification tag of sufficient dimension to contain the following information:

i. The generator's or intermediate handler's name;

ii. The generator's or intermediate handler's address. If the generator or intermediate handler is not located in New Jersey, then use their state permit or identification number, and if their state does not issue permit or identification numbers, then use the generator's or intermediate handler's address;

iii. The transporter's name;

iv. The transporter's NJDEP solid waste registration number;

v. The date of shipment; and

vi. Identification of contents as medical waste.

2. In addition to the requirements of (a)1 above, if the generator has used inner containers, including sharps and fluid containers, each inner container shall be marked with indelible ink or imprinted with water-resistant tags. The marking or the tag shall contain the following information:

i. The generator's or intermediate handler's name; and

ii. The generator's or intermediate handler's address. If the generator or intermediate handler is not located in New Jersey, then use their state permit or identification number, and if their state does not issue permit or identification numbers, then use the generator's or intermediate handler's address.

7:26-3A.16 General requirements for regulated medical waste generators, transporters, collection facilities, intermediate handlers and destination facilities

(a) A generator, transporter, collection facility, intermediate handler or destination facility that generates a medical waste, as defined in N.J.A.C. 7:26-3A.5 and who is located in New Jersey, or that stores, transfers, transports, treats, destroys or disposes of, or otherwise manages medical waste in New Jersey shall determine if that waste is a regulated medical waste.

(b) A generator, transporter, collection facility, intermediate handler or destination facility that either treats and/or destroys and disposes of regulated medical waste on-site (for example, incineration, burial or sewer disposal covered by Section 307(b)-(d) of the Clean Water Act,) or any generator, transporter, collection facility, intermediate handler or destination facility that neither treats nor destroys regulated medical waste on site but disposes of regulated medical waste via sewer disposal in compliance with all applicable Federal, State, county and local statutes, rules and ordinances is not subject to tracking requirements for that waste but is subject to all other applicable requirements, including, but not limited to, the generator reporting, registration, all fee requirements of this subchapter and the following conditions:

1. Bulk blood, body fluids and small amounts of pathological wastes that are liquefied or suspended in liquids, or have passed through the filters in alternative or innovative technologies may be disposed of in sanitary sewer, septic or municipal sewer system in accordance with Section 307(b) through (d) of the Clean Water Act.

2. Nonbiological regulated medical waste (for example, plastic blood bags, gauze bandages and similar substances) shall not be disposed of in a sanitary sewer, septic or municipal sewer system except for very minute amounts of such wastes that may escape retention on filters in alternative or innovative technologies designed to capture the insoluble waste particles in order to prevent their disposal into the sewer system.

(c) Vessels at port in New Jersey are subject to the requirements of this subchapter for those regulated medical wastes that are transported ashore in New Jersey. The owner or operator of the vessel and the person(s) removing or accepting waste from the vessel are considered co-generators of the waste.

(d) Any person offering regulated medical waste for transport shall use transporters that meet the requirements of N.J.A.C. 7:26-3A.27(c), unless the transporter is a generator meeting the requirements of N.J.A.C. 7:26-3A.17(a) or unless the transporter is the U.S. Postal Service and the requirements of N.J.A.C. 7:26-3A.17(b) are met.

(e) Persons shall dispose of regulated medical waste only with a registered intermediate handler, at a registered destination facility, a regulated medical waste sanitary landfill permitted in accordance with N.J.A.C. 7:26-3A.18, a resource recovery facility authorized to accept such waste and permitted in accordance with N.J.A.C. 7:26-2, or a facility in another state authorized to accept such wastes by such state. Shipments to out-of-State facilities shall be made in accordance with N.J.A.C. 7:26-3A.28 and 3A.46.

(f) A generator receiving regulated medical waste from other generators for transfer to a facility for treatment, destruction or disposal is considered a collection facility for the purposes of this section, except:

1. Any generator generating regulated medical wastes in the ordinary course of business and receiving home self-care medical waste for management in accordance with N.J.A.C. 7:26-3A.16(h).

(g) Any generator generating regulated medical wastes in the ordinary course of business and operating a noncommercial collection facility, an intermediate handler facility or a destination facility registered pursuant to this chapter, is not subject to the requirements at N.J.A.C. 7:26-16 or 16A.

(h) A generator generating regulated medical waste in the ordinary course of business, transporters, collection facilities, intermediate handlers or destination facilities may accept home self-care medical waste for management in accordance with the following requirements:

1. The generator, transporter, collection facility, intermediate handler or destination facility receiving the home self-care medical waste shall maintain a list of all persons delivering the home self-care medical waste, including such person's name, address, and telephone number, and the dates and the number of the medical waste containers received.

2. Containers shall meet the packaging requirements for regulated medical waste at N.J.A.C. 7:26-3A.11. Coffee cans, glass or soft thin-walled plastic bottles are not acceptable containers for collection and transportation of used or unused syringes. All containers shall be clearly labeled with the universal biohazard symbol or the words, "Home Self-Care Medical Waste."

3. The home self-care medical waste, after receipt, shall be managed in compliance with the requirements for regulated medical waste in this subchapter in addition to the following specific requirements:

i. For reporting purposes, home self-care medical waste shall be considered regulated medical waste by the person accepting it for disposal;

ii. Collected home self-care medical waste shall be transported in compliance with this subchapter;

iii. A person that offers home self-care medical waste for off-site treatment, destruction, or disposal shall use the tracking form required by N.J.A.C. 7:26-3A.19;

iv. Packaged cardboard shipping boxes in which containers of home self-care medical waste is transported shall be labeled with the universal biohazard symbol or the words, "Home Self-Care Medical Waste";

v. The tracking form shall be prepared in accordance with all State standards, except that Box 14 on the tracking form shall contain the words "Home Self-Care Medical Waste". Box 14 shall be used to identify the total number of containers shipped and total quantity (in net or gross mass, capacity, or as otherwise appropriate), including the unit of measurement (for example, lbs., gal., Kg., or L) of the shipment;

vi. Treatment and destruction shall be in accordance with this subchapter. A separate log shall be maintained to record the total number of containers and total quantity (in net or gross mass, capacity, or as otherwise appropriate), including the unit of measurement (for example, lbs., gal., Kg., or L) of home self-care medical waste treated and destroyed.

(i) No person shall install or use any alternative or innovative technology, or any modification thereof, for the treatment and/or destruction of regulated medical waste unless such technology or modification has been approved and authorized by the Department and DHSS for such purpose pursuant to N.J.A.C. 7:26-3A.47.

(j) No person shall abandon regulated medical waste on any public or private property or cause regulated medical waste to be abandoned. For the purpose of this section, "abandoned" means the intentional or unintentional placement, discard or loss of regulated medical waste in any area outside of the direct control of the person generating, transporting, managing, or disposing of the waste.

7:26-3A.17 Exemptions

(a) Generators of less than three cubic feet (50 pounds) of regulated medical waste per month that transport only their own regulated medical waste and home self-care medical waste to another generator for storage or disposal are exempt from the requirements of N.J.A.C. 7:26-3A.16(d) and the requirements of N.J.A.C. 7:26- 3A.27(c). The generator shall meet the following conditions:

1. The regulated medical waste is transported by the generator (or the generator's authorized employee) in a vehicle with a gross weight of less than 8,000 pounds that is owned by the generator, the same operator as the generator at that site or the same operator's or generator's authorized employee;

2. The original generation point and the storage point or disposal facility are located in New Jersey; and

3. The generator complies with the requirements of N.J.A.C. 7:26-3A.19.

(b) Generators that transport by the U.S. Postal Service regulated medical waste, Classes 4 and 7 as defined at N.J.A.C. 7:26-3A.6, are exempt from the requirements of N.J.A.C. 7:26-3A.16(d) if the generator generates less than three cubic feet (50 pounds) of regulated medical waste per month and ships less than three cubic feet (50 pounds) of regulated medical waste per shipment. The generator shall meet the following conditions:

1. The package shall be sent registered or certified mail, return receipt requested (indicating the person to which the package is sent, signature of sender, date, and address where delivered) or Priority Mail;

2. The generator shall retain the original mailing receipt and the returned registered or certified mail receipt, or in the case of Priority Mail, a hard copy of the electronic delivery confirmation (containing at a minimum the name, address, city, state, and zip code of the facility as well as the date of delivery and the amount of RMW delivered) attached to the generator copy of the tracking form; and

3. The generator shall comply with the requirements of N.J.A.C. 7:26-3A.19.

(c) Generators of less than 500 pounds of regulated medical waste per year, excluding blood and body fluids disposed of in a municipal sewer system in accordance with N.J.A.C. 7:26-3A.16(b), are exempt from the tracking requirements of N.J.A.C. 7:26-3A.19 provided:

1. Such generators generate regulated medical waste within the boundaries of a medical care room operated by another registered generator generating regulated medical waste in the ordinary course of business, such as a doctor or hospital; and

2. Each generator using the medical care room has a written agreement with the operator of the medical care room providing that such operator will dispose of the generator's regulated medical waste according to the requirements of this subchapter.

(d) A generator that collects regulated medical waste from other generators, in the same building or in other buildings on the generator's property or on contiguous property owned by the generator not divided by public roads, is exempt from the requirements of N.J.A.C. 7:26-3A.16(d) provided:

1. The generator collecting the regulated medical waste is registered as a collection facility, intermediate handler or destination facility;

2. The generator or its employee collects the regulated medical waste;

3. All the regulated medical waste is managed in compliance with this subchapter at all times; and

4. The collected regulated medical waste is not transported on public roads.

(e) A generator that generates regulated medical waste at a temporary facility operating less often than 15 days each year is exempt from the registration requirement of N.J.A.C. 7:26-3A.8(d) provided:

1. The generator maintains a permanent registered regulated medical waste generator facility; and

2. The generator transports the regulated medical waste from the temporary facility to the generator's permanent facility at the end of each working day for management as a regulated medical waste in accordance with this subchapter.

(f) Noncommercial collection facilities operating in accordance with N.J.A.C. 7:26-3A.39(b) and that collect less than 2,000 pounds of RMW per year are exempt from registration with the Department as a noncommercial collection facility. Noncommercial collection facilities collecting less than 2,000 pounds of regulated medical waste per year are also exempt from annual fees for collection facilities listed at N.J.A.C. 7:26-3A.8(d).

7:26-3A.18 Solid waste facility acceptance of regulated medical waste

(a) Regulated medical waste may be transported to or otherwise unloaded at any transfer station permitted or approved by the Department in accordance with N.J.A.C. 7:26, provided that the permittee applies to the Department for an amended permit, pursuant to N.J.A.C. 7:26-2.6, to authorize the facility to accept regulated medical waste.

1. Transfer stations accepting regulated medical waste shall comply with the requirements for regulated medical waste collection facilities at N.J.A.C. 7:26-3A.39(b)3 and (d)2 through 8.

(b) Regulated medical waste which has been treated may be transported to and disposed of at any sanitary landfill facility which is permitted or approved by the Department in accordance with N.J.A.C. 7:26, provided that the permittee applies to the Department for an amended permit, pursuant to N.J.A.C. 7:26-2.6, to authorize the facility to accept regulated medical waste.

7:26-3A.19 Generator use of tracking form

(a) A generator that transports or offers for transport regulated medical waste for off-site treatment, destruction, or disposal, including generators that meet the requirements of N.J.A.C. 7:26-3A.17, shall use only New Jersey regulated medical waste tracking forms, available upon request from the Department at the address listed at N.J.A.C. 7:26-3A.8(e).

(b) The tracking form shall be prepared in accordance with (c) through (g) below and the instructions provided by the Department.

1. Generators that transport regulated medical waste to the supplier of the radioactive medical materials from which the waste was derived and such supplier of radioactive medial materials shall complete the tracking form in accordance with (h) below.

(c) The generator shall prepare at least the number of tracking form copies that will provide the generator, each transporter(s), and each intermediate handler with one copy, and the owner or operator of the destination facility with two copies.

(d) The generator shall also:

1. Complete Boxes 1 through 15 of the tracking form for each shipment of regulated medical waste off-site;

i. The quantity (in net or gross mass, capacity, or as otherwise appropriate), including the unit of measurement (for example, lbs., gal., Kg., or L) of the regulated medical waste shall be entered in Box 13.

2. Sign and date the certification statement in Box 15 on the tracking form by hand;

3. Obtain the handwritten signature of the initial transporter and date of acceptance on the tracking form in Box 16; and

4. Retain "Copy 4—Generator Copy", in accordance with N.J.A.C. 7:26-3A.21(a)1.

(e) Generators that transport their own regulated medical waste and that meet the requirements of N.J.A.C. 7:26-3A.17(a) shall:

1. Sign and date the certification statement in Box 15 on the tracking form by hand, and enter in Box 5 the words "Self-Transport";

2. Sign the transporter section of the tracking form in Box 16, noting the date the regulated medical waste was transporter;

3. Enter the name, address, telephone number and State Permit number of the destination facility in Boxes 8 through 10;

4. Enter the name, address, telephone number and Generator Identification number of the collection facility in Box 14.

5. Retain "Copy 3—Transporter Copy" and "Copy 4—Generator Copy", in accordance with N.J.A.C. 7:26-3A.21(a)1.

6. Ensure that the tracking form accompanies the regulated medical waste while in transit; and

7. Comply with the tracking form requirements for transporters at N.J.A.C. 7:26-3A.31(d).

(f) Generators that transport their regulated medical waste through the U.S. Postal Service and that meet the requirements of N.J.A.C. 7:26-3A.17(b) shall:

1. Sign and date the certification statement in Box 15 on the tracking form by hand;

2. Sign and date the transporter section of the tracking form by noting that the transporter is the U.S. Postal Service in Box 5. The person delivering the RMW to the U.S. Postal Service shall sign and note the date the shipment was mailed in Box 16;

3. Enter the name, address, telephone number and State Permit number of the destination facility in Boxes 8 through 10;

4. Retain "Copy 3—Transporter Copy" and "Copy 4—Generator Copy", in accordance with N.J.A.C. 7:26-3A.21(a)1; and

5. Ensure that the tracking form accompanies the regulated medical waste while in transit.

(g) For rail shipments of regulated medical waste within the United States that originate at the site of generation, the generator shall send at least three copies of the tracking form dated and signed in accordance with this section to:

1. The next non-rail transporter, if any; or

2. The intermediate handler or destination facility if transported solely by rail; or

3. The last rail transporter to handle the waste in the United States if exported by rail.

(h) For regulated medical waste derived from radioactive medical materials the tracking form shall be prepared as follows:

1. The generator shall complete Boxes 1 through 10 on the tracking form;

2. The generator shall indicate in Box 14 that radioactive regulated medical waste is being transported to the supplier of the original radioactive medical materials;

3. The generator shall complete Box 15 (generator's certification) and enter the first date the tracking form is used. A copy of that specific tracking form may then be used for up to one year from the original date entered in Box 15;

4. A copy of the tracking form shall accompany each shipment of radioactive regulated medical waste from the generator to the supplier;

5. The generator shall use a registered regulated medical waste transporter;

6. The supplier shall maintain a receiving log for each shipment, which may be in the form of its usual recordkeeping for the radioactive waste inventory, in which the following information is recorded:

i. The date of receipt of the radioactive regulated medical waste shipment;

ii. The type of radioactive regulated medical waste received and the number of containers of each type; and

iii. The total quantity (in net or gross mass, capacity, or as otherwise appropriate), including the unit of measurement (for example, lbs., gal., Kg., or L) of each type of radioactive regulated medical waste received; and

7. The supplier shall, on a semi-annual basis, submit a summary of the receiving log information to the generator of the radioactive regulated medical waste and to the Department.

7:26-3A.20 Generators exporting regulated medical waste

(a) Generators (including transporters, collection facilities, transfer stations, and intermediate handlers that initiate tracking forms) that export regulated medical waste to a foreign country (for example, Canada) for treatment, destruction, or disposal, shall request that the destination facility provide written confirmation that the waste was received. If the generator has not received that confirmation from the destination facility within 45 days from the date of acceptance of the waste by the first transporter, the generator shall submit an exception report as required under N.J.A.C. 7:26-3A.22.

7:26-3A.21 Generator recordkeeping

(a) Each generator shall:

1. Keep the copy of each tracking form required by N.J.A.C. 7:26-3A.19 and the signed "Copy 1—Generator Copy" of each completed tracking form signed by the owner or operator of the destination facility, intermediate handler or collection facility for at least three years from the date the waste was accepted by the initial transporter unless the Department specifically requires an additional retention period; and

2. Retain a copy of all exception reports required to be submitted pursuant to N.J.A.C. 7:26-3A.22(b) for at least three years after the day the exception report was submitted unless the Department specifically requires an additional retention period.

(b) Each generator who treats and destroys regulated medical waste on-site by a method or process other than incineration, shall maintain the following records:

1. The approximate quantity by weight, of regulated medical waste that is subject to the treatment and destruction processes;

2. The approximate percent, by weight, of total waste treated and destroyed that is regulated medical waste; and

3. For regulated medical waste accepted from other generators, the name and address of the generators, the date the waste was accepted from each generator, the weight of waste accepted from each generator, and the date the waste was treated and destroyed for each generator.

(c) Each generator in (b) above shall maintain records for a period of at least three years from the date the waste was treated and destroyed, unless the Department specifically requires an additional retention period.

(d) All generators of regulated medical waste shall submit annual generator reports to the Department for the period June 22 through June 21 of each calendar year on forms available from the Department at the address listed at N.J.A.C. 7:26-3A.8(d) covering all regulated medical waste generated, treated or destroyed, and disposed of and shall be submitted to the Department by July 21 of each calendar year. The generator annual report shall include, but not be limited to, the following information:

1. The date of the report;

2. A description of the regulated medical waste, identified by Waste Class;

3. The total quantity in pounds for the year for each Waste Class of regulated medical waste generated, treated, destroyed, or disposed of;

4. The name and NJDEP solid waste transporter registration number of every transporter who transported the generator's regulated medical waste.

5. The name and address of each intermediate handler or destination facility and a description of quantity in pounds for each Waste Class of regulated medical waste sent to each facility; and

6. The method of treatment, destruction or disposal of each Waste Class by quantity in pounds (for example, on-site treatment, on-site incineration, disposal via sanitary sewer).

(e) Generators of regulated medical waste that is reused or recycled shall comply with the reporting requirements of N.J.A.C. 7:26-3A.6(b)6iii and 7iii.

(f) All copies of the generator's annual reports, tracking forms and other documents required to be maintained under this subchapter as well as copies of the Department's compliance inspection reports and the certificate of generator registration for the site shall be retained at the generator's site, for at least three years from the date that the documents were due, or created, unless the Department specifically requires an additional retention period.

(g) Generators required to file Annual Generator Reports pursuant to (d) above shall have the option to file the required data electronically via the Division of Solid and Hazardous Waste's Internet web site at **http://www.state.nj.us/dep/online**.

7:26-3A.22 Exception reporting for generators

(a) A generator shall contact the owner or operator of the destination facility, transporter(s), intermediate handler(s) and collection facility(s), as appropriate, to

determine the status of any tracked waste if the generator does not receive a copy of the completed tracking form with the handwritten signature of the owner or operator of the destination facility within 35 days of the date the waste was accepted by the initial transporter.

(b) A generator shall submit a generator exception report, as described below, to the Department at the address listed at N.J.A.C. 7:26-3A.8(d) if the generator has not received a completed copy of the tracking form signed by the owner or operator of the destination facility within 45 days of the date the waste was accepted by the initial transporter, or if the tracking form for the waste was consolidated onto a new tracking form by a transporter or a collection facility in accordance with N.J.A.C. 7:26-3A.33, within 60 days of the date the waste was accepted by the initial transporter. The exception report must be postmarked on or before the 46th day following the date the waste was accepted by the initial transporter, or for loads consolidated by transporters or collection facilities, on or before the 61st day, and shall include:

1. A legible copy of the original tracking form for which the generator does not have confirmation of delivery; and

2. A cover letter signed by the generator or his authorized representative explaining the efforts taken to locate the regulated medical waste, and its final disposition if ascertained, and the results of those efforts.

(c) A copy of the generator exception report shall be kept by the generator for a period of a least three years from the date the exception report was submitted unless the Department specifically requires an additional retention period.

7:26-3A.23 Additional reporting for generators

The Department and the Administrator may require generators to furnish additional information concerning the quantities and management methods of medical waste as they deem necessary under Resource Conservation Recovery Act (RCRA) Section 11004 and as the Department deems necessary under N.J.S.A. 13:1D-9.

7:26-3A.24 Generators of regulated medical waste who incinerate regulated medical waste on-site

(a) The requirements of N.J.A.C. 7:26-3A.25 and 3A.26 shall apply to generators of regulated medical waste who incinerate regulated medical waste on-site.

(b) Generators of regulated medical waste that incinerate such waste on-site and that accept regulated medical waste accompanied by a regulated medical waste tracking form are also subject to the requirements of N.J.A.C. 7:26-3A.39 through 3A.43.

(c) In addition, owners and operators of incinerators are required to comply with the requirements of N.J.A.C. 7:26-2, 2B, 4 and 16 unless they are temporarily authorized to operate in accordance with N.J.A.C. 7:26-3A.38.

7:26-3A.25 Recordkeeping for generators with on-site incinerators

(a) Generators shall keep a generator on-site incinerator operating log at their incineration facility that includes, but shall not be limited to, the following information:

1. The date each incineration cycle was begun;

2. The length of the incineration cycle;

3. The total quantity in pounds of solid waste and medical waste incinerated, per incineration cycle;

4. An estimate of the quantity in pounds of regulated medical waste incinerated, per incineration cycle; and

5. The quantity in pounds of ash generated and transported off-site, including dates of transport and the name, address, and NJDEP solid waste registration number of the transporters and the name and address of the disposal facilities utilized.

(b) Generators with on-site incinerators that accept regulated medical waste from other generator(s) shall maintain the following information, in addition to the on-site incinerator operating log required by (a) above, for each shipment of regulated medical waste accepted:

1. The date the waste was accepted:

2. The name and address of the generator who originated the shipment. If the generator is not located in New Jersey, then use the state permit or identification number of the other state and if the other state does not issue a permit or identification number, then use the generator's address;

3. The total weight in pounds of the regulated medical waste accepted from the originating generator; and

4. The signature of the individual accepting the waste.

(c) Generators with on-site incinerators shall initiate the generator on-site incinerator operating log required by (a) above as of June 22, 1989 and shall retain operating log for three years, unless the Department specifically requires an additional retention period.

(d) Generators with on-site incinerators that accept regulated medical waste from other generators shall keep copies of all tracking forms and operating logs for a period of three years from the date they accepted the waste unless the Department specifically requires an additional retention period.

(e) Generators shall retain a copy of the generator on-site incinerator report form required under N.J.A.C. 7:26-3A.26 for three years from the date of submission, unless the Department specifically requires an additional retention period.

7:26-3A.26 Recordkeeping for generators who incinerate regulated medical waste on-site

(a) The owner or operator of an on-site incinerator shall prepare three copies of an Annual Intermediate Handler and Destination Facility Report as required by N.J.A.C. 7:26-3A.44 on forms available from the Department at the address listed in N.J.A.C. 7:26-3A.8(f), and submit one copy of the generator on-site incinerator report to the Department, and two copies to:

Chief, Waste Characterization Branch
Office of Solid Waste (OS-332)
U.S. Environmental Protection Agency
401 M Street, SW
Washington, DC 20460

(b) The Intermediate Handler and Destination Facility Report submitted by generators with incinerators shall summarize, in the format provided by the Department, information collected in the generator on-site incinerator operating log and shall contain, but not be limited to, the following information:

1. Facility name, mailing address, and location;

2. Facility type (for example, hospital, laboratory);

3. Contact person;

4. Waste feed information;

5. The total number of incinerators at the facility that incinerate regulated medical waste and information concerning each incinerator; and

6. The quantity in pounds of ash generated and transported off-site, including dates of removal, the name, address and NJDEP solid waste transporter registration number of the transporter(s), and the name and address of the disposal facility.

(c) Each Intermediate Handler and Destination Facility Report submitted by generators with incinerators shall contain the following certification, signed by the facility owner or his authorized representative: "I certify that I have personally examined and am familiar with the information submitted in this and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete."

7:26-3A.27 Transporters

(a) The requirements of N.J.A.C. 7:26-3A.27 through 3A.37 apply to transporters and collection facilities, including generators that transport their own waste, and owners and operators of transfer facilities engaged in transporting regulated medical waste that is generated, stored, transferred, treated, destroyed, disposed of, or otherwise managed in New Jersey.

(b) The requirements of (a) above, shall not apply to on-site transportation of regulated medical waste.

(c) No person shall engage or continue to engage in transportation of regulated medical waste in New Jersey unless:

1. They register as a regulated medical waste transporter in accordance with N.J.A.C. 7:26-3A.8.;

2. They register as a solid waste transporter in accordance with N.J.A.C. 7:26-3.2, pay fees in accordance with N.J.A.C. 7:26-4, and comply with the requirements of N.J.A.C. 7:26-3.1, 3.4, 3.7, and 16; and

3. They obtain a certificate of public convenience and necessity as required by N.J.S.A. 48:13A-6;

(d) Generators of less than three cubic feet (50 pounds) of regulated medical waste per month that meet the requirements of N.J.A.C. 7:26-3A.17(a) are exempt from the requirements of (c) above.

(e) Generators, such as a hospitals or doctors, that generates regulated medical waste in the ordinary course of business and transports such regulated medical waste only among facilities that such generators wholly owns and operates are exempt from the requirements of (c) above, provided:

1. The generator files an affidavit with the Bureau of Registration in the Department verifying its limited transporter status;

2. The generator transports the regulated medical waste to a registered noncommercial treatment and destruction facility or a collection facility, wholly owned and operated by the generator; and

3. Pays the annual generator's noncommercial transporter fee pursuant to N.J.A.C. 7:26-3A.8.

(f) A transporter of regulated medical waste shall also comply with applicable requirements of N.J.A.C. 7:26-3A.16, 3A.18, 3A.20, 3A.21, 3A.22, 3A.23 and 3A.39, when it consolidates two or more shipments of regulated medical waste onto a single regulated medical waste tracking form.

(g) Transporters shall also comply with the pre-transport requirements of N.J.A.C. 7:26-3A.10 through 3A.15 if they:

1. Store regulated medical waste in the course of transport; or

2. Remove regulated medical waste from a reusable container; or

3. Modify packaging of regulated medical waste.

(h) Persons transporting regulated medical waste through New Jersey, when roadways and highways in New Jersey constitute a segment of such vehicle's route, are exempt from the requirements of (c) above, provided:

1. Transportation is completed in less than 24 hours, unless mechanical breakdown occurs and repair is necessitated;

2. Regulated medical waste is not collected, treated, transferred, or destroyed or disposed of in New Jersey;

3. Regulated medical waste is packaged, stored, labeled and marked in accordance with any applicable Federal law and regulations and with the requirements at N.J.A.C. 7:26-3A.11, 12, 15, and 16;

4. Containers of regulated medical waste are securely locked at all times during transit through New Jersey; and

5. The owner and/or operator of the vehicle transporting such waste is licensed in accordance with all applicable Federal law and regulations and all applicable law and regulations of the state of licensing of the owner and/or operator.

(i) Regulated medical waste transporters registered with the Department pursuant to N.J.A.C. 7:26-3, 3A, 16 and 16A that transport regulated medical waste of New Jersey origin may retain regulated medical waste in a transportation vehicle for up to 14 consecutive calendar days provided the waste does not become putrescent or emit any odors. If the regulated medical waste becomes putrescent, or emits any odors, the transporter shall dispose of the waste immediately.

(j) Regulated medical waste shall not be removed from or be transferred between vehicles by transporters or other persons unless the site of transfer is authorized as a solid waste transfer station for regulated medical waste pursuant to this chapter, or is registered and operating as a regulated medical waste collection facility pursuant to N.J.A.C. 7:26-3A.39.

(k) Regulated medical waste transported in New Jersey shall be transported in accordance with all applicable Federal regulations including, but not limited to, 49 C.F.R. 171-180 as amended and supplemented.

7:26-3A.28 Transporter acceptance of regulated medical waste

(a) Transporters shall not accept for transport any regulated medical waste unless the outer surface of the container:

1. Is labeled and marked in accordance with N.J.A.C. 7:26-3A.14 and 3A.15; and

2. Appears to be in good condition and shows no signs of leakage or other visible packaging deficiencies.

(b) Transporters shall accept a shipment of regulated medical waste only from a registered regulated medical waste generator and all shipments shall be accompanied by a properly completed tracking form as required by N.J.A.C. 7:26-3A.19.

(c) When regulated medical waste is handled by more than one transporter, each subsequent transporter shall attach a water resistant identification tag below the generator's marking on the outer surface of the packaging that does not obscure the generator's or previous transporter's markings. The transporter taking possession of the shipment must ensure that the tag contains the following information:

1. The name of transporter taking possession (receiving) of the regulated medical waste;

2. The transporter's NJDEP solid waste registration number. If the transporter does not transport in New Jersey, use the permit or identification number issued by the state in which the transporter is registered. If the transporter's state does not issue a permit or identification numbers, then use the transporter's address; and

3. The date of receipt.

(d) Before accepting regulated medical waste for transport to a facility outside New Jersey, a transporter shall obtain certification from the out-of-state facility that such a facility is authorized or permitted to accept such waste by the receiving state and shall submit the certification to the Bureau of Medical Waste and Technical Assistance in the Department.

7:26-3A.29 Transporter EPA notification [Repealed]

7:26-3A.30 Vehicle requirements.

(a) In addition to the requirements of N.J.A.C. 7:26-3, transporters shall use vehicles to transport regulated medical waste in accordance with all applicable Federal regulations including, but not limited to, 49 C.F.R. 171-180 as amended and supplemented and that meet the following requirements:

1. The vehicle shall have a fully enclosed, leak-resistant cargo-carrying body;

2. The transporter shall ensure that the waste does not become putrescent in the vehicle through lengthy storage and is not subject to mechanical stress or compaction during loading and unloading or during transit;

3. The transporter shall maintain the cargo-carrying body in good sanitary condition; and

4. The cargo-carrying body shall be securely locked if left unattended.

(b) The transporter shall use vehicles to transport regulated medical waste that have the following identification on the two sides and back of the cargo-carrying body in letters a minimum of three inches in height:

1. The name of the transporter;

2. The transporter's NJDEP solid waste transporter registration number; and

3. A sign or the following words imprinted.

i. Medical Waste; or

ii. INFECTIOUS WASTE.

(c) A transporter shall not transport regulated medical waste with other solid waste in the same container, unless the transporter manages both wastes as regulated medical waste in compliance with the requirements of N.J.A.C. 7:26-3A.27 through 3A.36.

7:26-3A.31 Tracking form requirements for transporters

(a) A transporter shall not accept a shipment of regulated medical waste if the regulated medical waste is to be treated, transported, stored, transferred, destroyed, disposed of, or otherwise managed in New Jersey, unless it is accompanied by a medical waste tracking form available from the Department at the address listed at N.J.A.C. 7:26-3A.8(d) and completed in accordance with instructions provided by the Department and signed by the generator in accordance with the provisions of N.J.A.C. 7:26-3A.19. In the case where a transporter intends to deliver regulated medical waste generated in New Jersey to another state which supplies its own tracking form and requires its use, the transporter shall provide the generator with the form of that state to which the waste is to be sent.

(b) Before accepting for collection, transport or transporting any regulated medical waste, the transporter shall:

1. Certify that the tracking form accurately reflects the number of the packages being transported by signing and dating the tracking form acknowledging acceptance of the regulated medical waste from the generator; and

2. Return a signed "Copy 4—Generator Copy" of the tracking form to the generator before leaving the generator's site.

(c) Each transporter shall ensure that the tracking form accompanies the regulated medical waste while in transit.

(d) A transporter, upon delivery of the regulated medical waste to another transporter (including a transfer facility) or to an intermediate handler or destination facility located in the United States, shall:

1. Complete Boxes 17 through 22 of the tracking form and obtain the date of delivery and the handwritten signature of the transporter, or the owner or operator of the intermediate handling facility or destination facility on the tracking form;

2. Retain "Copy 3—Transporter Copy" of the signed tracking form in accordance with N.J.A.C. 7:26-3A.34; and

3. Give the remaining copies of the tracking form to the second transporter, intermediate handler, or destination facility.

4. Third and/or subsequent transporters shall enter information required of transporter 2 in Boxes 17 through 21 in Box 14b.

5. Photocopies of the signed tracking form shall be retained by the second and/or any subsequent transporter(s).

(e) Any transporter that transports regulated medical waste across an international border, or that delivers regulated medical waste to a transporter or treatment, destruction, or destination facility located in a foreign country (for example, Canada) shall:

1. Obtain the signature of the accepting foreign transporter or destination facility; or

2. Verify that the waste has been delivered to the next (foreign) transporter, or treatment, destruction or destination facility by writing a statement to that effect in Box

14, certifying that the entire shipment (as specified in Boxes 11, 12 and 13 of the tracking form) has been delivered to the next (foreign) party, including the accepting party's name, company name, and mailing address, and signing directly below that certification statement; and

3. Retain "Copy 3—Transporter Copy" of the signed tracking form for that transporter's records; and

4. Return all remaining copies of the tracking form by mail to the generator.

(f) For shipments involving rail transportation, the requirements of N.J.A.C. 7:26-3A.45 apply to rail transporters in lieu of the requirement of (b), (c) and (d) above.

7:26-3A.32 Transporter compliance with the tracking form

(a) Except as provided in (b) and (c) below, the transporter shall deliver the entire quantity of regulated medical waste that the transporter has accepted from a generator or another transporter to:

1. The intermediate handler or destination facility listed on the tracking form; or

2. The next transporter.

(b) If the regulated medical waste cannot be delivered in accordance with (a) above, the transporter shall contact the generator for further directions, revise the tracking form according to the generator's instructions, and deliver the entire quantity of regulated medical waste from that generator according to the generator instructions.

(c) Notwithstanding (b) above, a transporter may deliver all or a portion of the regulated medical waste, in unopened containers, to a destination facility other than the destination facility designated on the generator's tracking form, if the generator in writing consents to the use of such specific alternative destination facility prior to the transfer of regulated medical waste from the generator to the transporter. The transporter shall enter the required information in Box 14 of the tracking form and shall comply with all other tracking form requirements of N.J.A.C. 7:26-3A.31.

7:26-3A.33 Transporters consolidating waste to a new tracking form

(a) A transporter that chooses to consolidate to a single tracking form shipments of regulated medical waste shall:

1. Enter the new consolidation tracking form number in Box 21 on the original generator's tracking form;

2. Enter the consolidating transporter's identification data as the generator of the consolidation tracking form in Boxes 1 through 4 of the consolidation tracking form;

3. Complete Boxes 5 through 14 of the consolidation tracking form.

i. Enter the tracking form number of the original generator's tracking form in Box 14 of the consolidation tracking form. If more than 20 tracking forms are being consolidated, reference shall be made in Box 14 to the consolidation log pursuant to (b) below and enter the total number of tracking forms being consolidated.

4. Sign Box 15 of the consolidation tracking form; and

5. Comply with N.J.A.C. 7:26-3A.31 through 3A.33, as applicable, to complete the remainder of the consolidation tracking form.

(b) When the transporter receives the signed tracking form that the transporter initiated by consolidating shipments of regulated medical waste back from the destination facility, the transporter shall:

1. Attach a copy of the tracking form signed by the destination facility to the generator's original tracking form;

2. Retain a copy of the each tracking form in accordance with N.J.A.C. 7:26-3A.34;

3. Return a copy of each tracking form to the generator within 15 days of receipt of the tracking form from the destination facility; and

4. Maintain a transporter consolidation log on forms supplied by the Department indicating all shipments consolidated on that form. The transporter consolidation log must accompany the tracking form and shall include the following information:

i. The name of each generator;

ii. The generator's address or if the regulated medical waste was generated in another state which issues a permit or identification number, then use that permit or identification number and, if the generator's state does not issue permit or identification numbers, then use the generator's address;

iii. The date the regulated medical waste was originally shipped by the generator;

iv. The quantity in pounds of regulated medical waste (number of containers and/ or quantity (in net or gross mass, capacity, or as otherwise appropriate), including the unit of measurement (for example, lbs., gal., Kg., or L)) by waste category (that is, "untreated" or "treated") shipped by each generator; and

v. The names, NJDEP registration numbers of all previous transporters or, if the transporters do not transport in New Jersey, then use the permit or identification number issued by the state in which the transporter is registered, and if the state does not issue permits or identification numbers, use the transporters' addresses.

7:26-3A.34 Recordkeeping for transporters of regulated medical waste

(a) A transporter of regulated medical waste shall keep a copy of the tracking form signed by the generator, himself, the previous transporter (if applicable), and the next party, which may be one of the following: another transporter; or the owner or operator of an intermediate handling facility or destination facility. The transporter shall retain a copy of this form for a period of three years from the date the waste was accepted by the next party unless the Department specifically requires an additional retention period.

(b) For any regulated medical waste received by the transporter and consolidated by the transporter to another tracking form, the transporter shall:

1. Retain "Copy 3—Transporter Copy" of the tracking form signed by the transporter for three years from the date the waste was accepted by the transporter unless the Department specifically requires an additional retention period; and

2. Retain "Copy 3—Transporter Copy" of the transporter initiated tracking form signed by the intermediate handler or destination facility and all consolidation logs required by N.J.A.C. 7:26-3A.33(b)4 for three years from the date the waste was accepted by the intermediate handler or destination facility unless the Department specifically requires an additional retention period.

(c) Transporters shall retain a copy of each regulated medical waste transporter report required by N.J.A.C. 7:26-3A.35 for three years after the date of submission unless the Department specifically requires an additional retention period.

7:26-3A.35 Transporter reporting

(a) A transporter who accepts regulated medical waste which is generated in New Jersey or that is to be stored, transferred, treated, destroyed, disposed of, or otherwise managed in New Jersey shall submit a regulated medical waste transporter report to the Department describing the source and disposition of the waste. The regulated medical waste transporter reports shall be submitted to forms available from the Department and sent to the address listed at N.J.A.C. 7:26-3A.8(d).

(b) Each regulated medical waste transporter report shall include, but not be limited to, the following information:

1. The transporter's name, address, and NJDEP solid waste transporter registration number or if the transporter does not transport in New Jersey, then use the permit or identification number issued of the state in which the transporter is registered;

2. The name and telephone number of a contact person;

3. The total number of generators from whom the transporter accepted regulated medical waste;

4. The name, address, and type of each generator (for example, hospital, doctor) from whom the transporter accepted regulated medical waste;

5. The quantity (in net or gross mass, capacity, or as otherwise appropriate), including the unit of measurement (for example, lbs., gal., Kg., or L) and waste category (untreated or treated) of regulated medical waste accepted from each generator;

6. The total quantity (in net or gross mass, capacity, or as otherwise appropriate), including the unit of measurement (for example, lbs., gal., Kg., or L) and by waste category, of regulated medical waste from all generators in New Jersey, or from all generators in another state that the transporter delivered to an intermediate handler or to a destination facility,

7. The total quantity (in net or gross mass, capacity, or as otherwise appropriate), including the unit of measurement (for example, lbs., gal., Kg., or L) and by waste category, of regulated medical waste from all generators in New Jersey or from all generators in another state that the transporter delivered to a second transporter or to a transfer facility; and

8. The certification of the transporter report signed by the owner or operator, or his authorized representative.

(c) Transporters who transport or deliver regulated medical waste to an intermediate handler or to a destination facility shall also provide the following information;

1. The name and address of each intermediate handler and destination facility to which the waste was delivered;

2. The amount in pounds, by waste category, that was delivered;

3. The total number of intermediate handlers and destination facilities to which waste was delivered.

(d) The transporter shall submit an annual regulated medical waste transporter report to the Department which shall cover the period from July 1 through June 30 and shall be due on or before July 30 of each calendar year.

(e) Each transporter who initiates a tracking form shall meet the requirements of N.J.A.C. 7:26-3A.22, exception reporting, except that the 35 and 45 day periods begin on the day the transporter accepted the waste from the generator.

(f) In accordance with N.J.A.C. 7:26-1.12(b), the information contained in the transporter report as outlined in 3A.35(b) above, is not deemed to be public record and the public shall not have a right to inspect, copy, or obtain a copy of the same.

7:26-3A.36 Additional reporting for transporters of regulated medical waste

The Department and the Administrator may require transporters to furnish additional information concerning the quantities and management methods of regulated medical waste as he or she deems necessary under RCRA Section 11004 and as the Department may deem necessary under N.J.S.A. 13:1D-9.

7:26-3A.37 Transporter management of spills

(a) All transporters shall develop and implement a Spill Management Plan to govern the management and decontamination of regulated medical waste spills. The Spill Management Plan shall be submitted to and approved by the Department.

1. This section shall not apply to transporters that are generators of less than 50 pounds of regulated medical waste per month and that transport RMW pursuant to N.J.A.C. 7:26-3A.17(a).

(b) All transporters shall maintain at each site and in each vehicle used to transport regulated medical waste a copy of the Spill Management Plan and appropriate equipment and supplies for cleaning up a spill of regulated medical waste, including but not limited to, the following:

1. A spill containment and cleanup kit in each area utilized for the collection, transfer, storage, treatment, packaging or other such handling of regulated medical waste. All vehicles operating under a New Jersey regulated medical waste transporter registration, or any out-of-State transporter transporting regulated medical waste through New Jersey in accordance with N.J.A.C. 7:26-3A.27(g), shall carry a spill containment and cleanup kit in the vehicle whenever regulated medical waste is transported. Personnel shall be trained in the use of the kit. The kit shall contain, at a minimum, the following:

i. Absorbent material for spilled liquids. The absorbent material shall have a rated capacity of one gallon of liquid for every cubic foot of regulated medical waste that is usually managed in the area for which the kit is provided or 10 gallons, whichever is less.

ii. One gallon of disinfectant in a sprayer capable of dispersing its charge in a mist and in a stream. The disinfectant shall be of hospital grade and of a formulation described in (c) below and be effective against mycobacteria.

iii. Fifty plastic bags that meet the requirements of N.J.A.C. 7:26-3A.11(b)2, 3 and 4 along with sealing tape (or devices for sealing), and appropriate labels as required by N.J.A.C. 7:26-3A.14. The plastic bags shall be large enough to overpack any box or other container usually used by the customers of the transporter for regulated medical waste packaging;

iv. Two sets of overalls, gloves, boots, caps, protective eye covering, and protective breathing devices all of which must be disposable and impermeable to liquids. Overalls, boots and caps shall be oversized or fitted to medical waste handlers and be made of a moisture resistant or moisture-proof material. When sharps are known not to be present, gloves for handling regulated medical waste shall be durable and moisture resistant or moisture proof. When sharps are known to be present or may be present, gloves for handling such waste shall be puncture resistant or puncture proof in addition to

being moisture resistant. Boots shall be of durable moisture resistant or moisture proof material that does not tear under the stress of walking. At a minimum, protective breathing devices shall include surgical masks. The kit shall also contain tape for sealing wrists and ankles of the protective overalls;

v. Scoops, shovels, push brooms, and buckets;

vi. A first-aid kit, boundary marking tape, fire extinguisher, lights, and other appropriate safety equipment;

vii. A suitable means of communication for summoning aid in an emergency, and

viii. A copy of the approved Spill Management Plan as described at (a) above.

(c) Disinfection and routine decontamination procedures for soiled surfaces include, but are not limited to, the following:

1. Exposure to hot water of at least 82 degrees Celcius (180 degrees Fahrenheit) for a minimum of 15 seconds; or

2. Exposure to a chemical sanitizer by rinsing with or immersion in a chemical disinfectant. Such disinfectants shall be registered with the USEPA as hospital disinfectants that are tuberculocidal, fungicidal, virucidal and effective against HIV-1. Also approved for this specific purpose as a disinfectant is ten percent volume/volume of sodium hypochlorite and water.

(d) In case of any spill of any regulated medical waste, the transporter shall immediately take steps to contain and clean up the regulated medical waste in accordance with the procedures specified in the Spill Management Plan.

1. The spill of any medical waste by a transporter shall be immediately reported by the transporter or its designee to the DEP Emergency Response 24-hour Hotline at 1-877-WARNDEP.

2. The transporter shall submit a written accident report to the Department within 48 hours of the occurrence of any spill of regulated medical waste on an accident report form provided by the Department. A copy of the report shall be kept on file for a minimum of three years from the date of submission in the.same location as the registration certificate. The record retention period shall be extended during the course of any unresolved litigation, or when otherwise required by the Department.

(e) In certain cases, the Department may allow a modified spill kit to be used. The contents of this modified spill kit shall be specific to the operations of a particular RMW transporter. The Department shall deem the contents of the modified kit as adequate to contain RMW spills that may occur specific to the transporter applying for the modification. If a modified spill kit is warranted, a letter stating so shall be issued by the Department.

7:26-3A.38 Temporary authorization to operate a regulated medical waste incinerator

(a) This section applies only to and sets forth requirements for an authorization to operate an incinerator that accepts regulated medical waste for disposal.

(b) Notwithstanding the requirements of N.J.A.C. 7:26-2 and 2B, but subject to the requirements of N.J.A.C. 7:26-16, the owner or operator of an incinerator shall be authorized to operate that incinerator if the following requirements are met:

1. The owner or operator shall submit documentation as submitted to the Department demonstrating that the incinerator was in operation accepting regulated medical waste for disposal on or before March 6, 1989;

2. The owner or operator of the disposal facility continues to accept regulated medical waste for disposal;

3. The owner or operator registers and pays fees as a regulated medical waste destination facility in accordance with N.J.A.C. 7:26-3A.8;

4. The owner or operator of the facility shall have a current certificate to operate control apparatus or equipment pursuant to N.J.A.C. 7:27;

5. The owner or operator shall be or is fully permitted pursuant to N.J.A.C. 7:26-2 and 2B prior to expiration of the facility's current certificate to operate control apparatus or equipment issued pursuant to N.J.A.C. 7:27. For the purposes of the temporary authorization, any application for a renewal or extension of the current certificate shall be considered an expiration of the current certificate;

6. No waste shall be stored overnight at any facility without effective treatment of prevent odors associated with putrefaction;

7. Facility property surrounding the actual disposal area shall be maintained free of litter, debris, and accumulations of unprocessed waste, process residues and effluents. Methods of effectively controlling wind-blown papers and other lightweight materials such as fencing shall be implemented;

8. The operation of the facility shall not result in odors associated with solid waste being detected off site in any area of human occupancy;

9. The owner or operator shall maintain all facility systems and related appurtenances in a manner that facilitates proper operation and minimizes system downtime. When requested, the operator of the facility shall furnish proof that provisions have been made for the repair and replacement of equipment which becomes inoperative;

10. An adequate water supply and adequate fire-fighting equipment shall be maintained at the facility or be readily available to extinguish any and all types of fires. Fire-fighting procedures, including the telephone numbers of the local fire, police, ambulance and hospitals facilities, shall be posted in and around the facility at all times;

11. The owner or operator shall effectively control insects, other arthropods and rodents at the facility by means of a program in compliance with the requirements of the New Jersey Pesticide Control Code, N.J.A.C. 7:30, and implemented by an applicator of pesticides, certified in accordance with the New Jersey Pesticide Control Code, N.J.A.C. 7:30;

12. The facility owner or operator shall be responsible for the sanitary condition and orderly operation of the area;

13. The Departments' inspectors shall have the right to enter and inspect any building or other portion of the facility, at any time. This right to inspect includes, but is not limited to:

i. Sampling any materials on site;

ii. Photographing any portion of the facility;

iii. Investigating an actual or suspected source of pollution of the environment;

iv. Ascertaining compliance or non-compliance with the statutes, rules or regulations of the Department, including conditions of the facility's authorization or permit issued by the Department; or

v. Reviewing and copying all applicable records, which shall be furnished upon request and made available at all reasonable times for inspection.

14. An operation and maintenance manual meeting the requirements of N.J.A.C. 7:26-2B.4(a)17 through 20 shall be maintained at the facility;

15. The owner or operator shall obtain or has obtained all applicable permits and approvals required by Federal, State, county and local ordinance;

16. The facility shall not pose a threat to the public health, safety or the environment; and

17. The facility shall only accept regulated medical waste from transporters who have NJDEP registration numbers and who have a certificate of public convenience and necessity issued by the Department, unless the transporter is exempt from these requirements pursuant to N.J.A.C. 7:26-3A.17(a) or unless the transporter is the U.S. Postal Service and the generator who has shipped the waste has complied with N.J.A.C. 7:26-3A.17(b).

7:26-3A.39 Collection facilities for medical wastes

(a) This section contains the regulations of the Department governing the authorization and operation of noncommercial and commercial collection facilities for regulated medical waste. Such facilities shall accept and handle only medical waste and regulated medical waste as defined at N.J.A.C. 7:26-3A.5. Such facilities shall not accept or handle solid waste as defined at N.J.A.C. 7:26-1.4 and 1.6 other than medical waste and regulated medical waste, hazardous waste as defined at N.J.A.C. 7:26G, or recyclable material as defined at N.J.A.C. 7:26A-1.3.

(b) Any registered regulated medical waste generator that conducts activities as a collection facility and that generates regulated medical waste in the ordinary course of business at the same site, such as a doctor or hospital, that operates on a noncommercial basis and accepts only medical wastes in quantities greater than 2,000 pounds per year from other generators registered pursuant to N.J.A.C. 7:26-3A.8 and home self-care medical wastes in accordance with N.J.A.C. 7:26-3A.16(h) for collection for transportation off-site for treatment and/or disposal in accordance with this subchapter shall operate as a noncommercial collection facility and shall comply with the requirements at (b)1 through 3 below and at (i) and (k)4 below.

1. Noncommercial collection facilities are exempt from registration as regulated medical waste transporters pursuant to N.J.A.C. 7:26-3A.8 provided they are operated in compliance with N.J.A.C. 7:26-3A.27(e), except that noncommercial collection facilities collecting less than 2,000 pounds of RMW per year shall additionally be exempt from N.J.A.C. 7:26-3A.27(e) as well.

2. Noncommercial collection facilities that collect 2,000 pounds or more of regulated medical waste per year shall comply with the standards for the operation of collection facilities at (i) below.

3. The boundaries of noncommercial collection facilities shall be limited to the site for which the owner and/or operator of the facility is registered as a regulated medical waste generator pursuant to N.J.A.C. 7:26-3A.8 or as an exempted transporter pursuant to N.J.A.C. 7:26-3A.27(e), including buildings on the site and vehicles registered pursuant to N.J.A.C. 7:26-3, 3A, 16 and 16A at the site for the purpose of transporting medical wastes.

(c) Any collection facility that does not meet the criteria in (b) above as a noncommercial collection facility shall obtain authorization as a commercial collection

facility pursuant to (d) below and shall operate in accordance with the requirements of this section.

(d) A person registered and licensed pursuant to this subchapter and N.J.A.C. 7:26-3, 16, and 16A to transport regulated medical waste in the State of New Jersey that seeks to operate a commercial collection facility for medical waste shall submit an application containing the information listed at (d)1 through 15 below. All maps of the proposed facility shall be prepared in a manner and format consistent with N.J.A.C. 7:1D, Appendix A. Three copies of the application and all accompanying documents shall be submitted to the Department at the address specified in (e) below, and one copy each to the host municipality and district solid waste management plan implementation agency:

1. The name, address and telephone number of the person or persons seeking to operate the proposed commercial collection facility;

2. A photocopy of the applicant's authorized registration as a regulated medical waste transporter obtained pursuant to N.J.A.C. 7:26-3, 3A, 16 and 16A;

3. Photocopies of all authorizations for siting, construction and operation obtained pursuant to applicable local, regional, State or Federal agency with jurisdiction over any aspect of the proposed facility;

4. A copy of the tax map showing the lot and block numbers of the facility site and of all adjoining properties;

5. A description of the current use of the facility site and of all adjoining properties;

6. Documentation establishing that the facility has been included by administrative action in the applicable district solid waste management plan. The Department may issue an authorization in the absence of an administrative action if it determines that the collection facility is needed to help fulfill the objectives of the adopted and approved Statewide Regulated Medical Waste Management Plan or any individual district regulated waste management plan. The Department shall notify the host county and municipality of such a determination and the reasons justifying facility authorization in writing prior to any approval of operations;

7. A description of the maximum amount and types of waste to be received and transferred at the facility each day, expressed in tons or gallons per day, as applicable;

8. A description of the sources of the waste and the anticipated disposal locations of the waste, both in State and out of State;

9. A description of the type(s) and number of containers that will be used at the facility and the type and means of storage and staging of the containers;

10. Three copies of a site plan, prepared, signed, and sealed by a licensed New Jersey professional engineer, surveyor or architect. The site plan shall:

i. Identify the placement of all equipment, buildings, activities and areas related to the receipt, loading, unloading and temporary storage of regulated medical waste;

ii. Be drawn to a scale no smaller than one inch equals to 100 feet;

iii. Indicate the routing of vehicles between the facility and all nearby roadways serving the site, as well as the traffic flow within the site. Such routing must ensure safe and efficient vehicular and pedestrian circulation, parking, and loading and unloading of packages of regulated medical waste;

iv. Delineate floodplains as defined at N.J.A.C. 7:13;

v. Delineate the location of State-designated wetlands, New Jersey Pinelands, existing or suitable agricultural lands, Federal or New Jersey-registered historic sites and other environmentally sensitive areas such as State parks, wildlife management areas and National Wildlife Refuges;

vi. Identify the direction of water runoff both on-site and off-site and the screening and landscaping on the site;

vii. Indicate topographic contours, drawn at three-foot intervals; and

viii. Indicate all site access controls to be employed at the facility;

11. An original current 7.5 minute USGS Quadrangle map with the boundary of the facility plotted thereon. The map shall delineate any public access roads to the site and any streams, ponds or other potential sensitive receptors such as, but not limited to, hospitals, schools, and shopping areas within a one-half mile radius of the site;

12. A copy of the deed of record establishing ownership of the facility property or, if the applicant is a person other than the landowner, a legal agreement (for example, a lease) to use the real property for the purpose of operating the facility;

13. A description of the design capacity of the facility, setting forth the number and types of all vehicles arriving at the facility and the number and types of all vehicles leaving the facility on a daily basis, stating the maximum number of vehicles per hour that will arrive at and leave the facility;

14. A copy of any New Jersey air pollution control permit application as applicable, in accordance with N.J.A.C. 7:27; and

15. A narrative describing the facility operations from the receipt of waste through the point of transfer to destination. The narrative must clearly demonstrate that packages and containers will not be opened and that employees, the public or the environment will not be exposed to regulated medical waste or medical waste.

(e) The application described in (d) above shall be submitted in triplicate, along with the application fee set forth in N.J.A.C. 7:26-3A.8, to:

New Jersey Department of Environmental Protection
Division of Solid and Hazardous Waste
Bureau of Resource Recovery and Technical Programs
PO Box 414
Trenton, New Jersey 08625-0414

(f) Within 45 days after the Department receives the application submitted pursuant to (d) above, the Department shall take one of the following actions:

1. Issue a letter of authorization to operate the commercial collection facility, or a denial of the application, to the applicant and provide a copy of the letter of authorization or denial to the host municipality and district solid waste management plan implementation agency. A letter of authorization shall not be transferred to any other person except in accordance with N.J.A.C. 7:26-3A.49(e);

2. Notify the applicant in writing of missing information and provide a copy of the letter of deficiency to the host municipality and district solid waste management plan implementation agency; or

3. Notify the applicant in writing of any information that does not satisfy the requirements of (d) above and provide a copy of the letter of deficiency to the host municipality and district solid waste management plan implementation agency.

(g) An applicant shall submit to the Department and to the host municipality and district solid waste management plan implementation agency any additional or corrected information required pursuant to (f)2 or 3 above within 30 days of receipt of the notification from the Department of missing and/or insufficient information.

(h) The Department shall deny without prejudice the application of any applicant that fails to submit the additional or corrected information required pursuant to (f)2 or 3 above or that otherwise fails to meet the application criteria of this section. The applicant may thereafter submit a new application for authorization to operate a commercial collection facility at the same location pursuant to the requirements of this section.

(i) The operating standards for collection facilities are as follows:

1. The maximum amount of regulated medical wastes at a collection facility including regulated medical wastes in any vehicles staged at the facility shall not exceed 300,000 pounds at any time unless a higher amount is specified in the facility's letter of authorization.

2. Collection facilities shall not receive medical wastes in excess of 150,000 pounds per day unless a higher amount is specified in the facility's letter of authorization.

3. Collection facility operators shall comply with all requirements for transporters at N.J.A.C. 7:26-3A.27 through 3A.37.

4. Collection facilities shall accept only regulated medical waste managed in accordance with this subchapter.

5. Collection facilities shall allow only collection and transportation vehicles registered in accordance with this subchapter and N.J.A.C. 7:26-2, 16, 16A and 27, and operated in accordance with N.J.A.C. 7:26-3 and this subchapter to transport regulated medical waste to and from the facility.

6. Regulated medical waste received, stored or transferred at any collection facility shall at all times remain fully contained in sealed packages and containers packaged, marked and labeled pursuant to this subchapter that do not leak any liquids or solid materials, are not opened for any purpose at the facility and are registered as solid waste containers pursuant to N.J.A.C. 7:26-3. Secondary outer packaging or containers may be removed so long as the primary packaging that contains the regulated medical waste and meets the performance requirements for packaging at N.J.A.C. 7:26-3A.11 is not opened, ruptured or compromised in any way.

7. Regulated medical waste shall not remain at a noncommercial collection facility for more than 90 consecutive calendar days, which period shall include weekends and holidays. A noncommercial collection facility at which waste is staged or stored for more than 90 days shall be deemed to be an illegal solid waste transfer station, and shall be subject to all penalties authorized pursuant to applicable statutes and rules.

8. Unless exempted under N.J.A.C. 7:26-6.3, all regulated medical waste accepted at a collection facility from New Jersey sources shall be disposed of in accordance with the applicable District Solid Waste Management Plan developed pursuant to N.J.A.C. 7:26-6. A collection facility shall not accept packages or containers in which regulated medical waste generated from more than one New Jersey district or county, or out-of-State source, has been mixed. Any out-of-State waste accepted at a collection facility shall be disposed of consistent with the provisions set forth in the approved District Solid Waste Management Plan for the district in which the facility is located, or at permitted out-of-State disposal facilities authorized by the receiving state.

9. Regulated medical waste at any collection facility shall not emit odors that are detectable at the facility or in the vicinity of the facility. Any waste that does emit any odor shall be immediately disposed of in accordance with this subchapter.

10. Access to any collection facility shall be restricted to facility operators, regulated medical waste vehicle operators and authorized visitors only. Effective security procedures shall be implemented to control entry and exit at all times. All regulated medical waste packages and containers staged or stored at the facility shall be secured at all times in a manner that prevents unauthorized access to the packages and containers and their contents.

11. The Department's designated representatives and inspectors shall have the right to enter and inspect any building or any other portion of any collection facility, including vehicles, at any time. This right to enter and inspect includes, but is not limited to:

i. Observing and sampling any wastes or other materials on site;

ii. Photographing any portion of the facility, regulated medical waste vehicles, regulated medical waste packages and containers;

iii. Investigating an actual or suspected source of pollution of the environment or any release of regulated medical waste;

iv. Ascertaining compliance or noncompliance with the statutes, rules, regulations, or/policies of the Department, including conditions of the facility's letter of authorization or any other permit or certificate issued by the Department; and

v. Reviewing and copying all applicable records described in this section, which shall be maintained at the facility at all times and shall be made available on request to Department representatives and inspectors at all reasonable times for review and inspection.

12. Collection facilities shall comply with the requirements of the Federal Occupational Safety and Health Administration and all other applicable standards of any agency for the operation of the facility and the maintenance of the health and safety of the employees and other persons.

13. Routine housekeeping and maintenance procedures shall be implemented at the facility to prevent the accumulation of dust and/or debris and to maintain general cleanliness throughout the facility and in the working environment.

14. Any areas or surfaces at a commercial collection facility that have come into contact with regulated medical waste shall be disinfected immediately in accordance with the Spill Management Plan approved pursuant to N.J.A.C. 7:26-3A.37.

15. Any release or discharge of any regulated medical waste at a collection facility shall be immediately reported by the facility operator or its designee to the DEP Emergency Response 24-hour Hotline at 1-877-WARNDEP. This telephone report shall specify the type of waste or substance discharged in estimated quantity, the nature of the discharge, the location of the discharge, any action being taken or proposed to be taken in order to mitigate the discharge, and any other information concerning the incident the Department may request at the time of notification. In addition, the facility operator or emergency coordinator designated pursuant to (j) below shall:

i. Immediately identify the character, source, amount, and extent of any discharge and notify all appropriate State or local agencies with designated response roles if assistance is needed;

ii. Assess possible hazards to public health or the environment that may result and notify appropriate local authorities if such assessment indicates that evacuation of local areas may be advisable;

iii. Ensure that no regulated medical waste is processed in the affected unit and area until cleanup procedures are completed and all equipment is again fit for its intended use;

iv. Notify the Department and appropriate local authorities when operations have returned to normal; and

v. Submit a written report on the incident to the Department within 15 days after the incident. The written report shall include, but not be limited to, the name, address, and telephone number of the facility; the date, time, and description of the incident; the extent of any injuries of any severity, with names and job responsibilities of those persons injured indicated; an assessment of actual damage to the environment; an assessment of the scope and magnitude of the incident; a description of the immediate actions initiated to clean up and disinfect the affected area; a description of actions taken to prevent a recurrence of a similar incident and, an implementation schedule for undertaking long-term measures to effect cleanup and avoid recurrence of the incident, if applicable.

16. Deliveries of regulated medical waste to collection facilities shall be scheduled in such a manner as to minimize truck queuing on the facility property as well as on the street or road leading to the entrance. On-site traffic control measures shall be implemented to provide orderly vehicle movement at collection facilities. If, at any time, the additional traffic generated by the operation of the facility results in congestion of surrounding roads and intersections, corrective measures shall be developed and implemented immediately to alleviate traffic-related problems.

17. No regulated medical waste or medical waste shall be staged, placed or stored beyond the confines of a building at the collection facility or a regulated medical waste vehicle registered pursuant to this subchapter, N.J.A.C. 7:26-3, 16 or 16A.

18. Collection facilities shall pay all fees and register in accordance with all applicable regulations for any other waste management activities conducted at the facility, in addition to the complying with the requirements of this subchapter.

(j) Additional operating requirements for commercial collection facilities are as follows:

1. The commercial collection facility operator shall designate an on-site emergency coordinator who is available during all hours of operation for the purpose of handling emergency situations such as, but not limited to, spills, discharges or releases of medical wastes at the facility.

2. The commercial collection facility operator shall develop and maintain at the site an operations and maintenance (O&M) manual that shall describe all operating conditions and procedures of the facility. The O&M manual shall be made available to all facility personnel. The O&M manual shall be prepared in accordance with N.J.A.C. 7:26-2.10(b)9.

3. All personnel directly involved in any commercial collection facility waste management activities or who operate, service or monitor any facility equipment, machinery or system at the facility shall successfully complete a training program of classroom instruction, which shall be combined with on-the-job training as needed. The training program shall:

i. Provide fire fighting training, instructions for implementing the Spill Management Plan in accordance with N.J.A.C. 7:26-3A.37 and ensure that facility personnel are able to effectively respond to any equipment malfunction and emergency situation that may arise;

ii. Provide instructions in the use and operation of safety equipment, procedures for inspecting, maintaining and repairing facility equipment, machinery and monitoring systems and the procedures to be followed during planned and unplanned shutdown of operations;

iii. Contain instructions that ensure the facility's compliance with the requirements of this chapter and the conditions of any Departmental letters of authorization and permits issued for the facility;

iv. Contain instruction for the constant monitoring of incoming loads for conformance with the requirements of this section and the identification and proper handling of suspected unauthorized wastes;

v. Be completed by all facility personnel within two weeks after the date of their employment and prior to work assignment at the facility;

vi. Be conducted on an annual basis for all facility personnel in the form of a planned annual review of the complete training program; and

vii. Be documented in the form of detailed training records that record the names of personnel trained, the dates when training occurred and the type and extent of training provided. The training documentation shall be maintained at the facility for three years from the date the training occurred.

4. Any commercial collection facility operator and any person designated by such operator to operate part or all of the collection facility or to conduct any of its waste-related activities shall be registered as a regulated medical waste transporter pursuant to N.J.A.C. 7:26-3A.3, 16 and 16A.

5. The commercial collection facility shall maintain sufficient staff to ensure the proper, orderly and safe operation of all facility systems and equipment, along with the ability to handle all routine facility maintenance requirements.

6. Fire detection and protection systems shall be maintained in operable condition at all times. Fire-fighting equipment shall be available on-site or on call to extinguish any and all fires. Fire fighting procedures shall be posted in each area of the facility and shall include the telephone number of local fire and police departments.

7. Noise control shall be implemented to ensure that sound levels generated by the facility operation, including vehicles, shall not exceed the standards set forth in Noise Control rules at N.J.A.C. 7:29.

8. One complete set of the commercial collection facility's operating records, the O&M manual and these rules shall be kept on file at the facility, and shall be available to facility personnel and for inspection by the Department or its designated representatives.

9. The commercial collection facility's material management system's safety appliances and related appurtenances shall, at all times, be kept in the proper operating order through an effective inspection, planned maintenance, repair and parts replacement program as described in the O&M manual. As part of this program, the facility operator shall maintain an inventory of spare parts and replacement equipment, records of all inspections, as well as have access to back up equipment to ensure continued operation of the facility.

10. Regulated medical waste shall not remain at a commercial collection facility for more than 14 consecutive calendar days, which period shall include weekends and holidays. A commercial collection facility at which waste is staged or stored for more than 14 calendar days shall be deemed to be an illegal solid waste transfer station, and shall be subject to all penalties authorized pursuant to applicable statutes and rules.

(k) A collection facility operator shall maintain the following records at the facility at all times and shall file reports as follows. The operator shall retain records and reports for three years.

1. A commercial collection facility shall maintain daily records that shall note the source, destination and quantity, by vehicle, of all regulated medical waste received, transferred and shipped to and from the facility. The records shall specify the source for every shipment of regulated medical waste received and the destination of very shipment of regulated medical waste out of the facility. Quantities of regulated medical waste shall be listed in tons or gallons as appropriate.

i. The daily records shall be compiled into quarterly reports in accordance with N.J.A.C. 7:26-2.13 and shall be submitted to the following address within 20 days of the end of each calendar quarter:

New Jersey Department of Environmental Protection
Division of Solid and Hazardous Waste
Bureau of Resource Recovery and Technical Programs
PO Box 414
Trenton, NJ 08625-0414

2. A commercial collection facility shall maintain records that document all violations of any local, State and Federal requirements, including violations of the collection facility authorization issued by the Department.

3. A commercial collection facility shall maintain records that document all incidents in which a transporter not registered and licensed pursuant to this subchapter and N.J.A.C. 7:26-3, 16 and 16A, or a container not registered pursuant to N.J.A.C. 7:26-3, was denied transfer privileges at the facility. These records shall specify the vehicle driver's name, the vehicle license number, the vehicle registration number, the name of the company operating the vehicle, the solid waste registration number of the company, the date and time of the denial, the size of the vehicle or container, and the tracking form numbers for the waste in the container. These incidents shall also be reported within 24 hours to the Department's Bureau of Solid Waste Compliance and Enforcement or the Environmental Hotline at 1-877-WARNDEP.

4. All collection facilities shall maintain records in accordance with N.J.A.C. 7:26-3A.34, 3A.43 and 3A.44, except that noncommercial facilities are not required to comply with N.J.A.C. 7:26-3A.44(a)1 and 2.

(l) Any person that conducts any of the activities of a commercial collection facility as defined in this section without authorization from the Department, or without a solid waste transfer station permit issued pursuant to N.J.A.C. 7:26-2A, shall be deemed to be operating an illegal solid waste facility and shall be subject to all applicable penalties pursuant to the Solid Waste Management Act, N.J.S.A. 13:1E, and N.J.A.C. 7:26-5.

(m) Any authorized commercial collection facility that accepts unauthorized waste, or fails to operate in compliance with the requirements of this section, shall be

deemed an illegal solid waste facility and shall be subject to all applicable penalties pursuant to the Solid Waste Management Act, N.J.S.A. 13:1E, and N.J.A.C. 7:26-5.

(n) Any authorized commercial collection facility that accepts regulated medical waste from a transporter not registered and licensed pursuant to this subchapter and N.J.A.C. 7:26-3, 16 and 16A shall be subject to penalties for violation of New Jersey solid waste planning rules at N.J.A.C. 7:26-6, including, but not limited to, revocation of transporter registration, certification and licensing, and revocation of collection facility authorization.

(o) The Department may revoke the authorization of a commercial collection facility if that facility fails to comply with the requirements for such facilities or any law in any way related to the operation of a commercial collection facility pursuant to New Jersey statute or the Department determines that any of the causes for modification in (p) below are sufficient cause for revocation in order to protect human health, safety and the environment.

(p) The Department may modify a commercial collection facility authorization for the following reasons and the operator shall pay a fee as specified in N.J.A.C. 7:26-3A.8 on issuance of any commercial collection facility authorization modification:

1. The Department determines that there are material and significant alterations or additions to the authorized commercial collection facility or operation that occurred after Department issued the existing letter of authorization that warrant the imposition of conditions different from or lacking in the existing authorization;

2. The Department receives information that was not available at the time it issued the letter of authorization that would have warranted the issuance of conditions in the authorization different from those imposed in the existing authorization. This information may include, but is not limited to, information concerning the effects of the facility on the properties surrounding the facility or the effects of the facility on the environment;

3. A change in Federal or State laws, regulations or policies governing solid waste and/or regulated medical waste management;

4. The regulatory compliance record of the collection facility operator;

5. A relevant judicial decision after the authorization was issued; or

6. An operator of a commercial collection facility shall request a modification of its authorization whenever the operator proposes to change any aspect of the operation as originally described in the application. Such change include, but are not limited to, changes in the amount and type of regulated medical waste managed at the facility, and changes in the sources of regulated medical waste and changes in the regulated medical waste disposal location.

(q) The Department shall provide 30-day prior notice of a modification to an authorization to operate a commercial collection facility pursuant to (p) above and its reasons for determining a modification is warranted. This notice shall be sent to the operator of the facility and the host municipality and district solid waste management plan implementation agency.

(r) Ninety days prior to the expiration of a Commercial Collection Facility Letter of Authorization, the bearer of the letter of authorization for the facility shall notify the Department in writing if they do not wish to renew said Letter of Authorization, otherwise a Letter of Authorization renewal application shall be submitted at that time in accordance with the provisions of N.J.A.C. 7:26-3A.49

7:26-3A.40 Intermediate handlers and destination facilities

(a) N.J.A.C. 7:26-3A.40 through 3A.44 apply to owners and operators of intermediate handler or destination facilities located in New Jersey that manage regulated medical waste and owners and operators of facilities in another state that receive regulated medical waste generated in New Jersey. Facilities that are subject to the above sections include:

1. Destination facilities, including treatment and destruction facilities, facilities that cause the regulated medical waste to meet the conditions of N.J.A.C. 7:26-3A.6(b)3 or 4 including incineration facilities, alternative or innovative technology facilities and disposal facilities; and

2. Intermediate handlers, including alternative or innovative technology or other facilities that either treat or destroy the regulated medical waste, but do not cause it to meet the conditions of N.J.A.C. 7:26-3A.6(b)3 or 4.

(b) The rule paragraphs noted in (a) above also apply to generators with on-site incinerators who accept regulated medical waste for disposal.

(c) No person shall engage in the treatment and/or destruction of regulated medical waste in New Jersey unless such person:

1. Registers the site as an intermediate handler or destination facility in accordance with N.J.A.C. 7:26-3A.8;

2. Obtains a tariff in accordance with N.J.S.A. 13:1E-48.12.b if operating commercially;

3. Uses treatment and/or destruction process(es) authorized by the Department and DHSS pursuant to N.J.A.C. 7:26-3A.47;

4. Obtains the specific approval of the Department and DHSS to operate an alternative or innovative technology approved pursuant to N.J.A.C. 7:26-3A.47 for the treatment and/or destruction of regulated medical waste at the registered facility; and

5. Complies with all other environmental statutes applicable to the facility, . including but not limited to, the Solid Waste Management Act, N.J.S.A. 13:1E-1 et seq., the Water Pollution Control Act, N.J.S.A. 58:10A-1 et seq., the Air Pollution Control Act, N.J.S.A. 26-2C-1 et seq., and the rules and regulations adopted thereunder, and any permits or orders issued pursuant thereto.

(d) Persons operating mobile treatment and/or destruction equipment for RMW shall:

1. Operate such equipment only within the boundaries of a site registered as an intermediate handler or destination facility with the Department pursuant to N.J.A.C. 7:26-3A.8(c) for the specific type of activity the mobile treatment and destruction unit will be engaged in; and

2. Comply with all applicable statutes and regulations, including but not limited to, the New Jersey Air Pollution Control Act, N.J.S.A. 26:2C-1 et seq. And 26:2D-1 et seq., the New Jersey Noise Control Act of 1971, N.J.S.A. 13:1G-1 et seq. And all other applicable Federal, State, and local requirements.

7:26-3A.41 Use of the tracking form for intermediate handlers and destination facilities

(a) The owner or operator of a destination facility when receiving a tracking form shall:

1. Sign and date each copy of the tracking form to certify that the regulated medical waste listed on the tracking form was received;

2. Note any discrepancies as defined in N.J.A.C. 7:26-3A.42(a) on the tracking form;

3. Immediately give the transporter "Copy 3—Transporter Copy" of the signed tracking form:

i. In the case of regulated medical waste transported in accordance with N.J.A.C. 7:26-3A.17(a) immediately give the generator "Copy 4—Generator Copy" of the signed tracking form.

ii. In the case of regulated medical waste transported in accordance with N.J.A.C. 7:26-3A.17(b) the disposal facility shall mail "Copy 4—Generator Copy" of the signed tracking form.

4. Send "Copy 4—Generator Copy" of the tracking form to the generator (or "Copy 3—Transporter Copy" to the transporter or intermediate handler that initiated the tracking form) within 15 days of the delivery; and

5. Retain "Copy 2—Destination Facility Copy" of each tracking form in accordance with N.J.A.C. 7:26-3A.43.

(b) When an intermediate handler receives regulated medical waste the owner or operator shall meet the following requirements:

1. The owner or operator shall meet all the requirements for generators under both N.J.A.C. 7:26-3A.10 through 3A.16 and 3A.18 through 3A.23, including signing the tracking form accepting the waste as specified in Box 20, noting any discrepancies on the tracking form in Box 23, and entering the new tracking form number in Box 21 when initiating a new tracking form for each shipment of regulated medical waste that has either been treated or destroyed.

2. The owner or operator shall maintain an intermediate handler log matching the original generator's tracking forms to the tracking form initiated. The intermediate handler log shall include:

i. The name(s) of generator(s);

ii. The generator's address. If the generator is not located in New Jersey, then use the generator's state permit or identification number. If the state does not issue permit or identification numbers, then use the generator's address;

iii. The date the regulated medical waste was originally shipped by the generator or the generator's unique tracking form number; and

iv. The new tracking form number to which the waste is assigned.

3. Within 15 days of receipt of the tracking form that the intermediate handler initiated and that was signed by the destination facility, the intermediate handler shall:

i. Attach a copy of the tracking form signed by the destination facility to the original tracking form initiated by the generator identified in (b)2i above;

ii. Send a copy of each tracking form to the generator who initiated the tracking form; and

iii. Retain a copy of each tracking form in accordance with the requirement of N.J.A.C. 7:26-3A.43.

(c) If a destination facility or intermediate handler receives from a rail transporter regulated medical waste that is accompanied by shipping papers containing the information required on the medical waste tracking form, with the exception of the

generator's certification and chain of custody signatures, the owner or operator or an agent of the owner or operator shall:

1. Sign and date each copy of the tracking form or the shipping papers (if the tracking form has not been received);

2. Note any discrepancies as defined in N.J.A.C. 7:26-3A.42(a) on each copy of the tracking form or shipping papers (if the tracking form has not been received);

3. Immediately give the rail transporter at least one copy of the tracking form or shipping papers (if the tracking form has not been received);

4. If the facility is a destination facility, send a copy of the signed and dated tracking form to the generator within 15 days after the delivery. If the owner or operator has not received the tracking form within 15 days of delivery, he shall send a copy of the signed and dated shipping papers to the party initiating the tracking form;

5. If the facility is an intermediate handler, retain a copy of the tracking form (or the shipping papers if the tracking form has not been received), until receiving a copy of the tracking form signed by the owner or operator of the destination facility. The facility then shall:

i. Attach a copy of the tracking form signed by the destination facility to the original tracking form (or the shipping papers if the tracking form has not been received) initiated by another party;

ii. Send a copy of each tracking form (or each set of shipping papers) to the party who initiated the tracking form; and

iii. Retain a copy of each tracking form in accordance with the requirements of N.J.A.C. 7:26-3A.43.

(d) The destination facilities and intermediate handlers as set forth in (c) above shall retain a copy of the tracking form (or shipping papers if signed in lieu of the tracking form) for at least three years from the date of acceptance of the regulated medical waste unless the Department specifically requires an additional retention period.

(e) The destination facilities and intermediate handlers receiving shipments by rail should expect to receive the tracking form from the generator, or the preceding non-rail transporter who will have sent the tracking form to the facility by some other means (for example, by mail).

(f) In cases where the destination facility or intermediate handler is an out-of-State facility and will not comply with the tracking form requirements of this section as listed above, signed generator copies of the tracking form shall be returned to the generator by the transporter.

7:26-3A.42 Tracking form discrepancies for intermediate handlers and destination facilities

(a) Tracking form discrepancies are:

1. For packages, any variation in piece count such as a discrepancy of one box, pail, or drum in a truckload;

2. For waste by categories (that is, untreated or treated), discrepancies in number of packages for each category of regulated medical waste as described on the label imprinted or affixed to the outer surface of the package;

3. Packaging that is broken, torn, or leaking;

4. Regulated medical waste that arrives at in intermediate handler or a destination facility unaccompanied by a tracking form, or for which the tracking from is incomplete or not signed; and

5. For quantity (in net or gross mass, capacity, or as otherwise appropriate), including the unit of measurement (for example, lbs., gal., Kg., or L) of packages, a discrepancy greater than three percent of each tracking form load or more than 200 pounds, whichever is less.

(b) Upon discovering a discrepancy, the owner or operator shall attempt to resolve (for example, with telephone conversations) the discrepancy to resolve (for example, with telephone conversations) the intermediate handler. If the discrepancy is not resolved, the owner or operator shall submit a letter, within 15 days of receiving the waste describing the nature of the discrepancy and the attempts the owner or operator has undertaken to reconcile it. The owner or operator shall include with the letter a legible copy of the tracking form or shipping papers in question. If the discrepancy is the type specified in (a)4 above, the letter shall specify the quantity of waste received, the transporter, and the generator(s). The letter shall be submitted to the Department at the address listed in N.J.A.C. 7:26-3A.8(d).

7:26-3A.43 Recordkeeping for collection facilities, intermediate handlers and destination facilities

(a) The owner or operator of a collection facility, destination facility or an intermediate handler receiving regulated medical waste generated, transported, treated, destroyed, disposed of or otherwise managed in New Jersey shall maintain records at the registered site, for a minimum of three years from the date the waste was accepted unless the Department specifically requires an additional retention period. These records shall contain the following information:

1. Copies of all tracking forms required by N.J.A.C. 7:26-3A.41(a)5, (b)3iii, and (c)5iii; and the logs required by N.J.A.C. 7:26-3A.41(b)2;

2. Copies of all discrepancy reports required by N.J.A.C. 7:26-3A.42(b); and

3. Copies of Department facility compliance inspection reports and the facility registration certificates.

7:26-3A.44 Additional reporting for collection facilities, intermediate handlers and destination facilities

(a) Beginning July 30, 2002, all regulated medical waste commercial collection facilities, intermediate handlers and destination facilities are required to submit an annual medical waste collection facility, intermediate handler and destination facility report to the Department, except that noncommercial collection facilities are not required to comply with (a)1 and 2 below, covering the period from July 1 through June 30 of each calendar year and shall be submitted by July 30 of each calendar year, on forms available from the Department at the address listed at N.J.A.C. 7:26-3A.8(f), which shall include, but not be limited, to the following information:

1. A description of the sources, the types and amounts of regulated medical waste and medical waste collected, treated and/or destroyed;

2. The methods used for treatment and/or destruction; and

3. A description of any injuries and illnesses resulting from the maintenance, operation or any other activity related to a regulated medical waste treatment and/or destruction device(s).

(b) The Administrator and the Department may require owners or operators of destination facilities and intermediate handlers to furnish additional information concerning the quantities and management methods of medical waste as he deems necessary under RCRA Section 11004 and as the Department deems necessary under N.J.S.A. 13:1D-9.

7:26-3A.45 Rail transporters

(a) The requirements in this section and in N.J.A.C. 7:26-3A.46 apply to persons engaged in rail transportation of regulated medical waste generated, stored, transferred, treated, destroyed, disposed of, or otherwise managed in New Jersey.

(b) Rail transporters of regulated medical waste shall also comply with the transporter requirements of N.J.A.C. 7:26-3A.27 through 3A.36 except as otherwise provided in N.J.A.C. 7:26-3A.31(f).

7:26-3A.46 Rail shipment tracking form requirements

(a) The following requirements apply to all shipments of regulated medical waste involving rail transport:

1. When accepting regulated medical waste generated, stored, transferred, treated, destroyed, disposed of, or otherwise managed in New Jersey from a non-rail transporter, the initial rail transporter shall:

i. Sign and date the tracking form acknowledging acceptance of the regulated medical waste;

ii. Return a signed copy of the tracking form to the non-rail transporter;

iii. Forward at least three copies of the tracking form to:

(1) The next non-rail transporter, if any; or

(2) The intermediate handler or destination facility, if the shipment is delivered to that facility by rail; or

(3) The last rail transporter designated to handle the waste in the United States; and

iv. Retain one copy of the tracking form and rail shipping paper in accordance with N.J.A.C. 7:26-3A.34.

2. Rail transporters shall ensure that a shipping paper containing all the information required on the tracking form (excluding permitting or licensing numbers, generator certification, and signatures) accompanies the shipment at all times. Intermediate rail transporters are not required to sign either the tracking form(s) or shipping paper(s).

3. When delivering regulated medical waste to an intermediate handler or destination facility, a rail transporter shall:

i. Obtain the date of delivery and handwritten signature of the owner or operator of the facility on the tracking form or the shipping papers (if the tracking form has not been received by the facility); and

ii. Retain a copy of the tracking form or signed shipping paper in accordance with N.J.A.C. 7:26-3A.34.

4. When delivering regulated medical waste to a non-rail transporter, a rail transporter shall:

i. Obtain the date of delivery and the handwritten signature of the next non-rail transporter on the racking form; and

ii. Retain a copy of the tracking form in accordance with N.J.A.C. 7:26-3A.34

5. Upon accepting regulated medical waste generated or to be treated, destroyed or disposed of in New Jersey from a rail transporter, a non-rail transporter shall sign and date the tracking form (or the shipping papers if the tracking form has not been received by the transporter) and provide a copy to the rail transporter.

7:26-3A.47 Alternative or innovative technology authorization

(a) Any alternative or innovative technology for the treatment and/or destruction of regulated medical waste, and any modification thereof, shall be authorized by the Department and DHSS prior to any marketing, sale or use in New Jersey, in accordance with the following:

1. Persons seeking to market, sell or use an alternative or innovative technology shall submit an application to the Bureau of Medical Waste and Technical Assistance in the Department for authorization and pay the alternative technology review fee in accordance with N.J.A.C. 7:26-3A.8. The application shall be on forms provided by the Department and shall include the following:

i. A description of the proposed method of operation;

ii. Actual performance data;

iii. Vendor and independently verified treatment efficacy data;

iv. Information on parametric monitoring and controls;

v. Limits on waste acceptance;

vi. Information on residuals produced;

vii. Potential environmental impacts, including emissions and noise impacts;

viii. Occupational exposures;

ix. Safety procedures; and

x. Installation and operating costs, including data on energy efficiency.

2. The DHSS may require additional information concerning the ability of the technology to effectively treat regulated medical waste.

3. The information provided in the application and all other information of any nature provided to or obtained by the Department and DHSS in their administration of this section, shall be available to the public for review, unless a specific claim of confidentiality is submitted pursuant to in N.J.A.C. 7:26-17.1.

4. The Department and DHSS may use the information and recommendations of the State and Territorial Association on Alternative Treatment Technologies, and other sources as needed, in evaluating regulated medical waste alternative or innovative technologies.

5. An alternative or innovative technology authorization to operate shall specify general operating conditions and other applicable requirements, such as, but not limited to, requirements for general operation; maintenance and housekeeping; injury reporting; emergency management and reporting; media; fugitive emissions and equipment performance monitoring and control; equipment operation; design; pollution control; data reporting; a DHSS protocol to monitor treatment efficacy or other conditions of operation

or performance; periodic technology evaluation progress reports as required by the Department and DHSS and other reports as needed; financial assurance; and operation termination and remedial action; and other applicable requirements as shall be determined by the Department and DHSS on a case-by-case basis. At a minimum, authorization shall include a DHSS protocol to monitor treatment efficacy.

6. An alternative or innovative technology authorization shall be issued only for the specific technology applied for. Any modifications to the technology shall be submitted to the Department and DHSS for review and approval pursuant to (a)1 through 5 above before introduction and use in New Jersey.

(b) Any alternative or innovative technology for the treatment and/or destruction of regulated medical waste authorized pursuant to (a) above:

1. May be marketed or sold for use in New Jersey;

2. Shall be authorized on a case-by-case basis at each facility intending to operate the alternative or innovative technology; and

3. Shall be installed and operated in compliance with all applicable Federal, State and local statutes and regulations.

(c) For the purposes of expediting development, demonstration, evaluation or implementation of alternative or innovative technologies and for the purpose of obtaining operational data and information on which the application for authorization to operate can be reviewed pursuant to (a) above, the Department may, in consultation with the DHSS, exempt any regulated medical waste alternative or innovative technology research, development or demonstration project from applicable waste management regulations in accordance with the procedures at N.J.A.C. 7:26-1.7(f).

7:26-3A.48 Requirements for generators using out-of-State facilities disposing of regulated medical waste from New Jersey

(a) A generator using an out-of-State intermediate handler, destination facility, transfer facility, or other medical waste disposal facility operating for any purpose that uses the U.S. Postal Service or other parcel delivery service in New Jersey and uses the U.S. Postal Service or other authorized mail or parcel delivery service to transport regulated medical waste from New Jersey to the out-of-State facility, shall request a certification from the out-of-State facility, which shall include copies of any state and local authorizations and/or permits. Copies of this certification shall be sent by the generator to the Bureau of Medical Waste and Technical Assistance. This information shall be provided by the generator prior to sending any RMW out-of-State for disposal,

(b) A generator using the out-of-State facility described in (a) above shall also submit a certification of any and all changes to the out-of-State facilities authorizations or permits within 30 days of such changes.

(c) A generator of regulated medical waste in this State shall not send regulated medical waste by the U.S. Parcel Service or other parcel delivery service to an out-of-State facility that has not submitted a certification to the Department in accordance with this section.

7:26-3A.49 Duration of the letter of authorization; letter of authorization renewal requirements; continuation of an expiring letter of authorization and transfer of an existing letter of authorization for commercial collection facilities.

(a) A letter of authorization issued pursuant to this subchapter shall be effective for a fixed term not to exceed five years except as provided in (c) and (d) below. A letter of authorization may be renewed in accordance with (b) below only for the duration of the facility's inclusion in the applicable District Solid Waste Management Plan and provided that the waste processing rate, as specified in the letter of authorization is not exceeded.

1. The term of a letter of authorization shall not be extended by modification beyond the maximum duration specified in this section.

2. Nothing herein shall be construed to allow the bearer of a letter of authorization to exceed the maximum waste processing rate of the facility as set forth in the letter of authorization for the facility at any time during the term of the letter of authorization. Any expansion, extension, enlargement or other increase beyond the letter of authorization waste processing rate shall be considered a new facility and shall require submittal of an application to the Department for approval of a new letter of authorization.

3. The Department may issue any letter of authorization for a duration that is less than the full allowable term under this section.

(b) Commercial Collection Facility letter of authorization renewal submission requirements and procedures shall be as follows:

1. The bearer of a letter of authorization of an authorized commercial collection facility shall apply for a letter of authorization renewal at least 90 days prior to the expiration date of the existing letter of authorization provided the facility is included in the applicable District Solid Waste Management Plan.

2. As an application to renew the letter of authorization for a commercial collection facility, the bearer of the letter of authorization for the facility, or the owner or operator of the facility shall submit all fees required by N.J.A.C. 7:26-3A.8(d)2, a letter requesting renewal of the letter of authorization for the facility and the following additional documents, if necessary to update the facility's operations:

i. an updated registration statement on forms provided by the Department;

ii. An updated engineering design for the facility;

iii. An updated Operations and Maintenance Manual for the facility; and

iv. An amendment to the disclosure statement as required pursuant to N.J.A.C. 7:26-16.6.

3. The Department shall publish notice in the DEP Bulletin and shall notify all parties as specified in N.J.A.C. 7:26-2.4(g)6 and 7 of the letter of authorization renewal application.

4. The Department shall review the application for completeness in accordance with the procedures set forth at N.J.A.C. 7:26-2.4(g).

(c) The conditions of an expired letter of authorization are continued in force pursuant to the Administrative Procedure Act, N.J.S.A. 52:14B-11 until the effective date of a new letter of authorization if:

1. The bearer of the letter of authorization has submitted a timely and complete application for a renewal pursuant to (b) above; and

2. The Department, through no fault of the bearer of the letter of authorization, does not issue a new letter of authorization with an effective date on or before the expiration date of the previous letter of authorization, due to time or resource constraints.

(d) Letters of authorization continued under this section remain fully effective and enforceable. If the bearer of a letter of authorization is not in compliance with any one of the conditions of the expiring or expired letter of authorization during the continuance, the Department may do any or all of the following:

1. Initiate enforcement action based upon the letter of authorization which has been continued;

2. Issue a notice of intent to deny the new letter of authorization under N.J.A.C. 7:26-2.4. If the letter of authorization is denied, the owner or operator shall immediately cease activities authorized by the continued letter of authorization or be subject to enforcement action for operating a commercial collection facility without an approved letter of authorization.

3. Issue a new letter of authorization under N.J.A.C. 7:26-2.4 with appropriate conditions; or

4. Take such other actions as are authorized by these regulations or the Solid Waste Management Act, N.J.S.A. 13:1E-1 et seq.

(e) A bearer of a letter of authorization shall not transfer the letter of authorization directly to a new owner or operator without the Department's approval.

1. Any transfer of a letter of authorization shall be pre-approved by the Department and a written request for permission to allow such transfer shall be received by the Department at least 180 days in advance of the proposed transfer of ownership or operational control of the facility. The request for approval shall include the following:

i. A registration statement completed by the prospective new bearer of the letter of authorization on forms provided by the Department;

ii. A disclosure statement as required by N.J.A.C. 7:26-16.4 completed by the proposed transferee;

iii. A written agreement between the bearer of the existing letter of authorization and the proposed bearer of the new letter of authorization containing a specific future date for transfer of ownership or operations.

2. A new owner or operator may commence operations at the facility only after the existing letter of authorization has been revoked and a new letter of authorization is issued pursuant to N.J.A.C. 7:26-3A.39.

3. The bearer of a letter of authorization of record remains liable for ensuring compliance with all conditions of the letter of authorization unless and until the existing letter of authorization is revoked and a new letter of authorization is issued in the name of the new owner or operator.

4. Compliance with the transfer requirements set forth in this subsection shall not relieve the bearer of the letter of authorization to be transferred from the separate responsibility of providing notice of such transfer pursuant to the requirements of any other statutory or regulatory provision which may apply.

SECTION .1200 - MEDICAL WASTE MANAGEMENT

.1201 DEFINITIONS

For the purpose of the Section, the following definitions apply:

(1) "Blood and body fluids" means liquid blood, serum, plasma, other blood products, emulsified human tissue, spinal fluids, and pleural and peritoneal fluids. Dialysates are not blood or body fluids under this definition.

(2) "Generating facility" means any facility where medical waste first becomes a waste, including but not limited to any medical or dental facility, funeral home, laboratory, veterinary hospital and blood bank.

(3) "Integrated medical facility" means one or more health service facilities as defined in G.S. 131E-176(9b) that are:

(a) located in a single county or two contiguous counties;

(b) affiliated with a university medical school or that are under common ownership and control; and

(c) serve a single service area.

(4) "Medical waste" as defined in G.S. 130A-290(18).

(5) "Microbiological waste" means cultures and stocks of infectious agents, including but not limited to specimens from medical, pathological, pharmaceutical, research, commercial, and industrial laboratories.

(6) "Microwave treatment" means treatment by microwave energy for sufficient time to render waste non-infectious.

(7) "Off-site" means any site which is not "on-site".

(8) "On-site" means the same or geographically contiguous property which may be divided by public or private right-of-way.

(9) "Pathological waste" means human tissues, organs and body parts; and the carcasses and body parts of all animals that were known to have been exposed to pathogens that are potentially dangerous to humans during research, were used in the production of biologicals or in vivo testing of pharmaceuticals, or that died with a known or suspected disease transmissible to humans.

(10) "Regulated Medical Waste" means blood and body fluids in individual containers in volumes greater than 20 ml, microbiological waste, and pathological waste that have not been treated pursuant to Rule .1207 of this Section.

(11) "Sharps" means and includes needles, syringes with attached needles, capillary tubes, slides and cover slips, and scalpel blades.

(12) "Treatment" as defined in G.S. 130A-309.26(a)(2).

History Note: Statutory Authority G.S. 130A-309.26; Eff. Oct. 1, 1990; Amended Eff. April 1, 1993.

.1202 GENERAL REQUIREMENTS FOR MEDICAL WASTE

(a) Medical waste is subject to all applicable rules in 15A NCAC 13B.

(b) At the generating facility, sharps shall be placed in a container which is rigid, leak-proof when in an upright position and puncture-resistant. Contained sharps shall not be compacted prior to off-site transportation. After leaving the generating facility, the container and its contents shall be handled in a manner that avoids human contact with the sharps.

(c) Blood and body fluids in individual containers of 20 ml or less which are not stored in a secured area restricted to authorized personnel prior to off-site transportation shall be packaged in accordance with the regulated medical waste packaging requirements as described in Rule .1204(a)(1) of this Section or in a container suitable for sharps. Containers of blood and body fluids which are packaged in accordance with Rule .1204(a)(1) of this Section or in a container suitable for sharps as required by this Rule shall not be compacted prior to off-site transportation.

(d) Regulated medical waste shall not be compacted.

History Note: Statutory Authority G.S. 130A-309.26; Eff. October 1, 1990; Amended Eff. January 4, 1993; March 1, 1991.

.1203 GENERAL REQUIREMENTS FOR REGULATED MEDICAL WASTE

(a) Regulated medical waste shall be treated prior to disposal. Acceptable methods of treatment are as follows:

(1) blood and body fluids in individual containers in volumes greater than 20 ml - Incineration or sanitary sewage systems, provided the sewage treatment authority is notified;

(2) microbiological waste - Incineration, steam sterilization, microwave treatment, or chemical treatment;

(3) pathological wastes - Incineration.

(b) Other methods of treatment shall require approval by the Division.

(c) Regulated medical waste treated in accordance with Paragraph (a) of this Rule may be managed in accordance with 15A NCAC 13B .0100 - .0700.

(d) Crematoriums are not subject to the requirements of Rule .1207(3) of this Section.

(e) A person who treats Regulated medical waste at the generating facility or within an integrated medical facility is not subject to the storage and record keeping requirements of Rule .1207(1) of this Section.

(f) Generating facilities and integrated medical facilities in operation on October 1, 1990 that incinerate Regulated medical waste are not subject to the requirements of Rule .1207(3)(a-l) of this Section until January 1, 1995.

History Note: Statutory Authority G.S. 130A-309.26; Eff. Oct. 1, 1990; Am. Eff. April 1, 1993.

.1204 REQUIREMENTS FOR GENERATORS OF REGULATED MEDICAL WASTE

(a) A person who ships regulated medical waste from the generating facility for off-site treatment shall meet the following requirements:

(1) Regulated medical waste shall be packaged in a minimum of one plastic bag placed in a rigid fiberboard box, rigid drum, or other rigid container constructed in a manner that prevents leakage of the contents. The plastic bag shall be impervious to moisture and have a strength sufficient to preclude ripping, tearing or bursting the waste-filled bag under normal conditions of usage and handling. Each bag shall be constructed of material of sufficient single thickness strength to pass the 165-gram dropped dart impact resistance test as prescribed by Standard D 1709-91 of the American Society for Testing and Materials, which is incorporated by reference including subsequent amendments and editions, and certified by the bag manufacturer. A copy is available for inspection at the Department of Environment, Health, and Natural Resources, Division of Solid Waste Management, 401 Oberlin Road,

Raleigh, North Carolina. Copies may be requested by mail at American Society for Testing and Materials, 1916 Race Street, Philadelphia, P.A. 19103 or by calling (215) 299-5400 for a cost of twelve dollars ($12.00) plus one dollar and fifty cents ($1.50) for shipping and handling unless prepaid, then the fee is twelve dollars ($12.00).

(2) Regulated medical waste shall be stored in a manner that maintains the integrity of the packaging at all times.

(3) Each package of regulated medical waste shall be labeled with a water-resistant universal biohazard symbol.

(4) Each package of regulated medical waste shall be marked on the outer surface with the following information:

(A) the generator's name, address, and telephone number;

(B) the transporter's name, address, and telephone number;

(C) storage facility name, address, and telephone number, when applicable;

(D) treatment facility name, address and telephone number;

(E) date of shipment; and

(F) "INFECTIOUS WASTE" or "MEDICAL WASTE".

(b) Records of regulated medical waste shall be maintained for each shipment and shall include the information listed in this Paragraph. This information shall be maintained at the generating facility for no less than three years.

(1) amount of waste by number of packages (piece count);

(2) date shipped off-site;

(3) name of transporter;

(4) name of storage or treatment facility.

The requirements of this Paragraph shall not apply to persons who generate less than 50 pounds of regulated medical waste per month.

(c) A plan to ensure proper management of regulated medical waste shall be prepared and maintained at the generating facility.

History Note: Statutory Authority G.S. 130A-309.26; Eff. October 1, 1990; Amended Eff. Oct. 1, 1992.

.1205 REQUIREMENTS FOR TRANSPORTERS OF REGULATED MEDICAL WASTE

A person who transports Regulated medical waste that has not been treated at the generating facility shall meet the following requirements:

(1) Transporters shall not accept waste which is improperly packaged.

(2) Regulated medical waste shall be transported in a manner that prevents leakage of the contents of the package.

(3) The integrity of the package shall be maintained at all times.

(4) The labeling and marking of the package shall be maintained at all times.

(5) All loads containing Regulated medical waste shall be covered during transportation.

(6) The universal biohazard symbol shall be displayed on all transportation vehicles, in accordance with Department of Transportation Standards and 49 CFR 172 Subpart F.

(7) Regulated medical waste shall be delivered to a permitted storage or treatment facility within seven calendar days of the date of shipment from the generator.

(8) Refrigeration at an ambient temperature between 35 and 45 degrees Fahrenheit shall be maintained for Regulated medical waste that will not be delivered for treatment within seven calendar days.

(9) A contingency plan shall be prepared and maintained in each vehicle used in the transporting of Regulated medical waste. The operator of each vehicle shall be knowledgeable of the plan.

(10) Vehicles used for the transportation of Regulated medical waste shall be thoroughly cleaned and disinfected with a mycobacteriocidal disinfectant before being used for any other purpose and in the event of leakage from packages.

(11) While transporting Regulated medical waste, vehicles are prohibited from transporting any material other than solid waste and supplies related to the handling of medical waste.

History Note: Statutory Authority G.S. 130A-309.26; Eff. October 1, 1990.

.1206 REQUIREMENTS FOR STORAGE OF REGULATED MEDICAL WASTE

A person who stores Regulated medical waste that has not been treated at the generating facility shall meet the following requirements:

(1) Regulated medical waste shall be stored in a manner that prevents leakage of the contents of the package.

(2) Regulated medical waste shall be stored in a manner that maintains the integrity of the packaging at all times.

(3) The labeling and marking of the package required in Rule .1204 of this Section shall be

maintained at all times.

(4) Regulated medical waste shall not be stored longer than seven calendar days from the date of shipment from the generator unless the Regulated Medical Waste is refrigerated at an ambient temperature between 35 and 45 degrees Fahrenheit.

(5) Only authorized personnel shall have access to areas used to store Regulated medical waste.

(6) All areas used to store Regulated medical waste shall be kept clean. Vermin and insects shall be controlled.

(7) All floor drains shall discharge directly to an approved sanitary sewage system. Ventilation shall be provided and shall discharge so as not to create nuisance odors.

(8) A plan shall be prepared, maintained and updated as necessary to ensure continued proper management of Regulated medical waste at the facility.

History Note: Statutory Authority G.S. 130A-309.26; Eff. October 1, 1990.

.1207 OPERATIONAL REQ/REGULATED MEDICAL WASTE TREATMENT FACILITIES

A person who treats Regulated medical waste shall meet the following requirements for each type of treatment in addition to the requirements in Rule .1203 of this Section.

(1) General requirements:

(a) Refrigeration at an ambient temperature between 35 and 45 degrees Fahrenheit shall be maintained for Regulated medical waste not treated within seven calendar days after shipment.

(b) Regulated medical waste shall be stored prior to treatment for no more than seven

calendar days after receipt.

(c) Regulated medical waste shall be stored no longer than seven calendar days after treatment.

(d) Only authorized personnel shall have access to areas used to store Regulated medical waste.

(e) All areas used to store Regulated medical waste shall be kept clean. Neither carpets nor floor coverings with seams shall be used in storage areas. Vermin and insects shall be controlled.

(f) Prior to treatment, all Regulated medical waste shall be confined to the storage area.

(g) All floor drains shall discharge directly to an approved sanitary sewage system. Ventilation shall be provided and shall discharge so as not to create nuisance odors.

(h) A plan shall be prepared, maintained and updated as necessary to ensure continued proper management of Regulated medical waste at the facility.

(i) Records of Regulated medical waste shall be maintained for each shipment and shall include the information listed in this Paragraph. This information shall be maintained at the treatment facility for no less than three years.

(i) name and address of generator;

(ii) date received;

(iii) amount of waste received by number of packages (piece count) from each generator;

(iv) date treated;

(v) name and address of ultimate disposal facility.

(j) Regulated medical waste treatment facilities that treat waste generated off-site shall submit to the Division an annual report, by August 1 of each year on a form prescribed and approved by the Division.

(2) Steam sterilization requirements:

(a) Steam under pressure shall be provided to maintain a minimum temperature of 250 degrees Fahrenheit for 45 minutes at 15 pounds per square inch of gauge pressure during each cycle; or other combinations of parameters that are shown to effectively treat the waste.

(b) The steam sterilization unit shall be provided with a chart recorder which accurately records time and temperature of each cycle.

(c) The steam sterilization unit shall be provided with a gauge which indicates the pressure of each cycle.

(d) Monitoring under conditions of full loading for effectiveness of treatment shall be performed no less than once per week through the use of biological indicators or other methods approved by the Division.

(e) Regulated medical waste may be disposed of until or unless monitoring as required in Sub-Item (2)(d) of this Rule does not confirm effectiveness.

(f) A log of each test of effectiveness of treatment performed shall be maintained and shall include the type of indicator used, date, time, and result of test.

(3) Incineration requirements:

(a) Regulated medical waste shall be subjected to a burn temperature in the primary chamber of not less than 1200 degrees Fahrenheit.

(b) Automatic auxiliary burners which are capable, excluding the heat content of the wastes, of independently maintaining the secondary chamber temperature at the minimum of 1800 degrees Fahrenheit shall be provided. Interlocks or other process control devices shall be provided to prevent the introduction of waste material to the primary chamber until the secondary chamber achieves operating temperature.

(c) Gases generated by the combustion shall be subjected to a minimum temperature of 1800 degrees Fahrenheit for a period of not less than one second.

(d) Continuous monitoring and recording of primary and secondary chamber temperatures shall be performed. Monitoring data shall be maintained for a period of three years.

(e) An Air Quality Permit shall be obtained from the Division of Environmental Management prior to construction and operation.

(f) A plan of procedures for obtaining representative weekly and monthly composite ash samples shall be submitted for Division approval prior to system start-up and operation. If design or operation of the system is substantially changed or modified, or if the waste composition, loading rate or loading method are substantially changed, the ash sampling plan will be subject to modification to accommodate such changes. Ash sampling procedures shall be initiated at the time the incineration system is first started for normal operation.

(g) As a minimum, a representative sample of about one kilogram (2.2 lb) shall be collected once for every eight hours of operation of a continuously fed incinerator; once for every 24 hours of operation of an intermittently operated incinerator; or once for every batch of a batch loaded incinerator. The samples shall be collected from either the discharge of the ash conveyor or from the ash collection containers prior to disposal. Samples shall be composited in a closed container weekly and shall be thoroughly mixed and reduced to a representative sample. These shall be composited into monthly samples. For the first three months of operation, each monthly sample shall be analyzed.

(h) For the remainder of the first year of operation, representative monthly samples shall be

composited into a quarterly sample and analyzed at the end of each quarter.

(i) After the first year, representative samples shall be analyzed at least twice a year.

(j) Ash samples shall be tested in accordance with provisions of 15A NCAC 13B .0103(e) and submitted to the N.C. Solid Waste Section.

(k) A log shall be kept documenting ash sampling, which shall include the date and time of each sample collected; the date, time, and identification number of each composite sample; and the results of the analyses, including laboratory identification.

(l) Records of stack testing as prescribed in the Air Quality Permit shall be maintained at the facility.

(m) Existing generating facilities shall conduct one weekly representative ash sampling and testing in accordance with Sub-Items (3)(f), (g) and (j) of this Rule annually during the second quarter of each calendar year.

(4) Chemical treatment requirements:

(a) Cultures of throat, urine, sputum, skin and genitourinal tract which contain only the following organisms; N. gonorrhea, E. coli, staphylococcus, proteus, Candida albicans, and B. cereus or normal flora in individual plates or tubes containing 5-20 ml media shall be covered, for a minimum of one hour, with a 1:5 dilution of household bleach (5.25 percent sodium hypochlorite) in water. The solution shall remain on the treated plates which are to be stacked in a plastic bag prior to disposal. The bag is to be sealed to prevent leakage.

(b) Approval for other types of chemical treatment must be obtained from the Division. Request for approval must be substantiated by results of demonstrated effectiveness of the chemical to treat the specific microbiological agent(s) of concern for the waste disposed. Consideration must be given to such factors as temperature, time of contact, pH, concentration and the presence and state of dispersion, penetrability and reactivity of organic

material at the site of application.

(c) A written plan must be maintained at the facility and units of the facility as necessary to ensure consistent procedures are used to treat the waste.

(5) Microwave treatment requirements:

(a) Microwave energy of appropriate output frequency shall be provided such that a minimum temperature of 95 degrees Centigrade (203 degrees Fahrenheit) is maintained for a minimum of 30 minutes each cycle; or other combinations of parameters that are shown to effectively treat the waste.

(b) The microwave system shall be provided with a means to continually monitor and record time and temperature of each cycle.

(c) Monitoring under conditions of full loading for effectiveness of treatment shall be performed through the use of a biological indicator or other methods approved by the Division. Testing shall be performed no less than once per week or as specified by the Division. Additional testing shall be performed if temperature/time monitoring indicates a variation from requirements in Sub-Item (5)(a) of this Rule.

(d) A log of each test of effectiveness of treatment performed shall be maintained and shall include the type of indicator used, date, time, and result of test.

(e) Regulated medical waste may be disposed of until or unless monitoring as required in Sub-Item (5)(c) of this Rule does not confirm effectiveness.

History Note: Statutory Authority G.S. 130A-309.26; Eff. October 1, 1990; Amended Eff. April 1, 1993; January 4, 1993.

APPENDIX B

MEDICAL WASTE MANAGEMENT PLAN CHECKLIST DEVELOPED BY CALIFORNIA STATE DEPARTMENT OF HEALTH SERVICES AND A SAMPLE OF MEDICAL WASTE MANAGEMENT PLAN FOR HEALTH CARE ORGANIZATION

Medical Waste Management Plan Checklist

Date: _____

Facility Name: _____
Address: _____
City: _____
Responsible Party: _____ Phone: _____
Inspector: _____ Phone: _____

This facility has been identified as: (check one)

_____ This generator of medical waste is a new facility or did not have a medical waste management plan (MWMP) on file with the Department. Below are the items to be incorporated in the MWMP. Use this checklist with the Medical Waste Management Act (MWMA) in drafting the MWMP for this facility. If you do not have a copy of the MWMA, contact the Department and one will be provided.

_____ A review of this facility's medical waste management plan (MWMP) revealed that it did not adequately address the items checked below. The items checked below are the areas of the MWMP, which need to be revised. Use this checklist with the Medical Waste Management Act (MWMA) in revising the MWMP for this facility. If you do not have a copy of the MWMA, contact the Department and one will be provided.

The following are highly recommended or required elements of a compliant medical waste management plan.

_____ Provide the name of the contact person at the facility for matters regarding medical waste. Section 117960(a) of the MWMA.

_____ Provide the name, phone number, and address of the facility. Section 117960(b) of the MWMA.

_____ Indicate the type of facility. Section 117960 (c) of the MWMA.

_____ Indicate the types and estimated average monthly quantity, of medical waste generated. Section 117960(d) of the MWMA. See Sections 117635 and 117755 of the MWMA for types of medical waste.

_____ Indicate the on-site medical waste treatment method utilized if applicable. Section 117960(e) of the MWMA.

_____ The name and business address of the registered hazardous waste hauler utilized to have untreated medical waste removed for treatment, if applicable. Sections 117960(f)(g) of the MWMA.

_____ The name and business address of the off-site treatment facility to which the medical waste is being hauled, if applicable. Section 117960(h).

_____ Provide an emergency action plan. Indicate in the emergency action plan the actions to be taken in the event of a disruption of service as the result of a natural disaster or an equipment failure. Section 117960(i) of the MWMA.

_____ Provide a statement certifying that the information provided is complete and correct. Section 117960(j) of the MWMA.

_____ Indicate in the medical waste management plan that tracking documents and treatment records will be maintained for 3 years. Section 117975 of the MWMA.

Procedures for the processing, storage, transport, and treatment of pathology wastes (recognizable human anatomical remains), trace contaminated tissues, and chemotherapeutic containers, and mixed waste.

_____ Indicate in the medical waste management plan how recognizable human anatomical remains are to be handled or treated to ensure compliance with Section 118220 of the MWMA. Describe the procedures to be used in their handling. <u>If there are no medical wastes produced which contain or are comprised of recognizable anatomical remains, indicate this fact in the medical waste management plan, and it will not be necessary to provide procedures for the handling of these wastes.</u>

_____ Indicate in the medical waste management plan how mixed waste as specified in Section 117730 of the MWMA are to be handled. State the procedures to be used to assure proper handling. <u>If there is no mixed waste produced by this facility containing hazardous or radiological materials, indicate this fact in the medical waste management plan, and it will not be necessary to provide procedures for the handling of these wastes.</u>

_____ Indicate in the medical waste management plan how pathology and chemotherapeutic wastes are handled and treated. The medical waste management plan must contain the definition of "empty," as specified in Section 117635 of the MWMA to assure that pathology and chemotherapeutic wastes are properly handled. Describe the procedures to be employed to assure proper handling.
If these wastes are not generated or handled by this facility, indicate this fact in the medical waste management plan, and it will not be necessary to provide procedures for the handling of these wastes.

Containment and Storage

_____ Indicate in the medical waste management plan that medical waste will be contained separately from other waste at the point of generation. Section 118275(a) of the MWMA.

_____ Indicate in the medical waste management plan that the medical waste shall be placed in a red biohazard bag. Sections 118275 (b) and 117630 of the MWMA.

_____ Indicate in the medical waste management plan that sharps waste must be contained in a sharps container. Sections 118275 (c), 117750, and 117755 of the MWMA.

_____ Indicate handling procedures for pathology, trace chemotherapeutic, and mixed waste. Section 118275(d) of the MWMA.

_____ Indicate in the medical waste management plan that red biohazard bags are to be tied. Section 118280 (a) of the MWMA.

_____ Indicate in the medical waste management plan that red biohazard bags are to be placed for storage, handling, and transport in rigid containers with tight-fitting lids labeled with the words "Biohazardous Waste," or the word "Biohazard," and the international biohazard symbol on the lids and sides so as to be visible from any lateral direction. Sections 118280 (b) and 117645 of the MWMA.

_____ Indicate in the medical waste management plan that the maximum storage time of medical waste above 32 degrees Fahrenheit is seven (7) days. If stored at or below 32 degrees Fahrenheit, please state this fact in the plan and describe the storage temperature monitoring schedule (maximum storage time at or below 32° F is 90 days). Section 118280 (d) (1) 7 days and (2) 30 days (< 20 lbs./month generated) of the MWMA.

_____ Provide in the medical waste management plan the procedures to containerize sharps waste. Section 118285 (a) through (d) of the MWMA.

_____ Provide in the medical waste management plan the protocol for routine washing and decontamination of reusable rigid medical waste containers (see Section 118295 (a) (b) for approved methods, disinfectants, and use). Section 118295 of the MWMA.

_____ Provide in the medical waste management plan the techniques performed and disinfectants to be utilized in the cleanup of medical waste spills. Provide the type(s) of disinfectant, concentration and contact time used for the decontamination of spills. (See Section 118295 (b) for approved disinfectants and use.) Section 118300.

_____ Indicate in the medical waste management plan that the accumulation area used by the facility to store containers of medical waste for accumulation must be secured so as to prevent or deny access by unauthorized persons. Warning signs must be posted on or adjacent to, the exterior of the entry doors, on entry doors, gates, or lids. These warning signs must be in both English and Spanish as follows: "CAUTION—BIOHAZARDOUS WASTE STORAGE AREA—UNAUTHORIZED PERSONS KEEP OUT" and in Spanish, "CUIDADO—ZONA DE RESIDUOS — BIOLOGICOS PELIGROSO—PROHIBIDA LA ENTRADA A PERSONAS NO AUTORIZADAS," or in another language in addition to English, determined to be more appropriate. Section 118310 of the MWMA.

Limited Quantity Hauling Exemption

_____ Indicate in the medical waste management plan if off-site medical waste is transported to this facility for consolidation and/or treatment. If so, indicate the sources and the protocols in place for accepting the waste. Section 118030 of the MWMA.

Treatment

Discharge to Public Sewer System

_____ Provide in the medical waste management plan the medical waste to be treated by means of discharge to the public sewer system. Describe in detail methods to be used and the types of medical waste to be treated in this manner. Section 118215 (b) of the MWMA.

Facilities which do not treat medical waste on-site are not responsible for the information below.

Steam Sterilization

_____ Provide in the medical waste management plan standard written operating procedures for biological indicators, or for other indicators of adequate sterilization approved by the Department, for each steam sterilizer, including time, temperature, pressure, type of waste, type of container, closure on container, pattern of loading, water content, and maximum load quantity. Section 118215 (c) (1) of the MWMA.

_____ Provide in the medical waste management plan procedures established for checking recording or indicating thermometers during each complete cycle to ensure the attainment of 121 degrees Centigrade (250°. Fahrenheit) for at least one-half hour. depending on the quantity and density of the load, in order to achieve sterilization of the entire load. Sections 118165 and 118215 (c)(2) of the MWMA.

_____ Indicate in the medical waste management plan that for each treatment cycle the amount and types of medical waste treated shall be recorded and maintained as part of the treatment records. Section 118155 (f) of the MWMA.

_____ Indicate in the medical waste management plan thermometers shall be checked for calibration annually and that records of the calibration checks shall be maintained as part of the facility's files and records for a period of three years, or for the period specified in the regulations. Section 118215 (c)(3) of the MWMA.

_____ Indicate in the medical waste management plan that heat-sensitive tape, or another method acceptable to the enforcement agency, shall be used on each biohazard bag or sharps container that is processed on-site to indicate attainment of adequate sterilization conditions. Section 118215 (c)(3) of the MWMA.

_____ State the course of action to be taken in the event that the heat-sensitive tape has not changed color and or the thermometer indicates that proper sterilization has not taken place. Section 118215 (c)(1) of the MWMA.

_____ Indicate in the medical waste management plan that biological indicator *Bacillus stearothermophilus*, or other indicator of adequate sterilization, as approved by the Department, shall be placed at the center of a load processed under standard operating conditions at least monthly to confirm the attainment of adequate sterilization conditions. Section 118215(c)(4) of the MWMA.

_____ State in the medical waste management plan that all records pertaining to on-site treatment shall be maintained for a period of not less than three years. Sections 117975, 118165 (b), and 118215 (c)(5) of the MWMA.

Incineration

_____ Provide a copy of the air pollution permit issued by the local enforcement agency to operate the medical waste incinerator. Section 118155 (f) of the MWMA.

_____ Indicate in the medical waste management plan the medical waste treatment standards and quality control audit procedures, such as throughput and types of waste logs, inspection checklist, maintenance records, incinerator operating procedures, and inspection of ash, and maximum amount of throughput to achieve minimum treatment standards. Sections 118155 and 118215 (a) of the MWMA.

_____ Indicate in the medical waste management plan that for each treatment cycle the amount and types of medical waste treated shall be recorded and maintained as part of the treatment records. Section 118155 (f) of the MWMA.

_____ State in the medical waste management plan that all records pertaining to on-site treatment shall be maintained for a period of not less than three years. Sections 117975 and 118165 of the MWMA.

Sample Medical Waste Management Plan

Facility: Acme Hospital
1234 Main Street
Small Town, CA 12345
(555) 123-4567

Person Responsible for Implementation of Plan: _____
Title: _____

Types of Medical Waste Generated:

BLOOD OR BODILY FLUIDS – Liquid blood elements or other regulated bodily fluids, or articles contaminated with blood or bodily fluids.

SHARPS – Syringes, needles, blades, broken glass.

ISOLATION WASTE – Waste contaminated with excretion, exudate, or secretions from humans who are isolated due to highly communicable diseases.

CHEMOTHERAPEUTIC WASTE – Trace amounts of chemotherapeutic waste.

PATHOLOGY WASTE – Recognizable human anatomical parts, human surgery specimens or tissues.

ACME HOSPITAL IS REGISTERED AS A LARGE QUANTITY GENERATOR. THE ESTIMATED MONTHLY VOLUME OF MEDICAL WASTE GENERATED IS 7000 POUNDS. ACME HOSPITAL DOES NOT TREAT ANY MEDICAL WASTE ON-SITE. ALL WASTE IS REMOVED BY A REGISTERED MEDICAL WASTE HAULER AND TREATED AT AN APPROVED OFF-SITE TREATMENT FACILITY.

Medical Waste Segregation, Containment, Labeling, and Collection Procedures:

Medical waste is contained separately from other wastes at the point of generation. In non-patient care areas, solid waste is not to be disposed of in medical waste containment devices. When cleaning patient care areas, Environmental Services will place all medical wastes into RED biohazard bags labeled with the words, "Biohazard Waste." These bags are to be impervious to moisture and have a strength sufficient to preclude ripping, tearing, or bursting under normal use and handling. The biohazard bag used must be constructed of material that will pass the 165 gram dropped dart impact resistance test as required by Standard D 170985 of the A.S.T.M. Documentation from the manufacturer of compliance with these minimum construction standards will be kept on file in the **Assistant Administrators Office.** All waste placed in a red bag is considered to be medical waste. The bags will be tied to prevent spillage in the event the bag is dumped upside down. All sharps will be placed in a sharps container labeled with the words "SHARPS WASTE" or with the international biohazard symbol and the word "Biohazard." Sharps containers will be rigid puncture proof containers that when sealed are leak resistant and not able to be reopened without great difficulty. Sharps containers shall be considered "full" when

they reach 2/3 capacity or the manufacturer's full line. Lids on filled sharps containers must be snapped closed, taped, or otherwise sealed to prevent loss of contents prior to disposal. Medical waste will be stored and transported in rigid containers to the Biohazardous Waste Storage Area located next to the Laundry Room at the back of the building. The containers will be labeled with the words "Biohazardous Waste," or the word "Biohazard," and the international biohazard symbol. This storage area will be locked at all times. Access will be limited to Environmental Services (ES) and Engineering Department personnel and the key will be available only from the ES office. Waste consisting of medical and nonmedical waste will be handled as medical waste except as follows:

1. Medical waste mixed with hazardous waste will be treated as hazardous waste.
2. Medical waste mixed with radioactive waste will be treated as radioactive waste.
3. Medical waste mixed with hazardous and radioactive waste will be treated as radioactive waste.

CHEMOTHERAPEUTIC WASTE:

All trace contaminated (e.g., empty vials, ampoules, IV bottles/bags, tubings and sharps) will be deposited in specially marked, yellow collection container labeled with the words "Chemotherapy Waste" or "Chemo." When the container is full, without compacting, the locking lid is to be secured to prevent loss of contents prior to disposal. Gowns, gloves, and other trace contaminated non-sharps objects may also be deposited in the container. These containers are picked up by Brand X medical waste hauler for transport to an approved incineration facility when routine medical waste is hauled away for treatment.

PATHOLOGY WASTE:

All Pathology Waste will be separated from other medical waste and hazardous wastes (such as fixatives). Waste will be placed in a red bag and deposited into a specially marked secondary container labeled with the words "Pathology Waste" or "PATH." The container will be stored in the morgue refrigerator until pick-up by Brand X medical waste hauler for transport to an approved incineration facility. Once specimens or tissues are deemed waste, they shall not be stored for more than seven (7) days at a temperature above 32 degrees Fahrenheit. Placentas from obstetrics are stored in the chest freezer in the soiled utility room. This waste can be stored frozen (at or below 32 degrees Fahrenheit) for not more than 90 days. At this hospital, Environmental Services staff will pick up placenta waste and deposit it into a clean pathology container for removal by Brand X at least every two weeks.

ACME HOSPITAL accepts no medical waste from any other facility.

Medical Waste Storage Methods

All medical waste will be collected and stored in the Biohazardous Waste Storage Area until transported by the medical waste hauler. All biohazardous waste shall be stored, handled or transported in containers that are leak resistant, have tight fitting covers and are kept clean and in good repair. This area shall be marked with warning signs saying in English "CAUTION – BIOHAZARDOUS WASTE STORAGE AREA – UNAUTHORIZED PERSONS KEEP OUT," and in Spanish, "CUIDADO – ZONA DE RESIDUOS BIOLOGICOS – PELIGROSOS – PROHIBIDA LA ENTRADA A PERSONAS NO AUTORIZADAS." Biohazard bags and filled sharps containers shall not be stored for more than seven (7) days at a temperature above 32

degrees Fahrenheit. This seven (7) day period begins when any waste has been placed in the bag or container. See 118280 (B) for 30-day allowance.

All reusable rigid containers that are used for accumulation, transportation and storage of Medical Waste shall be washed and decontaminated after a maximum of seven (7) days, or more if visibly soiled. The approved method for decontamination at this hospital is the use of a bleach solution diluted 1:10. The solution should be allowed contact with the surface for a minimum of 3 minutes. The amount of solution mixed will be no more than can be used at any one time.

Medical Waste Treatment and Disposal Method

All Medical Waste will be picked up three times weekly by Brand X Hauler and transported to the off-site treatment facility identified below. Records of Medical Waste transported to Brand X will be kept in the Staff Development Office and retained for a minimum of three (3) years.

Emergency Action Plan

While it is highly unlikely that the company would experience a shutdown of operations, contingencies include use of an alternate hauler or retention of the medical waste for not more than seven (7) days from the point of generation above 0 degrees Centigrade (32 degrees Fahrenheit). Another contingency for less well-defined emergency situations would be to contact the Local Enforcement Agency (Department of Health Services, Medical Waste Program) for guidance at (916) 327-6904.

Spills are cleaned up utilizing a solution of 1/2-ounce Concept 256 germicidal in one (1) gallon of water with a contact time of three (3) minutes. The amount of solution mixed will not exceed the amount to be used at any one time.

Waste Hauler:

Brand X Medical Waste Hauler
7777 Broadway
Large Town, CA 95555
(213) 123-1234

Waste Treatment Facility:

Same... (or specify name, address, phone number, etc.)

I declare under penalty of law that to the best of my knowledge and belief the statements made herein are correct and true.

Signature/Title: _____ **Date:** _____

Witness: _____ **Date:** _____

Medical Waste

Management and Disposal

Plan

Training Subject

Medical Waste Management and Disposal Plan

Individual Training Documentation

Name of Trainer: _____

Training Subject: **Medical Waste Management and Disposal Plan**

Training Materials Used: _____

_____

Name of Employee: _____

Date of Hire/Assignment: _____

I, _____ hereby certify that I received training as described above.

I understand this training and agree to comply with the Safe Practices Plan for my work area.

_____ _____

Employee Signature Date

Copy this page for each employee who will be trained. Make additional copies for future employees.

Place a copy in employee personnel file or other appropriate employee file.

MEDICAL WASTE MANAGEMENT AND DISPOSAL PLAN

This plan describes the medical waste management and disposal procedures of this dental office and contains information required by the California Medical Waste Management Act. The Act is enforced by the Department of Health Services (DHS) or by a designated local enforcement agency.

Please refer to the "Frequently Asked Questions" section of the *CDA Regulatory Compliance Manual* for additional information on the management of regulated medical waste.

I. MANAGEMENT OF MINIMALLY CONTAMINATED SOLID WASTE: Solid waste includes items that do not drip blood or saliva when compressed, (bibs, gloves, gauze, cotton rolls, etc.). These items are not considered "regulated medical waste" and may be disposed as regular solid waste. Such items should be disposed in regular waste containers.

II. MANAGEMENT OF REGULATED MEDICAL WASTE: Regulated medical waste in a dental office includes:

1. **Biohazardous waste**, such as

   (a) Disposable items that *drip* blood or body fluids when compressed, or flake dried blood when shaken, e.g., dressings, gauze, cotton rolls.

   (b) Fluid blood.

   (c) Human surgery tissues. Cal/OSHA does not prohibit dentists from giving patients back their own extracted teeth. The California Medical Waste Management Act mandates that only teeth deemed infectious by the dentist must be disposed of as medical waste. Therefore, it is up to the dentist to decide if the extracted materials are infectious. Teeth in this office are deemed non-infectious if they are: (check those that apply)

   ☐ disinfected with an appropriate surface disinfectant agent
   ☐ heat sterilized
   ☐ other _____

   (d) Waste contaminated by a person known to be infected with diseases which are highly communicable to humans. These diseases are classified by the Centers for Disease Control as Biosafety Level IV organisms: Congo-Crimean hemorrhagic fever, Tick-borne encephalitis virus complex, absettarov, Hanlova, Hypr, Kumlinge, Kyasanur Forest disease, Omsk hemorrhagic fever, and Russian Spring-summer encephalitis). Marburg disease, Ebola, Junin virus, Lassa fever virus, Machupo virus.

2. **Sharps**, including but not limited to needles, syringes, blades, endo files, burs, and anesthetic carpules that have been contaminated with blood or other bodily fluids.

3. **Pharmaceutical waste** (includes expired drugs).

- Containers for Regulated Medical Waste That Is Biohazardous

  These containers are located _____

  The containers are:

Leakproof.
Labeled "Biohazardous Waste" and color-coded red or orange red.
Closeable.
Must be shipped out of the office every

- ☐ 7 days (>20 lbs. waste generated/month)
- ☐ 30 days (<20 lbs. waste generated/month, kept above 0°)
- ☐ 90 days (<20 lbs. waste generated/month, kept below 0°)

- Containers for Contaminated Sharps Waste:

These containers are located _____

The containers are :
Closeable and difficult to re-open after sealing shut.
Puncture resistant.
Leakproof on sides and bottom.
Labeled "Sharps Waste" and color coded red or orange red.
Easily accessible to immediate area of use.
Maintained upright.
Replaced routinely, not overfilled.
Shipped out of the office within 7 days of filling.

Handling of Sharps Waste: Handle all sharps in a manner to prevent accidental punctures and personal contamination. Needles should never be bent or cut during disposal. Never put hands into a container for contaminated sharps.

- Containers for Pharmaceutical Waste:

These containers are located _____

The containers are:

Leakproof
Closeable
Labeled "Pharamaceutical Waste: Incineration Only" on the lids and on the sides
Must be shipped out of the office every

- ☐ 90 days (>10 lbs. generated/year)
- ☐ 1 year (<10 lbs. generated/year)

Storage for Regulated Medical Waste (check box if statement applies to the dental office)

- ☐ Isolyzer or Earth-Shield sharps management system containers are stored in a secured area
- ☐ A common storage facility is used by this office and other dental and medical offices in this building _____

A permit for this common storage facility is required and is held by (name of dental or medical office, registered hazardous waste transporter, property owner, or property management firm) _____

III. DISPOSAL OF REGULATED MEDICAL WASTE: There are options available for medical waste disposal. In this office the disposal of regulated medical waste is by: *(check appropriate boxes and complete information)*

☐ DHS-approved mail back system for sharps:

Name of Company _____

Telephone number of Company _____

Quantity of Waste Disposed _____

Records are kept: _____

☐ A pick-up service:

Name of Company _____

Telephone number of Company _____

Quantity of Waste Disposed _____

Records are kept: _____

Waste vendor's receipts must be retained for two (2) years.

☐ Treatment: Regulated medical waste may be treated using DHS-approved methods or using sterilization. Please check applicable box(es):

- ☐ Isolyser System for sharps disposal is used (no permit required).
- ☐ Earth Shield System for sharps disposal is used (no permit required).
- ☐ Other DHS-approved method is used (permit required; describe method):

_____

_____

_____

- ☐ Sterilization (requires permit, written operating procedures, recording or indicating thermometers, use of heat-sensitive tape and biological monitors, and 3-year record keeping - see Health & Safety Code, sections 118215 – 118245). Required documentation is filed: _____

☐ Self-hauling: Dental office owner or staff may transport medical waste to a permitted medical waste treatment facility, a transfer station, or other health care facility for the purpose of consolidation before treatment and disposal, under the following conditions:

- The office generates less than 20 pounds of medical waste per week and transports less than 20 pounds of medical waste at a time;
- The office is registered as a small quantity medical waste generator;
- A tracking document or log is maintained for three years. The document or log contains the name of the person transporting the waste, the number of containers and the type of medical waste, and the date of transport.
- A limited-quantity hauling exemption has been granted by the enforcement agency. The exemption is valid for one year.

Disinfection with a disinfectant, followed by encasement in dental stone is NOT legal in California.

Checklist for
Medical Waste Disposal

1. Equipment:

   - ✔ If used, a DHS-approved sharps disposal system.
   - ✔ Appropriate and labeled containers for biohazardous, sharps, and pharmaceutical wastes.

2. Employee Training Checklist

   - ✔ Instructed in the proper management of all regulated medical waste.
   - ✔ Informed that the term "sharps" includes needles, syringes, blades, and anesthetic carpules contaminated with blood or other bodily fluids.
   - ✔ Instructed not to place recognizable human tissues into solid waste containers.
   - ✔ Instructed not to place hazardous wastes, universal wastes, or recyclable metals into medical waste containers.

APPENDIX C

DRAFT FACT SHEETS OF ALTERNATIVE MEDICAL WASTE TREATMENT TECHNOLOGIES AND PERFORMANCE GUIDANCE FROM THE USEPA

DRAFT

"The attached draft information is provided as a tool for organizations developing their own means for evaluating medical waste treatment technologies. This information is provided only as a framework and is not for distribution and should not in any way be interpreted or represented as an official EPA document or test protocol."

STEAM AUTOCLAVE

DESCRIPTION: Steam autoclave treatment combines moisture, heat, and pressure to inactivate microorganisms. All steam autoclaves are constructed with a metal chamber to withstand the increased pressure/temperature. Autoclaves come in two basic varieties, gravity displacement and prevacuum autoclaves. The size of the devices may vary from benchtop models to large commercial models which can treat more than a ton of waste per cycle.

OPERATING PARAMETERS: The factors that affect the efficacy of steam autoclave treatment of medical waste are those affecting the internal waste load temperature, steam penetration of the waste, and the duration of treatment. These factors include:

- temperature and pressure achieved by the autoclave
- size of the waste load
- composition of the waste load
- steam penetration of the waste
- packaging of the waste for treatment
- orientation of the waste load within the autoclave

Steam autoclaves operate most effectively when the temperature measured at the center of the waste load approaches 121 °C and there is adequate steam penetration of the waste load under pressure.

WASTES SUITABLE FOR TREATMENT BY STEAM AUTOCLAVING: All wastes with the exceptions of body parts and contaminated animal carcasses which are excluded from treatment by steam autoclaving because the density of the waste items prevents adequate steam penetration. Radioactive, hazardous, and cytotoxic wastes are also inappropriate for treatment by steam autoclaving.

INDICATOR ORGANISMS: Thermally resistant indicator organisms are selected to provide a maximum challenge. *Bacillus subtilis* (globigii) ATCC 9372 (10^4) may be used to demonstrate a 4 $\log_{10}$ reduction of viable spores.

Bacillus stearothermophilus ATCC 12980 (10^6) may be used to demonstrate a 6 $\log_{10}$ reduction of viable spores.

TEST PROCEDURE: Dried test spores are placed in a thermally resistant and steam permeable container near the center of the waste load. The autoclave is operated under normal conditions. At the conclusion of the cycle the test organisms are removed from the load and recovered within 24 hours. To recover the test organism the test discs or strips should be aseptically inoculated into 5.0 mL soybean-casein digest broth medium (or equivalent) and incubated for at least 48 hours (30 °C for *B. subtilis* or 55 °C for *B. stearothermophilus*). At the end of the incubation period the media should be examined for turbidity as a sign of bacterial growth. Any growth should be subcultured onto appropriate media to confirm the identity of the organism as the indicator organism or an environmental contaminant.

DRAFT

"The attached draft information is provided as a tool for organizations developing their own means for evaluating medical waste treatment technologies. This information is provided only as a framework and is not for distribution and should not in any way be interpreted or represented as an official EPA document or test protocol."

MICROWAVE IRRADIATION

DESCRIPTION: Large microwave irradiation medical waste treatment units include an initial destruction phase. The waste is automatically fed into a waste grinding device where it is shredded and sprayed with steam to increase the moisture content of the waste to approximately 10 percent. The moist ground waste is then heated by exposure to six microwave irradiation units over a 2 hour period. This process heats the waste to >90 °C.

OPERATING PARAMETERS: The factors which affect microwave treatment of medical waste include the frequency and wavelength of the irradiation, the duration of the exposure, destruction and moisture content of the waste material, process temperature, and the mixing of the waste during treatment.

WASTES SUITABLE FOR TREATMENT BY MICROWAVE IRRADIATION: Microwave treatment units can treat most infectious waste with the exception of cytotoxic, hazardous, or radioactive wastes. Contaminated animal carcasses, body parts, human organs, and large metal items may also be unsuitable for treatment by microwave irradiation.

INDICATOR ORGANISMS: Thermally resistant indicator organisms are selected to provide a maximum challenge. *Bacillus subtilis* (globigii) ATCC 9372 (10^4) may be used to demonstrate a 4 $\log_{10}$ reduction of viable spores.

TEST PROCEDURE: Dried test spores are placed in a steam permeable container and added to the waste stream after the waste is ground and sprayed with steam but before exposure to microwave irradiation. The microwave unit is operated under normal conditions. At the conclusion of the cycle the test organisms are removed from the waste and recovered within 24 hours. To recover the test organism the test discs or strips should be aseptically inoculated into 5.0 mL soybean-casein digest broth medium (or equivalent) and incubated for at least 48 hours (30 °C for *B. subtilis*). At the end of the incubation period the media should be examined for turbidity as a sign of bacterial growth. Any growth should be subcultured onto appropriate media to confirm the identity of the organism as the indicator organism or an environmental contaminant.

APPENDIX D

LISTS OF ALTERNATIVE MEDICAL WASTE TREATMENT TECHNOLOGIES APPROVED BY THE STATES OF CALIFORNIA, NORTH CAROLINA, AND NEW YORK

STATE OF CALIFORNIA – HEALTH AND HUMAN SERVICES AGENCY

ARNOLD SCHWARZENEGGER, *Governor*

DEPARTMENT OF HEALTH SERVICES

MEDICAL WASTE MANAGEMENT PROGRAM, MS 7405
P.O. BOX 997413
SACRAMENTO, CA 95899-7413
(916) 449-5671 (916) 449-5565 fax

Alternative Medical Waste Treatment Technologies Approved by the California Department of Health Services

Effective Date: February 19, 2004

DEPARTMENT OF HEALTH SERVICES

The technologies listed below have been approved by the Department of Health Services to treat medical waste in California. The approval may be limited to certain types of wastes. Please review the information provided to verify the approved uses of each technology. Individuals interested in the products described in this document are encouraged to contact the company directly.

Alternative Technology Approval is based solely on a product's demonstration of pathogen destruction. Putting the technologies to use may require permitting as on-site or off-site medical waste treatment. Sections 118130 and 118135 of the Medical Waste Management Act require that any offsite medical waste treatment facility obtain a permit from the Department before treating medical waste. Permitting of onsite facilities is addressed in 117925 (a) and 117950 (a) of the Medical Waste Management Act.

Disposable technologies (products which treat medical waste and are then disposed along with the treated waste) do not require permits. Those products are noted in the list as "permit-exempt".

Condor Healthcare Services

Condor Health Care Services, LLC
1532 E. Kattella Ave
Anaheim, CA 92805
www.condortechnology.com

(714) 456-0790 Office
John Chahine
Previously "Winfield Condor Technology"

The process is designed for on-site applications for disinfection of medical waste. The system produces chlorine dioxide in-situ from sodium chlorite and citric acid. Mechanical shredding in the presence of chlorine dioxide results in disinfection and destruction. Treatment residues are confetti-like and may be disposed in solid waste landfills.

Not for pathology, chemotherapy, or pharmaceutical waste.

EARTH-SHIELD Company - Sharp-Shield

Joe A. Dendy, D.V.M.
Earth Shield Company
304 Yampa Street
Bakersfield, CA 93307

(661) 322-0300 Office

The device is a point-of-generation disposable system for sharps waste only. Hypodermic needles placed in the container are sanitized within 24 hours by low concentrations of gaseous chlorine, slowly released by dry calcium hypochlorite present in the sharps container. Reagents are added to the full container and the needles become encased in a solid cementatious medium. The container may then be disposed of as solid waste.

Sharps waste only. —Permit-Exempt.

Kvaerner U.S. Inc. Successor to Mediclean Technology Inc., Medical Compliance Services, Inc.- Encore 2000 RWP

Mr. David Hahn, (508) 399-6400 Office
Vice President/ Sales and Marketing
Kvaerner U.S., Inc.
116 Roddy Avenue
South Attleboro, MA 02703-7974

The device pre-shreds and then "granulates" medical waste in the presence of chlorine dioxide (ClO_2). Chlorine dioxide is generated in-situ. Precursors are approved by Federal EPA and the California Department of Pesticide Regulation. The capacity of the system is approximately 2,000 pounds per hour of typical input waste.

Previously known as Mediclean Technology Inc., Medical Compliance Services, Inc.

Not for pathology, chemotherapy, or pharmaceutical waste. —Permit-Exempt

Medical Innovations, Inc. TAPS (Thermal Activated Plastic Sterilization)

David Freedman (508) 358-8099 Voice
Medical Innovations, Inc. (508) 358-2131 Fax
P.O. Box 148
Wayland, MA 01778

TAPS™ is a bench-top treatment technology approved for treatment of sharps waste. The system completely encases treated waste in a solid plastic cylinder, and relies on direct conduction of heat from molten plastic to the contaminated waste to achieve disinfection. Therefore, if there is any waste protruding from the plastic cylinder the cycle must be repeated.

Not for pathology, chemotherapy, or pharmaceutical waste.

Medical SafeTEC

Lynn Benson, Manager (801) 209-6582 Office
Medical Waste SafeTEC (801) 936-0112 Fax
330 West Center Street http://www.medwastetec.com/
North Salt Lake, Utah 84054

This system uses a hammer mill and sodium hypochlorite for grinding and disinfecting medical waste. Red bags and sharps waste are fed into the unit through the hopper. Once the waste is processed, the resulting solid waste is unrecognizable and may be disposed at a solid waste facility.

Not for pathology, chemotherapy, or pharmaceutical waste.

PEAT, Inc (formerly Plasma Arc.)

Roy DuPree,
Director of Marketing
PEAT, Inc.
4914 Moores Mill Road
Huntsville, AL 35811

(256) 859-3006 Office

Plasma arc reactors generate intense heat (12,000°F) through discharge of a powerful electrical arc ("artificial lightning"). The thermal energy generated by ionizing gasses is transferred to the waste, where at temperatures of 2000 to 3000°F, volatile constituents are vaporized while inorganic matter is fused into a glassy slag. After CO_2, HCL and oxides of sulfur are scrubbed, the gas (principally N_2, H_2, and CO) is flared.

All forms of medical waste.

Plasma Enhanced Melter™

David L. Farmer
President
InEnTec Medical Services, LLC
1935 Butler Loop
Richland, WA 99352

(509) 946-5700
(949) 472-3713
www.inentec.com

The IET Plasma Arc Melter™ destroys medical waste in a chemically reducing environment at temperatures exceeding 1800°F. Organic material (plastics, pathology, pharmaceutical and trace chemotherapy waste) is converted via steam reforming into synthesis gas that can be sold for hydrogen content or to power onsite electrical or steam plants. The system is equipped with activated charcoal filters which are specially dosed to remove mercury (of any is present) from the gas. The residual inorganic material (glass, ceramics, needles, ash) forms a leach resistant glass that will incorporate any heavy metals present.

All forms of medical waste.

PMA Services Inc. - MedClean-M

Mr Joseph T. Militello
PMA Services, Inc.
22347 La Palma Ave. Ste. 106
Yorba Linda, CA 92887

(714) 692-8533 Office
(714) 692-5478 Fax

This device disinfects medical waste through the use of dry heat. Plastic items including needles and syringes, petri dishes, culture plates and red-bag waste are heated to temperatures in excess of 500° Fahrenheit. The resulting block of plastic encases sharps, is unrecognizable as medical in origin, and may be disposed of as solid waste. The unit provides a printout of each cycle showing cycle time and temperature.

Not for pathology, chemotherapy, or pharmaceutical waste.

Steris Corporation - EcoCycle 10 Processor

Mr. Paul Zamecnik, President (216) 354-2600 Office
Steris Corporation
9450 Pineneedle Drive
Mentor, OH 44060

The device grinds up to 8 pounds of medical waste in the presence of diluted peractic acid and other inert ingredients followed by an exposure time "rest" to assure pathogen destruction. The chamber contents are then rinsed and spin-dried. The liquid portion is sewered, and the solids may be disposed as solid waste.

Not for pathology, chemotherapy, or pharmaceutical waste.

Stericycle, Inc. - Electro-Thermal Deactivation

Richard T. Cogler, COO (847) 607-2070 Office
27161 N. Keith Drive
Lake Forest, IL 60045

The device disinfects medical waste by heating it with low-frequency radio waves. Once moistened with approximately 10% H_2O, the waste is heated to a minimum of 90°C and held in insulated containers (to slow heat loss).

Not for pathology, chemotherapy, or pharmaceutical waste.

Thermal Waste Technologies, Inc. Demolizer System (Heat Sterilization)

Mr. Jon Bricken, President/CEO (203) 778-1139
Thermal Waste Technologies, Inc.
19 Stoney Hill Road (Previously known as DOCC, Inc.)
Bethel, CT 06801

In this table-top unit, sharps and biohazardous waste in one gallon sealed container filled with medical waste are heated to 350°F for 90 minutes. After cooling, the treated waste can be disposed of as solid waste.

Not for pathology, chemotherapy, or pharmaceutical waste.- Permit -Exempt

Thermal Equipment Corporation--Mediclave

Mr. Kenneth R. Earls (310) 328-6600 Office
Thermal Equipment Corporation
1301 W. 228th Street
Torrance, CA 90501

This is an abbreviated-cycle steam sterilization device which applies high pressure (150 psi), high temperature (350°F) steam within a jacketed pressure vessel. At the end of the cycle, a hydraulic ram within the unit compresses the super-heated waste into an eight-inch-by-three-foot diameter disk, which can be recycled or landfilled.

Not for pathology, chemotherapy, or pharmaceutical waste.

WPS Company – SSM-150

Dr. Sanford A. Glazer (443) 524 4245
WPS Company
3051 Washington Blvd.
Baltimore, MD 21230

This high-temperature and pressure device shreds medical waste into a slurry in rapidly circulating superheated water. Beginning when the mixture reaches 250 ° Fahrenheit, computerized monitoring integrates time and temperature parameters, maintaining the device in treatment mode until treatment is complete.

Not for pathology, chemotherapy, or pharmaceutical waste.

WR^2 – ChemClave

Randall G. McKee (317) 484-4200 Office
Sterile Technology Industries, Inc. (317) 484-4201 Fax
5711 W. Minnesota Street
Indianapolis, Indiana 46241

The device is a medium to high throughput continuous-feed ambient pressure steam treatment system. Shredded medical waste is augered through a steam-jacketed tunnel for treatment. The waste is initially bathed in steam that is released into the auger, then dried and heated further as it passes through the second portion of the steam jacket, which does not release steam. The treated waste is deposited into a compactor for disposal as solid waste.

Not for pathology, chemotherapy, or pharmaceutical waste.

WR^2 – Tissue Digestor

Waste Reduction by Waste Reduction Inc (317) 484-4200 Office
5711 W. Minnesota Street (317) 484-4201 Fax
Indianapolis, Indiana 46241

The device is a batch-feed pressure-vessel treatment system that using both thermal and chemical activity to inactivate pathogens. Waste is held at 250-300 ° C for a minimum of three hours in stoichiometric amounts of ~1N alkali at, achieving digestion and dissolution of protein and lipid matter along with pathogen kill. The liquid residue may be sewered in conformance with local POTW requirements. Solid residue (remaining inorganic bone material) may be disposed as municipal solid waste, or recycled as fertilizer.

Not for chemotherapy or pharmaceutical waste.

Technical Assistance, Education & Guidance
>> Innovative Technology >> Medical Waste
Alternative Medical Waste Treatment Technologies

Many hospitals and medical waste treatment facilities have discontinued use of incinerators because of increased costs. The costs of operating medical waste incinerators have risen mainly because of the recently enacted EPA regulations for Hospital/Medical/Infectious Waste Incinerators (HMIWI).

A number of new technologies have been developed which minimize or nearly eliminate environmental discharges. A summary of some representative technologies is presented in USEPA Alternate Treatment Technologies Fact Sheets

Applying for State Approval in North Carolina

It is necessary to obtain state approval to operate a new treatment technology in North Carolina. Vendors who would like to seek approval of a medical waste technology may submit information to obtain approval. Vendors should submit:

- General description of the treatment system
- Efficacy data on representative microorganisms (a full report is required which includes complete information on experimental design, unsummarized and summarized data, and qualifications of the testing laboratory)
- Description of any environmental discharges
- Information on worker safety aspects
- Additional information may be required.

For further information please contact the Solid Waste Section at (919-733-0692).

Guidance and Assistance in Evaluating New Treatment Technologies

Guidance for Evaluating Medical Waste Treatment Technologies - EPA publication which provides guidance on how to evaluate new technologies

Some types of technology require registration under the Federal Insecticide, Fungicide, and Rodenticide Act

Technologies Approved for Use in North Carolina

The following alternative medical waste treatment technologies are approved for use in North Carolina. This listed is updated periodically and only reflects technologies currently approved for use in North Carolina.

Company	Product Name (approval date)	Technology Type	Contact Information
Antaeus Group 3051Washington Blvd. Baltimore, MD 21030	SSM 150/75 (Feb. 5, 2003)	Superheated Water	William D. Norton, Pres. & CEO Ph: 410-666-6160 Fax: 410-666-6110

ALTERNATIVE MEDICAL WASTE DISPOSAL TECHNOLOGIES AUTHORIZED IN NEW JERSEY (AS OF 9/30/2003)

TECHNOLOGY	PROCESS	PRODUCT**	VENDOR**
Steam Sterilization and Shredding	Air is evacuated from the sterilization chamber and steam is injected into the chamber. The treated material is shredded and ground.	Remedy-One Rotoclave®* Models 1250-G1, 1500-D1, 2500-D1, 1500-D(formerly 1500D2)	Tempico, Inc P.O. Box 428 251 Highway 21 North Madisonville, LA 70447-0428 (800) 728-9006
		San-I-Pak™Mark VII Sterilizer Compactor with Shredder*	San-I-Pak™, Inc. 23535 South Bird Road Tracy, CA 95378-1183 (209) 836-2310
Chemical disinfection and Mechanical Shredding	A chemical disinfectant is mixed with the waste and then the material is shredded and ground in a mechanical grinder or Hammermill chamber.	Condor™ Medical Waste Treatment System*	Condor Healthcare Services, LLC 1532 East Katella Avenue Anaheim, CA 92805-6627 (714) 456-0790
		MST 1200 ENRC* Medical Safetec Brand	Circle Medical Products, Inc. 5616 Massachusetts Ave Indianapolis, IN 46218 (317)-541-8080
	Chemical disinfectant & water mixed w/ RMW in grinding chamber. Processed waste rinsed w/ water and solid/liquid waste separated in rinse/separator chamber	Steris® Ecocycle 10™ Processing System Model P 3000*	Steris Corporation 5960 Heisley Road Mentor, OH 44060 (216) 354-2600
	NaOCL applied to RMW then dropped into shredder. After shredding more chem. & water applied, then solid and liquid separated w/ film remaining.	STI Chem-Clav Processing System Model STI-2000CV*	Sterile Technology Industries, Inc. 1155 Phoenixville Pike Unit 105 West Chester, PA 19380 (610)-436-9980
Microwave And Shredding	Waste is shredded and moistened with steam. The material is then microwaved in a treatment chamber and shredded, and Ground in a particulizer	HG-A250-S* and HGA-100-S*	SaniTec, Inc. 26 Fairfield Place West Caldwell, NJ 07006 (973) 227-8826
Steam Sterilization	RMW is steam sterilized. High vacuum treatment boils off and condenses liquid. RMW is dried and cooled to below 170°F (approved for treatment only. Processed medical	Tuttnauer Medical Waste Sterilizer Model#3648-144***	Tuttnauer USA CO., LTD. 33 Comac Loop, Equip-Park Ronkonkoma, NY 11779 (800) 624-5836

Managing Regulated Medical Waste

Alternative Regulated Medical Waste Treatment Technologies
New York State Approved Treatment Systems

October 2000

Manufacturer	Alternative Technology	Contact Person	Approved	Method	Capacity
Sanitec, Inc. 23 Fairfield Place West Caldwell, NJ 07006 Tel: (973) 227-8855 Fax: (617) 942-7114 Web Site: sanitec@worldnet.att.net	Sanitec Microwave Disinfection System (Models HG-A-250S and HG-A-100S)	Joseph Delloiacovo, President	12/1/91	Shredding/Thermal inactivation by microwave	550lbs/hr. - 250S and 220 lbs/hr. - 100S
Global Environmental Service, LLC 905 Esther Lane Murfreesboro, TN 37129 Tel: (800) 503-3908 Fax: (615) 907-2102 Web Site: www.algesco.com	GS 1850	John Chahine, Chief Operating Offier	10/19/92	Shredding/Chemical inactivation by chlorine dioxide	Up to 1850 lbs/hr..

Stericycle, Inc. 28161 North Keith Drive Lake Forrest, IL 60045 Tel: (847) 367-5910 Fax: (847-945-6550	Stericycle Electro-Thermal Deactivation System	John Vitali, Vice President-Regulatory Affairs & Quality Assurance	6/9/93	Shredding/Thermal inactivation by low frequency radio waves	Up to 6,000 lbs/cycle
Circle Medical Products, Inc. (Formerly Medical SafeTEC) 5616 Massachusetts Avenue Indianapolis, IN 46218 Tel: (317) 541-8080 Fax: (317) 541-0646	LFB 12-5 System	Jon Watson, General Manager	9/27/93	Shredding/Chemical inactivation by sodium hypochlorite	800-3000 lbs/hr.
Steris Corporation 5960 Heisley Road Mentor, Ohio 44060 Tel: (440) 354-2600 Fax: (440) 639-4450 Web Site:www.steris.com	EcoCycle 10	Raymond Ursick, Vice President	6/3/95	Grinding/Chemical inactivation by peracetic acid	~ 2-5 lbs/10 minute cycle
*** Thermal Equipment Corporation** 1301 West 228th St. Torrance, CA 90501 Tel: (310) 328-6600 Fax: (310) 320-2692	Mediclave	Thomas Brown, President	3/28/96	Saturated steam/heat/compression	200 lbs/20 minute cycle 600 lbs/hr
Waste Reduction By Waste Reduction, Inc.	WR [2] Animal Tissue	Joseph Wilson, CEO	12/6/96	Akaline Hydrolysis	400 lbs/100 gallon unit

Tel: (915) 772-2288 Fax: (915) 771-8538					
CMB, Ltd. Mechanical Engineering Environmental Technology and Marketing Plabutscherstrasse 115, A-8051 Graz, Austria Tel: 011-43-316-6855150 Fax: 011-43-316-685500-69	Sintion 1.1	Ms. Carmen Spinotti, Sales Management	1/22/98	Microwave steam disinfection	65 lbs./hr.
M.C.M. Environmental Technologies Ltd. Moledet, M.P. Gilboa 19130, Israel Tel: 972-6-653.1104 Fax: 972-6-653 2505 Web Site: www.mcm-environment.com	SteriMed	Yoav Divr, Vice President for Marketing	6/12/98	Shredding/Chemical inactivation	15 gallons/cycle
Antaeus Group 10626 York Road, Suite D Hunt Valley, MD 21030 Tel: (410) 666-6160 Fax: (410) 666-6110 Web Site:antaeusgroup.com	SSM-150	William D. Norton, President & CEO	9/28/98	Maceration/steam heat	Up to 150 lbs/hr.
KC MediWaste, L.L.C. 4219 University Blvd.	KC MediWaste	M. Keith Cox, D.D.S.	8/17/99	Hot air convection	20 lbs/cycle 10 cycles/hr. 200

APPENDIX E

MEDICAL WASTE REGULATIONS DEVELOPED AND PROMULGATED BY THE PEOPLE'S REPUBLIC OF CHINA (PRC) CENTRAL GOVERNMENT

中华人民共和国卫生部令(第 36 号)

2003-10-26 14:07:05

中华人民共和国卫生部令

第 36 号

《医疗卫生机构医疗废物管理办法》已于2003年8月14日经卫生部部务会议讨论通过，现予发布，自发布之日起施行。

部 长 吴 仪

二〇〇三年十月十五日

附件

- 医疗卫生机构医疗废物管理办法

医疗卫生机构医疗废物管理办法

第一章 总 则

第一条 为规范医疗卫生机构对医疗废物的管理，有效预防和控制医疗废物对人体健康和环境产生危害，根据《医疗废物管理条例》，制定本办法。

第二条 各级各类医疗卫生机构应当按照《医疗废物管理条例》和本办法的规定对医疗废物进行管理。

第三条 卫生部对全国医疗卫生机构的医疗废物管理工作实施监督。

县级以上地方人民政府卫生行政部门对本行政区域医疗卫生机构的医疗废物管理工作实施监督。

第二章 医疗卫生机构对医疗废物的管理职责

第四条 医疗卫生机构应当建立、健全医疗废物管理责任制，其法定代表人或者主要负责人为第一责任人，切实履行职责，确保医疗废物的安全管理。

第五条 医疗卫生机构应当依据国家有关法律、行政法规、部门规章和规范性文件的规定，制定并落实医疗废物管理的规章制度、工作流程和要求、有关人员的工作职责及发生医疗卫生机构内医疗废物

流失、泄漏、扩散和意外事故的应急方案。内容包括:

（一）医疗卫生机构内医疗废物各产生地点对医疗废物分类收集方法和工作要求;

（二）医疗卫生机构内医疗废物的产生地点、暂时贮存地点的工作制度及从产生地点运送至暂时贮存地点的工作要求;

（三）医疗废物在医疗卫生机构内部运送及将医疗废物交由医疗废物处置单位的有关交接、登记的规定;

（四） 医疗废物管理过程中的特殊操作程序及发生医疗废物流失、泄漏、扩散和意外事故的紧急处理措施;

（五）医疗废物分类收集、运送、暂时贮存过程中有关工作人员的职业卫生安全防护。

第六条 医疗卫生机构应当设置负责医疗废物管理的监控部门或者专（兼）职人员，履行以下职责:

（一）负责指导、检查医疗废物分类收集、运送、暂时贮存及机构内处置过程中各项工作的落实情况;

（二）负责指导、检查医疗废物分类收集、运送、暂时贮存及机构内处置过程中的职业卫生安全防护工作;

（三）负责组织医疗废物流失、泄漏、扩散和意外事故发生时的紧急处理工作;

（四）负责组织有关医疗废物管理的培训工作;

（五）负责有关医疗废物登记和档案资料的管理;

（六）负责及时分析和处理医疗废物管理中的其它问题。

第七条 医疗卫生机构发生医疗废物流失、泄漏、扩散时，应当在48小时内向所在地的县级人民政府卫生行政主管部门、环境保护行政主管部门报告，调查处理工作结束后，医疗卫生机构应当将调查处理结果向所在地的县级人民政府卫生行政主管部门、环境保护行政主管部门报告。

县级人民政府卫生行政主管部门每月逐级上报至当地省级人民政府卫生行政主管部门。

省级人民政府卫生行政主管部门每半年汇总后报卫生部。

第八条 医疗卫生机构发生因医疗废物管理不当导致1人以上死亡或者3人以上健康损害，需要对致病人员提供医疗救护和现场救援的重大事故时，应当在24小时内向所在地的县级人民政府卫生行政主管部门、环境保护行政主管部门报告，并根据《医疗废物管理条例》的规定，采取相应紧急处理措施。

县级人民政府卫生行政主管部门接到报告后，应当在12小时内逐级向省级人民政府卫生行政主管部门。

省级人民政府卫生行政主管部门接到报告后，应当在12小时内向卫生部报告。

发生医疗废物导致传染病传播或者有证据证明传染病传播的事故有可能发生时，应当按照《传染病防治法》及有关规定报告，并采取相应措施。

第九条 医疗卫生机构应当根据医疗废物分类收集、运送、暂时贮存及机构内处置过程中所需要的专业技术、职业卫生安全防护和紧

急处理知识等，制定相关工作人员的培训计划并组织实施。

第三章　分类收集、运送与暂时贮存

第十条　医疗卫生机构应当根据《医疗废物分类目录》，对医疗废物实施分类管理。

第十一条　医疗卫生机构应当按照以下要求，及时分类收集医疗废物：

（一）根据医疗废物的类别，将医疗废物分置于符合《医疗废物专用包装物、容器的标准和警示标识的规定》的包装物或者容器内；

（二）在盛装医疗废物前，应当对医疗废物包装物或者容器进行认真检查，确保无破损、渗漏和其它缺陷；

（三）感染性废物、病理性废物、损伤性废物、药物性废物及化学性废物不能混合收集。少量的药物性废物可以混入感染性废物，但应当在标签上注明；

（四）废弃的麻醉、精神、放射性、毒性等药品及其相关的废物的管理，依照有关法律、行政法规和国家有关规定、标准执行；

（五）化学性废物中批量的废化学试剂、废消毒剂应当交由专门机构处置；

（六）批量的含有汞的体温计、血压计等医疗器具报废时，应当交由专门机构处置；

（七）医疗废物中病原体的培养基、标本和菌种、毒种保存液等

高危险废物，应当首先在产生地点进行压力蒸汽灭菌或者化学消毒处理，然后按感染性废物收集处理；

（八）隔离的传染病病人或者疑似传染病病人产生的具有传染性的排泄物，应当按照国家规定严格消毒，达到国家规定的排放标准后方可排入污水处理系统；

（九）隔离的传染病病人或者疑似传染病病人产生的医疗废物应当使用双层包装物，并及时密封；

（十）放入包装物或者容器内的感染性废物、病理性废物、损伤性废物不得取出。

第十二条　医疗卫生机构内医疗废物产生地点应当有医疗废物分类收集方法的示意图或者文字说明。

第十三条　盛装的医疗废物达到包装物或者容器的 3/4 时，应当使用有效的封口方式，使包装物或者容器的封口紧实、严密。

第十四条　包装物或者容器的外表面被感染性废物污染时，应当对被污染处进行消毒处理或者增加一层包装。

第十五条　盛装医疗废物的每个包装物、容器外表面应当有警示标识，在每个包装物、容器上应当系中文标签，中文标签的内容应当包括：医疗废物产生单位、产生日期、类别及需要的特别说明等。

第十六条　运送人员每天从医疗废物产生地点将分类包装的医疗废物按照规定的时间和路线运送至内部指定的暂时贮存地点。

第十七条　运送人员在运送医疗废物前，应当检查包装物或者容器的标识、标签及封口是否符合要求，不得将不符合要求的医疗废物运送至暂时贮存地点。

第十八条　运送人员在运送医疗废物时，应当防止造成包装物或容器破损和医疗废物的流失、泄漏和扩散，并防止医疗废物直接接触身体。

第十九条　运送医疗废物应当使用防渗漏、防遗撒、无锐利边角、易于装卸和清洁的专用运送工具。

每天运送工作结束后，应当对运送工具及时进行清洁和消毒。

第二十条 医疗卫生机构应当建立医疗废物暂时贮存设施、设备，不得露天存放医疗废物；医疗废物暂时贮存的时间不得超过 2 天。

第二十一条　医疗卫生机构建立的医疗废物暂时贮存设施、设备应当达到以下要求：

（一）远离医疗区、食品加工区、人员活动区和生活垃圾存放场所，方便医疗废物运送人员及运送工具、车辆的出入；

（二）有严密的封闭措施，设专（兼）职人员管理，防止非工作人员接触医疗废物；

（三）有防鼠、防蚊蝇、防蟑螂的安全措施；

（四）防止渗漏和雨水冲刷；

（五）易于清洁和消毒；

（六）避免阳光直射；

（七）设有明显的医疗废物警示标识和“禁止吸烟、饮食”的警示标识。

第二十二条 暂时贮存病理性废物，应当具备低温贮存或者防腐条件。

第二十三条 医疗卫生机构应当将医疗废物交由取得县级以上人民政府环境保护行政主管部门许可的医疗废物集中处置单位处置，依照危险废物转移联单制度填写和保存转移联单。

第二十四条 医疗卫生机构应当对医疗废物进行登记，登记内容应当包括医疗废物的来源、种类、重量或者数量、交接时间、最终去向以及经办人签名等项目。登记资料至少保存3年。

第二十五条 医疗废物转交出去后，应当对暂时贮存地点、设施及时进行清洁和消毒处理。

第二十六条 禁止医疗卫生机构及其工作人员转让、买卖医疗废物。

禁止在非收集、非暂时贮存地点倾倒、堆放医疗废物，禁止将医疗废物混入其它废物和生活垃圾。

第二十七条 不具备集中处置医疗废物条件的农村地区，医疗卫生机构应当按照当地卫生行政主管部门和环境保护主管部门的要求，自行就地处置其产生的医疗废物。自行处置医疗废物的，应当符合以下基本要求：

（一） 使用后的一次性医疗器具和容易致人损伤的医疗废物应当消毒并作毁形处理；

（二） 能够焚烧的，应当及时焚烧；

（三） 不能焚烧的，应当消毒后集中填埋。

第二十八条 医疗卫生机构发生医疗废物流失、泄漏、扩散和意外事故时，应当按照以下要求及时采取紧急处理措施：

（一）确定流失、泄漏、扩散的医疗废物的类别、数量、发生时间、影响范围及严重程度；

（二）组织有关人员尽快按照应急方案，对发生医疗废物泄漏、扩散的现场进行处理；

（三）对被医疗废物污染的区域进行处理时，应当尽可能减少对病人、医务人员、其它现场人员及环境的影响；

（四）采取适当的安全处置措施，对泄漏物及受污染的区域、物品进行消毒或者其他无害化处置，必要时封锁污染区域，以防扩大污染；

（五）对感染性废物污染区域进行消毒时，消毒工作从污染最轻

区域向污染最严重区域进行，对可能被污染的所有使用过的工具也应当进行消毒；

（六）工作人员应当做好卫生安全防护后进行工作。

处理工作结束后，医疗卫生机构应当对事件的起因进行调查，并采取有效的防范措施预防类似事件的发生。

第四章　人员培训和职业安全防护

第二十九条　医疗卫生机构应当对本机构工作人员进行培训，提高全体工作人员对医疗废物管理工作的认识。对从事医疗废物分类收集、运送、暂时贮存、处置等工作的人员和管理人员，进行相关法律和专业技术、安全防护以及紧急处理等知识的培训。

第三十条　医疗废物相关工作人员和管理人员应当达到以下要求：

（一）掌握国家相关法律、法规、规章和有关规范性文件的规定，熟悉本机构制定的医疗废物管理的规章制度、工作流程和各项工作要求；

（二）掌握医疗废物分类收集、运送、暂时贮存的正确方法

和操作程序；

（三）掌握医疗废物分类中的安全知识、专业技术、职业卫生安全防护等知识；

（四）掌握在医疗废物分类收集、运送、暂时贮存及处置过程中预防被医疗废物刺伤、擦伤等伤害的措施及发生后的处理措施；

（五）掌握发生医疗废物流失、泄漏、扩散和意外事故情况时的紧急处理措施。

第三十一条 医疗卫生机构应当根据接触医疗废物种类及风险大小的不同，采取适宜、有效的职业卫生防护措施，为机构内从事医疗废物分类收集、运送、暂时贮存和处置等工作的人员和管理人员配备必要的防护用品，定期进行健康检查，必要时，对有关人员进行免疫接种，防止其受到健康损害。

第三十二条 医疗卫生机构的工作人员在工作中发生被医疗废物刺伤、擦伤等伤害时，应当采取相应的处理措施，并及时报告机构内的相关部门。

第五章 监督管理

第三十三条 县级以上地方人民政府卫生行政主管部门应当依

照《医疗废物管理条例》和本办法的规定，对所辖区域的医疗卫生机构进行定期监督检查和不定期抽查。

第三十四条 对医疗卫生机构监督检查和抽查的主要内容是：

（一）医疗废物管理的规章制度及落实情况；

（二）医疗废物分类收集、运送、暂时贮存及机构内处置的工作状况；

（三）有关医疗废物管理的登记资料和记录；

（四）医疗废物管理工作中，相关人员的安全防护工作；

（五）发生医疗废物流失、泄漏、扩散和意外事故的上报及调查处理情况；

（六）进行现场卫生学监测。

第三十五条 卫生行政主管部门在监督检查或者抽查中发现医疗卫生机构存在隐患时，应当责令立即消除隐患。

第三十六条 县级以上卫生行政主管部门应当对医疗卫生机构发生违反《医疗废物管理条例》和本办法规定的行为依法进行查处。

第三十七条 发生因医疗废物管理不当导致发生传染病传播事故，或者有证据证明传染病传播的事故有可能发生时，卫生行政主管部门应当按照《医疗废物管理条例》第四十条的规定及时采取相应措施。

第三十八条 医疗卫生机构对卫生行政主管部门的检查、监测、调查取证等工作，应当予以配合，不得拒绝和阻碍，不得提供虚假材料。

第六章　罚 则

第三十九条　医疗卫生机构违反《医疗废物管理条例》及本办法规定，有下列情形之一的，由县级以上地方人民政府卫生行政主管部门责令限期改正、给予警告；逾期不改正的，处以2000元以上5000以下的罚款：

（一）未建立、健全医疗废物管理制度，或者未设置监控部门或者专（兼）职人员的；

（二）未对有关人员进行相关法律和专业技术、安全防护以及紧急处理等知识的培训的；

（三）未对医疗废物进行登记或者未保存登记资料的；

（四）未对机构内从事医疗废物分类收集、运送、暂时贮存、处置等工作的人员和管理人员采取职业卫生防护措施的；

（五）未对使用后的医疗废物运送工具及时进行清洁和消毒的；

（六）自行建有医疗废物处置设施的医疗卫生机构，未定期对医疗废物处置设施的卫生学效果进行检测、评价，或者未将检测、评价效果存档、报告的。

第四十条　医疗卫生机构违反《医疗废物管理条例》及本办法规定，有下列情形之一的，由县级以上地方人民政府卫生行政主管部门责令限期改正、给予警告，可以并处5000元以下的罚款；逾期不改正的，处5000元以上3万元以下的罚款：

（一）医疗废物暂时贮存地点、设施或者设备不符合卫生要求的；

（二）未将医疗废物按类别分置于专用包装物或者容器的；

（三）使用的医疗废物运送工具不符合要求的。

第四十一条 医疗卫生机构违反《医疗废物管理条例》及本办法规定，有下列情形之一的，由县级以上地方人民政府卫生行政主管部门责令限期改正，给予警告，并处5000元以上1万以下的罚款；逾期不改正的，处1万元以上3万元以下的罚款；造成传染病传播的，由原发证部门暂扣或者吊销医疗卫生机构执业许可证件；构成犯罪的，依法追究刑事责任：

（一）在医疗卫生机构内丢弃医疗废物和在非贮存地点倾倒、堆放医疗废物或者将医疗废物混入其他废物和生活垃圾的；

（二）将医疗废物交给未取得经营许可证的单位或者个人的；

（三）未按照条例及本办法的规定对污水、传染病病人和疑似传染病病人的排泄物进行严格消毒，或者未达到国家规定的排放标准，排入污水处理系统的；

（四）对收治的传染病病人或者疑似传染病病人产生的生活垃圾，未按照医疗废物进行管理和处置的。

第四十二条 医疗卫生机构转让、买卖医疗废物的，依照《医疗废物管理条例》第五十三条处罚。

第四十三条 医疗卫生机构发生医疗废物流失、泄漏、扩散时，未采取紧急处理措施，或者未及时向卫生行政主管部门报告的，由县级以上地方人民政府卫生行政主管部门责令改正，给予警告，并处1万元以上3万元以下的罚款；造成传染病传播的，由原发证部门暂扣

或者吊销医疗卫生机构执业许可证件；构成犯罪的，依法追究刑事责任。

第四十四条 医疗卫生机构无正当理由，阻碍卫生行政主管部门执法人员执行职务，拒绝执法人员进入现场，或者不配合执法部门的检查、监测、调查取证的，由县级以上地方人民政府卫生行政主管部门责令改正，给予警告；拒不改正的，由原发证部门暂扣或者吊销医疗卫生机构执业许可证件；触犯《中华人民共和国治安管理处罚条例》，构成违反治安管理行为的，由公安机关依法予以处罚；构成犯罪的，依法追究刑事责任。

第四十五条 不具备集中处置医疗废物条件的农村，医疗卫生机构未按照《医疗废物管理条例》和本办法的要求处置医疗废物的，由县级以上地方人民政府卫生行政主管部门责令限期改正，给予警告；逾期不改的，处1000元以上5000元以下的罚款；造成传染病传播的，由原发证部门暂扣或者吊销医疗卫生机构执业许可证件；构成犯罪的，依法追究刑事责任。

第四十六条 医疗卫生机构违反《医疗废物管理条例》及本办法规定，导致传染病传播，给他人造成损害的，依法承担民事赔偿责任。

第七章 附 则

第四十七条 本办法所称医疗卫生机构指依照《医疗机构管理条例》的规定取得《医疗机构执业许可证》的机构及疾病预防控制机构、采供血机构。

第四十八条 本办法自公布之日起施行。

卫　生　部
国家环保总局　文件

卫医发〔2003〕287号

关于印发《医疗废物分类目录》的通知

各省、自治区、直辖市卫生厅局、环境保护局，新疆生产建设兵团卫生局、环境保护局：

根据《医疗废物管理条例》，卫生部和国家环境保护总局制定了《医疗废物分类目录》。现印发给你们，请遵照执行。

附件：医疗废物分类目录

中华人民共和国卫生部　　国家环境保护总局

二〇〇三年

附件：

医疗废物分类目录

类别	特征	常见组分或者废物名称
感染性废物	携带病原微生物具有引发感染性疾病传播危险的医疗废物。	1、被病人血液、体液、排泄物污染的物品，包括： ---棉球、棉签、引流棉条、纱布及其他各种敷料； ---一次性使用卫生用品、一次性使用医疗用品及一次性医疗器械； ---废弃的被服； ---其他被病人血液、体液、排泄物污染的物品。
		2、医疗机构收治的隔离传染病病人或者疑似传染病病人产生的生活垃圾。
		3、病原体的培养基、标本和菌种、毒种保存液。
		4、各种废弃的医学标本。
		5、废弃的血液、血清。
		6、使用后的一次性使用医疗用品及一次性医疗器械视为感染性废物。
病理性废物	诊疗过程中产生的人体废弃物和医学实验动物尸体等。	1、手术及其他诊疗过程中产生的废弃的人体组织、器官等。
		2、医学实验动物的组织、尸体。
		3、病理切片后废弃的人体组织、病理蜡块等。

说明：

一次性使用卫生用品是指使用一次后即丢弃的，与人体直接或者间接接触的，并为达到人体生理卫生或者卫生保健目的而使用的各种日常生活用品。

一次性使用医疗用品是指临床用于病人检查、诊断、治疗、护理的指套、手套、吸痰管、阴道窥镜、肛镜、印模托盘、治疗巾、皮肤清洁巾、擦手巾、压舌板、骨垫等接触完整粘膜、皮肤的各类一次性使用医疗、护理用品。

一次性医疗器械指《医疗器械管理条例》及相关配套文件所规定的用于人体的一次性仪器、设备、器具、材料等物品。

医疗卫生机构废弃的麻醉、精神、放射性、毒性等药品及其相关的废物的管理，依照有关法律、行政法规和国家有关规定、标准执行。

抄送：教育部、科技部、国家人口和计划生育委员会、国家食品药品监督管理局、国家中医药管理局、总后卫生部，部直属有关单位及部管医院。

卫生部办公厅　　2003年10月13日印发

校对：郭燕红

中华人民共和国固体废物污染环境防治法

（一九九五年十月三十日第八届全国人民代表大会常务委员会第十六次会议通过 中华人民共和国主席令第98号公布）

第一章 总则

第一条 为了防治固体废物污染环境，保障人体健康，促进社会主义现代化建设的发展，制定本法。

第二条 本法适用于中华人民共和国境内固体废物污染环境的防治。
固体废物污染海洋环境的防治和放射性固体废物污染环境的防治不适用本法。

第三条 国家对固体废物污染环境的防治，实行减少固体废物的产生、充分合理利用固体废物和无害化处置固体废物的原则。

第四条 国家鼓励、支持开展清洁生产，减少固体废物的产生量。
国家鼓励、支持综合利用资源，对固体废物实行充分回收和合理利用，并采取有利于固体废物综合利用活动的经济、技术政策和措施。

第五条 国家鼓励、支持有利于保护环境的集中处置固体废物的措施。

第六条 县级以上人民政府应当将固体废物污染环境防治工作纳入环境保护规划，并采取有利于固体废物污染环境防治的经济、技术政策和措施。

第七条 国家鼓励、支持固体废物污染环境防治的科学研究、技术开发、推广先进的防治技术和普及固体废物污染环境防治的科学知识。

第八条 各级人民政府对在固体废物污染环境防治工作以及相关的综合利用活动中作出显著成绩的单位和个人给予奖励。

第九条 任何单位和个人都有保护环境的义务，并有权对造成固体废物污染环境的单位和个人进行检举和控告。

第十条 国务院环境保护行政主管部门对全国固体废物污染环境的防治工作实施统一监督管理。国务院有关部门在各自的职权范围内负责固体废物污染环境防治的监督管理工作。
的防治县级以上地方人民政府环境保护行政主管部门对本行政区域内固体废物污染环境工作实施统一监督管理。县级以上地方人民政府有关部门在各自的职权范围内负责固体废物污染环境的监督管理工作。
国务院建设行政主管部门和县级以上地方人民政府环境卫生行政主管部门负责城市生活垃圾清扫、收集、储存、运输和处置的监督管理工作。

第二章 固体废物污染环境防治的监督管理

第十一条 国务院环境保护行政主管部门建立固体废物污染环境监测制度，制定统一的监测范围，并会同有关部门组织监测网络。

第十二条 建设产生工业固体废物的项目以及建设储存、处置固体废物的项目，必须遵守国家有关建设项目环境保护管理的规定。

建设项目的环境影响报告书，必须对建设项目产生的固体废物对环境的污染和影响作出评价，规定防治环境污染的措施，并按照国家规定的程序报环境保护行政主管部门批准。环境影响报告书经批准后，审批建设项目的主管部门方可批准该建设项目的可行性研究报告或者设计任务书。

第十三条 建设项目的环境影响报告书确定需要配套建设的固体废物污染环境防治设施，必须与主体工程同时设计、同时施工、同时投产使用。固体废物污染环境防治设施必须经原审批环境影响报告书的环境保护行政主管 部门验收合格后，该建设项目方可投入生产或者使用。对固体废物污染环境防治设施的验收应当与对主体工程的验收同时进行。

第十四条 县级以上人民政府环境保护行政主管部门和其他固体废物污染环境防治工作的监督管理部门，有权依据各自的职责对管辖范围内与固体废物污染环境防治有关的单位进行现场检查。被检查的单位应当如实反映情况，提供必要的资料。检查机关应当为被检查的单位保守技术秘密和业务秘密。

检查人员进行现场检查，应当出示证件。

第三章 固体废物污染环境的防治

第一节 一般规定

第十五条 产生固体废物的单位和个人，应当采取措施，防止或者减少固体废物对环境的污染。

第十六条 收集、贮存、运输、利用、处置固体废物的单位和个人，必须采取扬散、防流失、防渗漏或者其他防止污染环境的措施。

不得在运输过程中沿途丢弃、遗撒固体废物。

第十七条 产品应当采用易回收利用、易处置或者在环境中易消纳的包装物。

产品生产者、销售者、使用者应当按照国家有关规定对可以回收利用的产品包装物和容器等回收利用。

第十八条 国家鼓励科研、生产单位研究、生产易回收利用、易处置或者在环境中易消纳的农用薄膜。

使用农用薄膜的单位个人，应当采取回收利用等措施，防止或者减少农用薄膜对环境的污染。

第十九条 对收集、贮存、运输、处置固体废物的设施、设备和场所，应当加强管理和维护，保证其正常运行和使用。

第二十条 禁止擅自关闭、闲置或者拆除工业固体废物污染环境防治设施、场所；确有必要关闭、闲置或者拆除的，必须经所在地县级以上地方人民政府环境保护行政主管部门核准，并采取措施，防止污染环境。

第二十一条 对造成固体废物严重污染环境的企业事业单位，限期治理。被限期治理的企业事业单位必须按期完成治理任务。限期治理由县级以上人民政府按照国务院规定的权限决定。

第二十二条 在国务院和国务院有关主管部门及省、自治区、直辖市人民政府划定的自然保护区、风景名胜区、生活饮用水源地和其他需要特别保护的区域内，禁止建设工业固体废物集中贮存、处置设施、场所和生活垃圾填埋场。

第二十三条 转移固体废物出省、自治区、直辖市行政区域贮存、处置的，应当向固体废物移出地的省级人民政府环境保护行政主管部门报告，并经固体废物接受地的省级人民政府环境保护行政主管部门许可。

第二十四条 禁止中国境外的固体废物进境倾倒、堆放、处置。

第二十五条 国家禁止进口不能用作原料的固体废物；限制进口可以用作原料的固体废物。

国务院环境保护行政主管部门会同国务院对外经济贸易主管部门制定、调整并公布可以用作原料进口的固体废物的目录，未列入该目录的固体废物禁止进口。

确有必要进口列入前款规定目录中的固体废物用作原料的，必须经国务院环境保护行政主管部门会同国务院对外经济贸易主管部门审查许可，方可进口。

具体办法，由国务院规定。

第二节 工业固体废物污染环境的防治

第二十六条 国务院环境保护行政主管部门应当会同国务院经济综合主管部门和其他有关部门对工业固体废物对环境的污染作出界定，制定防治工业固体废物污染环境的技术政策，组织推广先进的防治工业固体废物污染环境的生产工艺和设备。

第二十七条 国务院经济综合部门应当会同国务院有关部门组织研究、开发和推广减少工业固体废物产生量的生产工艺和设备，公布限期淘汰产生严重污染环境的工业固体废物的落后生产工艺、落后设备的名录。

生产者、销售者、进口者或者使用者必须在国务院经济综合主管部门会同国务院有关部门规定的限期内分别停止生产、销售、进口或者使用列入前款规定的名录中的设备。生产工艺的采用者必须在国务院经济综合主管部门会同国务院有关部门规定的限期内停止采用列入前款规定的工艺。

依照前两款规定被淘汰的设备，不得转让给他人使用。

第二十八条 县级以上人民政府有关部门应当制定工业固体废物污染环境防治工作规划，推动能够减少工业固体废物产生量的先进生产工艺和设备，推动工业固体废物污染环境防治工作。

第二十九条 产生工业固体废物的单位应当建立、健全污染环境防治责任制度，采取防治工业固体废物污染环境的措施。

第三十条 企业事业单位应当合理选择和利用原材料、能源和其他资源，采用先进的生产工艺和设备，减少工业固体废物产生量。

第三十一条 国家实行工业固体废物申报登记制度。

产生工业固体废物的单位必须按照国务院环境保护行政主管部门的规定，向所在地县级以上地方人民政府环境保护行政主管部门提供工业固体废物的产生量、流向、贮存、处置等有关资料。

第三十二条 企业事业单位对其产生的不能利用或者暂时不利用的工业固体废物，必须按照国务院环境保护行政主管部门的规定，建设存贮存或者处置的设施、场所。

第三十三条 露天贮存冶炼渣、化工渣、燃煤灰渣、废矿石、尾矿和其他工业固体废物的，应当设置专用的贮存设施、场所。

第三十四条 建设工业固体废物贮存、处置的设施、场所，必须符合国务院环境保护行政主管部门规定的环境保护标准。

本法施行前产生工业固体废物的单位，没有依照本法第三十二条规定建设工业固体废物贮存或者处置的设施、场所，或者工业固体废物贮存、处置的设施、场所不符合环境保护标准的，必须限期建成或者改造；在限期内，对新产生的污染环境的工业固体废物，应当缴纳排污费或者采取其他措施，采取缴纳排污费措施的单位在限期内提前建成工业固体废物贮存或者处置的设施、场所或者经改造使其符合环境保护标准的，自建成或者改造完成之日起，不再缴纳排污费；在限期内未建成或者经改造仍不符合环境保护标准的，继续缴纳排污费，直至建成或者经改造符合环境保护标准为止。具体办法由国务院规定。排污费用于环境污染的防治，不得挪作他用。

第三节 城市生活垃圾污染环境的防治

第三十五条 任何单位和个人应当遵守城市人民政府环境卫生行政主管部门的规定，在指定的地点倾倒、堆放城市生活垃圾，不得随意扔撒或者堆放。

第三十六条 贮存、运输、处置城市生活垃圾，应当遵守国家有关环境保护和城市环境卫生的规定，防止污染环境。

第三十七条 城市生活垃圾应当及时清运，并积极开展合理利用和无害化处置。

城市生活垃圾应当逐步做到分类收集、贮存、运输和处置。

第三十八条 城市人民政府应当有计划地改进燃料结构，发展城市煤气 、天然气、液化气和其他清洁能源。

城市人民政府有关部门应当组织净菜进城，减少城市生活垃圾。

城市人民政府有关部门应当统筹规划，合理安排收购网点，促进废弃物的回收利用工作。

第三十九条 城市人民政府应当配套建设城市生活垃圾清扫、收集、贮存、运输、处置设施。

第四十条 建设城市生活垃圾处置设施、场所，必须符合国务院环境保护行政主管部门和国务院建设行政主管部门规定的环境保护和城市环境卫生标准。

禁止擅自关闭、闲置或者拆除城市生活垃圾处置设施、场所；确有必要关闭、闲置或者拆除的，必须经所在地县级以上地方人民政府环境卫生行政主管部门和环境保护行政主管部门核准，并采取措施，防止污染环境。

第四十一条 施工单位应当及时清运、处置建筑施工过程中产生的垃圾，并采取措施，防止污染环境。

第四章 危险废物污染环境防治的特别规定

第四十二条 危险废物污染环境的防治，适用本章规定；本章未作规定的，适用本法其他有关规定。

第四十三条 国务院环境保护行政主管部门应当会同国务院有关部门制定国家危险废物名录，规定统一的危险废物鉴别标准、鉴别方法和识别标志。

第四十四条 对危险废物的容器和包装物以及收集、贮存、运输、处置危险废物的设施、场所、必须设置危险废物识别标志。

第四十五条 产生危险废物的单位，必须按照国家有关规定申报登记。

第四十六条 产生危险废物的单位，必须按照国家有关规定处置；不处置的，由所在地县级以上地方人民政府环境保护行政主管部门责令限期改正；逾期不处置或者处置不符合国家有关规定的，由所在地县级以上地方人民政府环境保护行政主管部门指定单位按照国家有关规定代为处置，处置费用由产生危险废物的单位承担。

第四十七条 城市人民政府应当组织建设对危险废物进行集中处置的设施。

第四十八条 以填埋方式处置危险废物不符合国务院环境保护行政主管部门的规定的，应当缴纳危险废物排污费。危险废物排污费征收的具体办法由国务院规定。

危险废物排污费用于危险废物污染环境的防治，不得挪作他用。

第四十九条 从事收集、贮存、处置危险废物经营活动的单位，必须向县级以上人民政府环境保护行政主管部门申请领取经营许可证，具体管理办法由国务院规定。

禁止无经营许可证或者不按照经营许可证规定从事危险废物收集、贮存、处置的经营活动。

禁止将危险废物提供或者委托给无经营许可证的单位从事收集、贮存、处置的经营活动。

第五十条 收集、贮存危险废物，必须按照危险废物特性分类进行。禁止混合收集、贮存、运输、处置性质不相容而未经安全性处置的危险废物。

禁止将危险废物混入非危险废物中贮存。

第五十一条 转移危险废物的，必须按照国家有关规定填写危险废物转移联单，并向危险废物移出地和接受地的县级以上地方人民政府环境保护行政主管部门报告。

第五十二条 运输危险废物，必须采取防止污染环境的措施，并遵守国家有关危险货物运输管理的规定。

禁止将危险废物与旅客在同一运输工具上载运。

第五十三条 收集、贮存、运输、处置危险废物的场所、设施、设备和容器、包装物及其他物品转作他用时，必须经过消除污染的处理，方可使用。

第五十四条 直接从事收集、贮存、运输、利用、处置危险废物的人员，应当接受专业培训，经考核合格，方可从事该项工作。

第五十五条 产生、收集、贮存、运输、利用、处置危险废物的单位，应当制定在发生意外事故时采取的应急措施和防范措施，并向所在地县级以上人民政府环境保护行政主管部门报告；环境保护行政主管部门应当进行检查。

第五十六条 因发生事故或者其他突发性事件，造成危险废物严重污染环境的单位，必须立即采取措施消除或者减轻对环境的污染危害，及时通报可能受到污染危害的单位和居民，并向所在地县级以上人民政府环境保护行政主管部门和有关部门报告，接受调查处理。

第五十七条 在发生危险废物严重污染环境、威胁居民生命财产安全时，县级以上地方人民政府环境保护行政主管部门必须立即向本级人民政府报告，由人民政府采取有效措施，解除或者减轻危害。

第五十八条 禁止经中华人民共和国过境转移危险废物。

第五章 法律责任

第五十九条 违反本法规定，有下列行为之一的，由县级以上人民政府环境保护行政主管部门责令限期改正，并处罚款

（一） 不按照国家规定申报登记工业固体废物或者危险废物，或者在申报登记时弄虚作假的；

（二） 拒绝环境保护行政主管部门现场检查，或者在被检查时弄虚作假的；

（三） 不按照国家规定缴纳排污费的；

（四） 将列入限期淘汰名录淘汰的设备转让给他人使用的；

（五） 擅自关闭、闲置或者拆除固体废物污染环境防治设施、场所的；

（六） 在自然保护区、风景名胜区、生活饮用水源地和其他需要特别保护的区域内，建设工业固体废物集中贮存、处置设施、场所或者生活垃圾填埋场的；

（七） 擅自转移固体废物出省、自治区、直辖市行政区域贮存、处置的。

有前款第（一）项、第（二）项行为的，处一万元以下的罚款；有前款第（三）项行为的，处应缴纳排污费金额百分之五十以下的罚款；有前款第（四）项、第（五）项、第（六）项、第（七）项行为之一的，处五万元以下的罚款。

第六十条 违反本法规定，生产、销售、进口或者使用淘汰的设备，或者采用淘汰的生产工艺的，由县级以上人民政府综合主管部门责令改正；情节严重的，由县级以上人民政府经济综合主管部门提出意见，报请同级人民政府按照国务院规定的权限责令停业、关闭。

第六十一条 建设项目中需要配套建设的固体废物污染环境防治设施未建成或者未经验收合格即投入生产或者使用的，由审批该建设项目的环境影响报告书的环境保护行政主管部门责令停止生产或者使用，可以并处十万元以下的罚款。

第六十二条 对经限期治理逾期未完成治理任务的企业事业单位，可以根据所造成的危害后果处十万元以下的罚款，或者责令停业、关闭。

前款规定的罚款由环境保护行政主管部门决定。责令停业、关闭，由县级以上人民政府按照国务院规定的权限决定。

第六十三条 贮存、运输、处置城市生活垃圾违反本法规定的，按照国务院关于环境保护和城市环境卫生的有关规定予以处罚。

第六十四条 违反本法有关危险废物污染环境防治的规定，有下列行为之一的，由县级以上人民政府环境保护行政主管部门责令停止违法行为、限期改正，并处五万元以下的罚款

（一） 不设置危险废物识别标志的；

（二） 将危险废物提供或者委托给无经营许可证的单位收集、贮存、处置的；

（三） 转移危险废物，不按照国家规定填写危险废物转移联单或者未向移出地和接受地的县级以上人民政府环境保护行政主管部门报告的；

（四） 将危险废物混入非危险废物中贮存的；

（五） 未经安全性处置，混合收集、贮存、运输、处置具有不相容性质的危险废物的；

（六） 将危险废物和旅客在同一运输工具上载运的；

（七） 危险废物产生者不处置其产生的危险废物或者不承担依法应当承担的处置费用的；

（八） 未经消除污染的处理，将收集、贮存、运输、处置危险废物的场所、设施、设备和容器、包装物及其他物品转作他用的。

第六十五条 无经营许可证或者不按照经营许可证规定从事收集、贮存、处置危险废物经营活动的，由县级以上地方人民政府环境保护行政主管部门责令停止违法行为，没收违法所得，可以并处违法所得一倍以下的罚款。

不按照经营许可证规定从事前款活动的，还可以由发证机关吊销经营许可证。

第六十六条 违反本法规定，将中国境外的固体废物进境倾倒、堆放、处置，或者未经国务院有关主管部门许可擅自进口固体废物用作原料的，由海关责令退运该固体废物，可以并处十万元以上一百万元以下的罚款。逃避海关监管，构成走私罪的，依法追究刑事责任。

以原料利用为名，进口不能用作原料的固体废物的，依照前款规定处罚。

第六十七条 违反本法规定，经中华人民共和国过境转移危险废物的，由海关责令退运该危险废物，可以并处以五万元以上五十万元以下的罚款。

第六十八条 对已经非法入境的固体废物，由省级以上人民政府环境保护行政主管部门依法向海关提出处理意见，海关应当依照本法第六十六条的规定作出处罚决定；已经造成环境污染的，由省级以上人民政府行政主管部门责令进口者消除污染。

第六十九条 违反本法规定，造成固体废物污染环境事故的，由县级以上人民政府环境保护行政主管部门处十万元以下的罚款；造成重大损失的，按照直接损失的百分之三十计算罚款，但是最高不超过五十万元；对负有直接责任的主管人员和其他直接责任人员，由其所在单位或者政府主管机关给予行政处分。

第七十条 罚款一律上交国库，任何单位和个人不得截留。

第七十一条 受到固体废物污染损害的单位和个人，有权要求依法赔偿损失。

赔偿责任和赔偿金额的纠纷，可以根据当事人的请求，由环境保护行政主管部门或者其他固体废物污染环境防治工作的监督管理部门调解处理；调解不成的，当事人可以向人民法院提起诉讼。当事人也可以直接向人民法院提起诉讼。

第七十二条 违反本法规定，收集、贮存、处置危险废物，造成重大环境污染事故，导致公私财产重大损失或者人身伤亡的严重后果的，比照刑法第一百一十五条或者第一百八十七条的规定追究刑事责任。

单位犯本条罪，处以罚金，并对直接负责的主管人员和其他直接责任人员依照前款规定追究刑事责任。

第七十三条 固体废物污染环境防治监督管理人员滥用职权、玩忽职守、徇私舞弊，构成犯罪的，依法给予行政处分。

第六章 附 则

第七十四条 本法中下列用语的含义

（一） 固体废物，是指在生产建设、日常生活和其他活动中产生的污染环境的固态、半固态废弃物质。

（二） 工业固体废物，是指在工业、交通等生产活动中产生的固体废物。

（三） 城市生活垃圾，是指在城市日常生活中或者为城市日常生活提供服务的活动中产生的固体废物以及法律、行政法规规定视为城市生活垃圾的固体废物。

（四） 危险废物，是指列入国家危险废物名录或者根据国家规定的危险废物鉴别标准和鉴别方法认定的具有危险特性的废物。

（五） 处置，是指将固体废物焚烧和用其他改变固体废物的物理、化学、生物 特性的方法，达到减少已产生的固体废物数量、缩小固体废物体积、减少或者消除其危险成分的活动，或者将固体废物最终置于符合环境保护规定要求的场所或者设施并不再回取的活动。

第七十五条 液态废物和置于容器中的气态废物的污染防治，适用本法；但是，排入水体的废水和排入大气的废气的污染防治适用有关法律，不适用本法。

第七十六条 中华人民共和国缔结或者参加的固体废物污染环境防治有关的国际条约与本法有不同规定的，适用国际条约的规定；但是，中华人民共和国声明保留的条款除外。

中华人民共和国传染病防治法

《中华人民共和国传染病防治法》已由中华人民共和国第七届全国人民代表大会常务委员会第六次会议于１９８９年２月２１日通过，现予公布，自１９８９年９月１日起施行。

中华人民共和国主席　杨尚昆

１９８９年２月２１日

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第一章　总　则

第一条　为了预防、控制和消除传染病的发生与流行，保障人体健康，制定本法。

第二条　国家对传染病实行预防为主的方针，防治结合、分类管理。

第三条　本法规定管理的传染病分为甲类、乙类和丙类。

甲类传染病是指：鼠疫、霍乱。

乙类传染病是指：病毒性肝炎、细菌性和阿米巴性痢疾、伤寒和副伤寒、艾滋病、淋病、梅毒、脊髓灰质炎、麻疹、百日咳、白喉、流行性脑脊髓膜炎、猩红热、流行性出血热、狂犬病、钩端螺旋体病、布鲁氏菌病、炭疽、流行性和地方性斑疹伤寒、流行性乙型脑炎、黑热病、疟疾、登革热。

丙类传染病是指：肺结核、血吸虫病、丝虫病、包虫病、麻风病、流行性感冒、流行性腮腺炎、风疹、新生儿破伤风、急性出血性结膜炎、除霍乱、痢疾、伤寒和副伤寒以外的感染性腹泻病。

国务院可以根据情况，增加或者减少甲类传染病病种，并予公布；国务院卫生行政部门可以根据情况，增加或者减少乙类、丙类传染病病种，并予公布。

第四条　各级政府领导传染病防治工作，制定传染病防治规划，并组织实施。

第五条　各级政府卫生行政部门对传染病防治工作实施统一监督管理。

各级各类卫生防疫机构按照专业分工承担责任范围内的传染病监测管理工作。

各级各类医疗保健机构承担责任范围内的传染病防治管理任务，并接受有关卫生防疫机构的业务指导。

军队的传染病防治工作，依照本法和国家有关规定办理，由中国人民解放军卫生主管部门实施监督管理。

第六条　同防治传染病有关的食品、药品和水的管理以及国境卫生检疫，分别依照有关法律规定办理。

第七条　在中华人民共和国领域内的一切单位和个人，必须接受医疗保健机构、卫生防疫机构有关传染病的查询、检验、调查取证以及预防、控制措施，并有权检举、控告违反本法的行为。

第八条　对预防、控制传染病做出显著成绩和贡献的单位和个人，给予奖励。

第七十七条 本法自 1996 年 4 月 1 日起施行。

附刑法有关条款

第一百一十五条 违反爆炸性、易燃性、放射性、毒害性、腐蚀性物品的管理规定，在生产、出厂、运输、使用中发生重大事故，造成严重后果的，处三年以下有期徒刑或者拘役；后果特别严重的，处三年以上七年以下有期徒刑。

第一百八十七条 国家工作人员由于玩忽职守，致使公共财物、国家和人民利益遭受重大损失的，处五年以下有期徒刑或者拘役。

第二章　预 防

第九条　各级政府应当开展预防传染病的卫生健康教育，组织力量消除鼠害和蚊、蝇等病媒昆虫以及其他传播传染病的或者患有人畜共患传染病的动物的危害。

第十条　地方各级政府应当有计划地建设和改造公共卫生设施，对污水、污物、粪便进行无害化处理，改善饮用水卫生条件。

第十一条　各级各类医疗保健机构应当设立预防保健组织或者人员，承担本单位和责任地段的传染病预防、控制和疫情管理工作。

市、市辖区、县设立传染病医院或者指定医院设立传染病门诊和传染病病房。

第十二条　国家实行有计划的预防接种制度。

国家对儿童实行预防接种证制度。

第十三条　供水单位供应的饮用水必须符合国家规定的卫生标准。

第十四条　传染病病人、病原携带者和疑似传染病病人，在治愈或者排除传染病嫌疑前，不得从事国务院卫生行政部门规定禁止从事的易使该传染病扩散的工作。

第十五条　医疗保健机构、卫生防疫机构和从事致病性微生物实验的单位，必须严格执行国务院卫生行政部门规定的管理制度、　操作规程，防止传染病的医源性感染、医院内感染、实验室感染和致病性微生物的扩散。

第十六条　传染病菌种、毒种的保藏、携带、运输，必须按照国务院卫生行政部门的规定严格管理。

第十七条　被甲类传染病病原体污染的污水、污物、粪便，有关单位和个人必须在卫生防疫机构的指导监督下进行严密消毒后处理；拒绝消毒处理的，　当地政府可以采取强制措施。

被乙类、丙类传染病病原体污染的污水、污物、粪便，有关单位和个人必须按照卫生防疫机构提出的卫生要求进行处理。

第十八条　同人畜共患传染病有关的家畜家禽的传染病防治管理工作，由各级政府畜牧兽医部门负责。

同人畜共患传染病有关的野生动物，未经当地或者接收地的政府畜牧兽医部门检疫，禁止出售或者运输。

狂犬病防治管理工作，由各级政府畜牧兽医、卫生、公安部门按照国务院的规定分工负责。

第十九条　在自然疫源地和可能是自然疫源地的地区兴办的大型建设项目开工前，建设单位应当申请当地卫生防疫机构对施工环境进行卫生调查，并根据卫生防疫机构的意见，采取必要的卫生防疫措施。施工期间，建设单位应当设立专人负责工地上的卫生防疫工作。

第二十条　对从事传染病预防、医疗、科研、教学的人员，现场处理疫情的人员，以及在生产、工作中接触病病原体的其他人员，有关单位应当根据国家规定，采取有效的防护措施和医疗保健措施。

第三章　疫情的报告和公布

第二十一条　任何人发现传染病病人或者疑似传染病病人时，都应当及时向附近的医疗保健机构或者卫生防疫机构报告。

执行职务的医疗保健人员、卫生防疫人员发现甲类、乙类和监测区域内的丙类传染病病人、病原携带者或者疑似传染病病人，必须按照国务院卫生行政部门规定的时限向当

地卫生防疫机构报告疫情。卫生防疫机构发现传染病流行或者接到甲类传染病和乙类传染病中的艾滋病、炭疽中的肺炭疽的疫情报告，应当立即报告当地卫生行政部门，由当地卫生行政部门立即报告当地政府，同时报告上级卫生行政部门和国务院卫生行政部门。

第二十二条　各级政府有关主管人员和从事传染病的医疗保健、卫生防疫、监督管理的人员，不得隐瞒、谎报或者授意他人隐瞒、谎报疫情。

第二十三条　国务院卫生行政部门应当及时地如实通报和公布疫情，并可以授权省、自治区、直辖市政府卫生行政部门及时地如实通报和公布本行政区域的疫情。

第四章　控 制

第二十四条　医疗保健机构、卫生防疫机构发现传染病时，应当及时采取下列控制措施：

（一）对甲类传染病病人和病原携带者，乙类传染病中的艾滋病病人、炭疽中的肺炭疽病人，予以隔离治疗。隔离期限根据医学检查结果确定。拒绝隔离治疗或者隔离期未满擅自脱离隔离治疗的，可以由公安部门协助治疗单位采取强制隔离治疗措施；

（二）对除艾滋病病人、炭疽中的肺炭疽病人以外的乙类、丙类传染病病人，根据病情，采取必要的治疗和控制传播措施；

（三）对疑似甲类传染病病人，在明确诊断前，在指定场所进行医学观察；

（四）对传染病病人、病原携带者、疑似传染病病人污染的场所、物品和密切接触的人员，实施必要的卫生处理和预防措施。

传染病病人及其亲属和有关单位以及居民或者村民组织应当配合实施前款所列措施。

第二十五条　传染病暴发、流行时，当地政府当立即组织力量进行防治，切断传染病的传播途径；必要时，报经上一级地方政府决定，可以采取下列紧急措施：

（一）限制或者停止集市、集会、影剧院演出或者其他人群聚集的活动；

（二）停工、停业、停课；

（三）临时征用房屋、交通工具；

（四）封闭被传染病病原体污染的公共饮用水源。

县级以上地方政府接到下一级政府关于采取前款所列紧急措施的报告时，应当在规定的时限内作出决定。

紧急措施的解除，由原决定机关宣布。

第二十六条　甲类、乙类传染病暴发、流行时，县级以上地方政府报经上一级地方政府决定，可以宣布疫区，在疫区内采取本法第二十五条规定的紧急措施，并可以对出入疫区的人员、物资和交通工具实施卫生检疫。经省、自治区、直辖市政府决定，可以对甲类传染病疫区实施封锁；封锁大、中城市的疫区或者跨省、自治区、直辖市的疫区，以及封锁疫区导致中断干线交通或者封锁国境的，由国务院决定。

疫区封锁的解除，由原决定机关宣布。

第二十七条　发生重大传染病疫情时，国务院卫生行政部门有权在全国范围或者跨省、自治区、直辖市范围内，地方各级政府卫生行政部门有权在本行政区域内，调集各级各类医疗保健人员、卫生防疫人员参加疫情控制工作。

第二十八条　患鼠疫、霍乱和炭疽死亡的，必须将尸体立即消毒，就近火化。患其他传染病死亡的，必要时，应当将尸体消毒后火化或者按照规定深埋。

医疗保健机构、卫生防疫机构必要时可以对传染病病人尸体或者疑似传染病病人尸体进行解剖查验。

省、自治区人民代表大会常务委员会对民族自治地方执行前两款的规定，必要时可以

作出变通的规定。

第二十九条　医药部门和其他有关部门应当及时供应预防和治疗传染病的药品和器械。生物制品生产单位应当及时供应预防和治疗传染病的生物制品。预防和治疗传染病的药品、生物制品和器械应当有适量的储备。

第三十条　铁路、交通、民航部门必须优先运送卫生行政部门批准的处理疫情的人员、防治药品、生物制品和器械。

第三十一条　以控制传染病传播为目的的交通卫生检疫的具体办法，由国务院卫生行政部门会同有关部门制定，报国务院批准后施行。

第五章　监 督

第三十二条　各级政府卫生行政部门对传染病防治工作行使下列监督管理职权：

（一）对传染病的预防、治疗、监测、控制和疫情管理措施进行监督、检查；

（二）责令被检查单位或者个人限期改进传染病防治管理工作；

（三）依照本法规定，对违反本法的行为给予行政处罚。

国务院卫生行政部门可以委托其他有关部门卫生主管机构，在本系统内行使前款所列职权。

第三十三条　各级政府卫生行政部门和受国务院卫生行政部门委托的其他有关部门卫生主管机构以及各级各类卫生防疫机构内设立传染病管理监督员，执行卫生行政部门或者其他有关部门卫生主管机构交付的传染病监督管理任务。

传染病管理监督员由合格的卫生专业人员担任，由省级以上政府卫生行政部门聘任并发给证件。

第三十四条　各级各类医疗保健机构设立传染病管理检查员，负责检查本单位及责任地段的传染病防治管理工作，并向有关卫生防疫机构报告检查结果。

传染病管理检查员由县级以上地方政府卫生行政部门批准并发给证件。

第六章　法律责任

第三十五条　违反本法规定，有下列行为之一的，由县级以上政府卫生行政部门责令限期改正，可以处以罚款；有造成传染病流行危险的，由卫生行政部门报请同级政府采取强制措施：

（一）供水单位供应的饮用水不符合国家规定的卫生标准的；

（二）拒绝按照卫生防疫机构提出的卫生要求，对传染病病原体污染的污水、污物、粪便进行消毒处理的；

（三）准许或者纵容传染病病人、病原携带者和疑似传染病病人从事国务院卫生行政部门规定禁止从事的易使该传染病扩散的工作的；

（四）拒绝执行卫生防疫机构依照本法提出的其他预防、控制措施的。

第三十六条　当事人对罚款决定不服的，可以自收到处罚决定通知书之日起十五日内向上一级卫生行政部门申请复议；对复议决定仍然不服的，可以自收到复议决定通知书之日起十五日内向法院提起诉讼。当事人也可以自收到处罚决定通知书之日起十五日内，直接向法院提起诉讼。逾期不申请复议或者不提起诉讼又不履行的，做出处罚决定的卫生行政部门可以申请法院强制执行。

第三十七条　有本法第三十五条所列行为之一，引起甲类传染病传播或者有传播严重危险的，比照刑法第一百七十八条的规定追究刑事责任。

第三十八条　从事实验、保藏、携带、运输传染病菌种、毒种的人员，违反国务院卫生行政部门的有关规定，造成传染病菌种、毒种扩散，后果严重的，依照刑法第一百一

十五条的规定追究刑事责任；情节轻微的，给予行政处分。

第三十九条　从事传染病的医疗保健、卫生防疫、监督管理的人员和政府有关主管人员玩忽职守，造成传染病传播或者流行的，给予行政处分；情节严重、构成犯罪的，依照刑法第一百八十七条的规定追究刑事责任。

第七章　附 则

第四十条　国务院卫生行政部门根据本法制定实施办法，报国务院批准后施行。

第四十一条　本法自１９８９年９月１日起施行。

附：刑法有关条文

第一百七十八条　违反国境卫生检疫规定，引起检疫传染病的传播，或者有引起检疫传染病传播严重危险的，处三年以下有期徒刑或者拘役，可以并处或者单处罚金。

第一百一十五条　违反爆炸性、易燃性、放射性、毒害性、腐蚀性物品的管理规定，在生产、储存、运输、使用中发生重大事故，造成严重后果的，处三年以下有期徒刑或者拘役；后果特别严重的，处三年以上七年以下有期徒刑。

第一百八十七条　国家工作人员由于玩忽职守，致使公共财产、国家和人民利益遭受重大损失的，处五年以下有期徒刑或者拘役。

国家危险废物名录

（1998年1月4日，国家环保局、国家经贸委、外经贸部、公安部颁布，1998年7月1日实施环发[1998]089号）

国家危险废物名录说明

一、为防止危险废物对环境的污染，加强对危险废物的管理，保护环境和保障人民身体健康，根据《中华人民共和国固体废物污染环境防治法》，制定《国家危险废物名录》。

二、国家制定《危险废物鉴别标准》。凡《名录》中所列废物类别高于鉴别标准的属危险废物，列入国家危险废物管理范围；低于鉴别标准的，不列入国家危险废物管理。

三、对需要制定危险废物鉴别标准废物类别，在其鉴别标准颁布以前，仅作为危险废物登记使用。

四、危险废物的管理按照《中华人民共和国固体废物污染环境防治法》中有关危险废物的管理条款执行。

五、本次公布的《国家危险废物名录》为第一批执行《名录》。随着经济和科学技术的发展，《国家危险废物名录》将不定期修订。

六、本《名录》由国家环境保护总局负责解释。

编号	废物类别	废物来源	常见危害组分或废物名称
HW01	医院临床废物	从医院、医疗中心和诊所的医疗服务中产生的临床废物 ——手术、包扎残余物 ——生物培养、动物试验残余物 ——化验检查残余物 ——传染性废物 ——废水处理污泥	手术残物，敷料、化验废物，传染性废物，动物试验废物
HW02	医药废物	从医用药品的生产制作过程中产生的废物，包括兽药产品(不含中药类废物) ——蒸馏及反应残余物 ——高浓度母液及反应基或培养基废物 ——脱色过滤(包括载体)物 ——用过废弃的吸附剂、催化剂、溶剂 ——生产中产生的报废药品及过期原料	废抗菌药、甾类药、抗组织胺类药、镇痛药、心血管药、神经系统药、杂药，基因类废物
HW03	废药物、药品	过期、报废的无标签的及多种混杂的药物、药品(不包括HW01，HW02类中的废药品) ——生产中产生的报废药品(包括药品废原料和中间体反应物) ——使用单位(科研、监测、学校、医疗单位、化验室等)积压或报废的药品(物) ——经营部门过期的报废药品(物)	废化学试剂，废药品，废药物
HW04	农药废物	来自杀虫、灭菌、除草、灭鼠和植物生长调节剂的生产、经销、配制和使用过程中产生的废物	有机磷杀虫剂、有机氯杀虫剂、有机氮杀虫剂、氨基甲酸酯类杀虫剂、拟除虫菊酯

		——蒸馏及反应残余物 ——生产过程母液及(反应罐及容器)清洗液 ——吸附过滤物(包括载体，吸附剂，催化剂) ——废水处理污泥 ——生产、配制过程中的过期原料 ——生产、销售、使用过程中的过期和淘汰产品 ——沾有农药及除草刑的包装物及容器	类杀虫剂、杀螨剂、有机磷杀菌剂、有机氯杀菌剂、有机硫杀菌剂、有机锡杀菌剂、有机氮杀菌剂、醌类杀菌剂、无机杀菌剂、有机胂杀菌剂、氨基甲酸酯类除草剂、酸类除草剂、酚类除草剂、酰胺类除草剂、取代脲类除草剂、苯氧羧酸类除草剂、均三氮苯类除草剂、无机除草剂
HW05	木材防腐剂废物	从木材防腐化学品的生产、配制和使用中产生的废物(不包括与HW04类重复的废物) ——生产单位生产中产生的废水处理污泥、工艺反应残余物、吸附过滤物及载体 ——使用单位积压、报废或配制过剩的木材防腐化学品 ——销售经营部门报废的木材防腐化学品	含五氯酚，苯酚，2一氯酚，甲酚，对氯间甲酚，三氯酚，屈萘，四氯酚，杂酚油，萤蒽，苯并a芘，2，4一二甲酚，2，4一二硝基酚，苯并(b)萤蒽，苯并(a)蒽，二苯并(a)蒽的废物
HW06	有机溶剂废物	从有机溶剂生产、配制和使用过程中产生的废物(不包括HW42类的废有机溶剂) ——有机溶剂的合成、裂解、分离、脱色、催化、沉淀、精馏等过程中产生的反应残余物，吸附过滤物及载体 ——配制和使用过程中产生的含有机溶剂的清洗杂物	废催化剂，清洗剥离物，反应残渣及滤渣，吸附物与载体废物
HW07	热处理含氰废物	从含有氯化物热处理和退火作业中产生的废物 ——金属含氰热处理 ——含氰热处理回火池冷却 ——含氰热处理炉维修 ——热处理渗碳炉	含氰热处理钡渣，含氰污泥及冷却液，含氰热处理沪内衬，热处理渗碳氰渣
HW08	废矿物油	不适合原来用途的废矿物油 ——来自于石油开采和炼制产生的油泥和油脚 ——矿物油类仓贮过程中产生的沉积物 ——机械、动力、运输等设备的更换油及清洗油(泥) ——金属轧制、机械加工过程中产生的废油(渣) ——含油废水处理过程中产生的废油及油泥 ——油加工和油再生过程中产生的油渣及过滤介质	废机油、原油、液压油、真空泵油、柴油、汽油、重油、煤油、热处理油、樟脑油、润滑油(脂)、冷却油
HW09	废乳化液	从机械加工、设备清洗等过程中产生的废乳化液、废油水混合物	废皂液、乳化油/水、烃/水混合物、乳化液(膏)、切

		——生产、配制、使用过程中产生的过剩乳化液(膏) ——机械加工、金属切削和冷拔过程产生的废乳化剂 ——清洗油罐、油件过程中产生的油水、烃水混合物 ——来自于(乳化掖)水压机定期更换的乳化废液	削剂、冷却剂、润滑剂、拔丝剂
HW10	含多氯联苯废物	含有或沾染多氯联苯(PCBs)，多氯三联苯(PCTs)、多溴联苯(PBBs)的废物质和废物品 ——过剩的、废弃的、封存的、待替换的含有 PCBs、PBBs 和 PCTs 的电力设备(电容器、变压器) ——从含有 PCBs、PBBs 或 PCTs 的电力设备中倾倒出的介质油、绝缘油、冷却油及传热油 ——来自含有 PCBs，PBBs 和 PCTs 或被这些物质污染的电力设备的拆装过程中的清洗液 ——被 PCBs，PBBs 和 PCTs 污染的土壤及包装物	含多氯联苯(PCBs)，多溴联苯(PBBs)、多氯三联苯(PCTs)废物
HW11	精(蒸)馏残渣	从精炼、蒸馏和任何热解处理中产生的废焦油状残留物 ——煤气生产过程中产生的焦油渣 ——原油蒸馏过程中产生的焦油残余物 ——原油精制过程中产生的沥青状焦油及酸焦油 ——化学品生产过程中产生的蒸馏残渣和蒸馏釜底物 ——化学品原科生产的热解过程中产生的焦油状残余物 ——被工业生产过程中产生的焦油或蒸馏残余物所污染的土壤 ——盛装过焦油状残余物的包装和容器	沥青渣，焦油渣，废酸焦油，酚渣，蒸馏釜残物，精馏釜残物，甲苯渣，液化石油气残液(含苯并(a)芘、屈萘、萤蒽、多环芳烃类废物)
HW12	染料、涂料废物	从油墨、染料、颜料、油漆、真漆、罩光漆的生产配制和使用过程中产生的废物 ——生产过程中产生的废弃的颜料、染料、涂料和不合格产品 ——染料、颜料生产硝化、氧化、还原、磺化、重氮化、卤化等化学反应中产生的废母液、残渣、中间体废物 ——油漆、油墨生产、配制和使用过程中产生的含颜料、油墨的有机溶剂废物 ——使用酸、碱或有机溶剂清洗容器设备	废酸性染料、碱性染料、媒染染料、偶氮染料、直接染料、冰染染料、还原染料、硫化染料、活性染料、醇酸树脂涂料、丙烯酸树脂涂料、聚氨酯树脂涂料、聚乙烯树脂涂料、环氧树脂涂料、双组份涂料、油墨、重金属颜料

		产生的污泥状剥离物 ——含有染料、颜料、油墨、油漆残余物的废弃包装物 ——废水处理污泥	
HW13	有机树脂类废物	从树脂、胶乳、增塑剂、胶水/胶合剂的生产、配制和使用过程中产生的废物 ——生产、配制、使用过程中产生不合格产品、废副产物 ——在合成、酯化、缩合等反应中产生的废催化剂、高浓度废液 ——精馏、分离、精制过程中产生的釜残液、过滤介质和残渣 ——使用溶剂或酸、碱清洗容器设备剥离下的树脂状、黏稠杂物 ——废水处理污泥	含邻苯二甲酸酯类，脂肪酸二元酸酯类，磷酸酯类，环氧化合物类，偏苯三甲酸酯类，聚酯类，氯化石蜡，二元醇和多元醇酯类，磺酸衍生物的废物
HW14	新化学品废物	从研究和开发或教学活动中产生的尚未鉴定的和(或)新的并对人类和(或)环境的影响未明的化学废物	新化学品研制中产生的废物
HW15	爆炸性废物	在生产、销售、使用爆炸物品过程中产生的次品、废品及具有爆炸性质的废物 ——不稳定，在无爆震时容易发生剧烈变化的废物 ——能和水形成爆炸性混合物 ——经过发热、吸湿、自发的化学变化具有着火倾向的废物 ——在有引发源或加热时能爆震或爆炸的废物	含叠氮乙酰，硝酸乙酰酯，叠氮铵，氯酸铵，六硝基高钴酸铵，硝酸铵，氮化铵，过碘酸铵，高锰酸铵，苦味酸铵，四过氧铬酸铵，叠氮羰基胍，叠氮钡，氯化重氮苯，苯并三唑，亚硝基胍，硝化甘油，四硝基戊四醇，三硝基氮苯，聚乙烯硝酸酯，硝酸钾，叠氮化银，氮化银，三硝基苯间二酚银，四氮烯银，无烟火药，叠氮化钠，苦味酸钠，四硝基甲烷、四氮化四硒，四氮化四硫，四氮烯，氮化铊，二氮化三铅，二氮化三汞，三硝基苯，氯酸钾，雷汞，雷银，三硝基甲苯，三硝基间苯二酚的废物
HW16	感光材料废物	从摄影化学品、感光材料的生产、配制、使用中产生的废物 ——生产过程中产生的不合格产品和过期产品 ——生产过程中产生的残渣及废水污泥 ——出版社、报社、印刷厂、电影厂在使用和经营活动中产生的废显(定)影液、胶片及废像纸	废显影液、定影液、正负胶片、像纸、感光原料及药品

		——社会照像部、冲洗部在使用和经营活动中产生的废显(定)影液、胶片及废像纸 ——医疗院所的X光和CT检查中产生的废显(定)影液及胶片	
HW17	表面处理废物废物	从金属和塑料表面处理过程中产生的 ——电镀行业的电镀槽渣、槽液及水处理污泥 ——金属和塑料表面酸(碱)洗、除油、除锈、洗涤工艺产生的腐蚀液、洗涤液和污泥 ——金属和塑料表面磷化、出光、化抛过程中产生的残渣(液)及污泥 ——镀层剥除过程中产生的废液及残渣	废电镀溶液，镀槽淤渣，电镀水处理污泥，表面处理酸碱渣，氧化槽渣，磷化渣，亚硝酸盐废渣
HW18	焚烧处置残渣	从工业废物处置作业中产生的残余物	焚烧处置残渣及灰尘
HW19	含金属羰基化合物废物	在金属羰基化合物制造以有使用过程中产生的含有羰基化合物成份的废物 ——精细化工产品生产 ——金属有机化合物的合成	金属羰基化合物(五羰基铁，八羰基二钴，羰基镍，三羰基钴，氢氧化四羰基钴)废物
HW20	含铍废物	含铍及其化合物的废物 ——稀有金属冶炼 ——铍化合物生产	含铍，硼氢化铍，溴化铍，氢氧化铍，碘化铍，碳酸铍，硝酸铍，氧化铍，硫酸铍，氟化铍，氯化铍，硫化铍的废物
HW21	含铬废物	含有六价铬化合物的废物 ——化工(铬化合物)生产 ——皮革加工(鞣革)业 ——金属、塑料电镀 ——酸性媒介染料染色 ——颜料生产与使用 ——金属铬冶炼(修合金)	含铬酸酐，(重)铬酸钾，(重)铬酸钠，铬酸，重铬酸，三氧化铬，铬酸锌，铬酸钾，铬酸钙，铬酸银，铬酸铅，铬酸钡的废物
HW22	含铜废物	含有铜化合物的废物 ——有色金属采选和冶炼 ——金属、塑料电镀 ——铜化合物生产	含溴化(亚)铜，氢氧化铜，硫酸(亚)铜，磺化(亚)铜，碳酸铜，硝酸铜，硫化铜，氟化铜，硫化(亚)铜，氯化(亚)铜，醋酸铜，氧化铜钾，磷酸铜，二水合氯化铜铵的废物
HW23	含锌废物	含有锌化合物的废物 ——有色金属采选及冶炼 ——金属、塑料电镀 ——颜料、油漆、橡胶加工 ——锌化合物生产 ——含锌电池制造业	含溴化锌，碘化锌，硝酸锌，硫酸锌，氟化锌，硫化锌，过氧化锌，高猛酸锌，醋酸锌，草酸锌，铬酸锌，溴酸锌，磷酸锌，焦磷酸锌，磷化锌的废物

HW24	含砷废物	含砷及砷化合物的废物 ——有色金属采选及冶炼 ——砷及其化合物的生产 ——石油化工 ——农药生产 ——染料和制革业	含砷，三氧化二砷，亚砷酐，五氧化二砷，五硫化二砷，硫化亚砷，砷化锌，乙酰基砷铜，砷化钙，砷化铁，砷化铜，砷化铅，砷化银，乙基二氯化砷，(亚)砷酸，三氟化砷，砷酸锌，砷酸铵，砷酸钙，砷酸铁，砷酸钠，砷酸汞，砷酸铅，砷酸镁，三氯化砷，二硫化砷，砷酸钾，砷化(三)氢的废物
HW25	含硒废物	含硒及硒化合物废物 ——有色金属冶炼及电解 ——硒化合物生产 ——颜料、橡胶、玻璃生产	含硒，二氧化硒，三氧化硒，四氟化硒，六氟化硒，二氯化二硒，四氯化硒，亚硒酸，硒化氢，硒化钠，(亚)硒酸钠，二硫化硒，硒化亚铁，亚硒酸钡，硒酸，二甲基硒的废物
HW26	含镉废物	含镉及其化合物废物 ——有色金属采选及冶炼 ——镉化合物生产 ——电池制造业 ——电镀行业	含镉，溴化镉，碘化镉，氢氧化镉，碳酸镉，硝酸镉，硫酸镉，硫化镉，氯化镉，氟化镉，醋酸镉，氧化镉，二甲基镉的废物
HW27	含锑废物	含锑及其化合物废物 ——有色金属冶炼 ——锑化合物生产和使用	含锑，二氧化二锑，亚锑酐，五氧化二锑，硫化亚锑，硫化锑，氟化亚锑，氟化锑，氯化(亚)锑，三氢化锑，锑酸钠，锑酸铅，乳酸锑，亚锑酸纳的废物
HW28	含碲废物	含碲及其化合物废物 ——有色金属冶炼及电解 ——硫化合物生产和使用	含碲，四溴化碲，四碘化碲，三氧化蹄，六氟化碲，四氯化碲，亚碲酸，碲化氢，碲酸，二乙基碲，二甲基碲的废物
HW29	含汞废物	含汞及其化合物废物 ——化学工业含汞催化剂制造与使用 ——含汞电池制造业 ——汞冶炼及汞回收工业 ——有机汞和无机汞化合物生产 ——农药及制药业 ——荧光屏及汞灯制造及使用 ——含汞玻璃计器制造及使用 ——汞法烧碱生产产生的含汞盐泥	含汞，溴化(亚)汞，碘化(亚)汞，硝酸(亚)汞，氧化汞，硫酸(亚)汞，氯化(亚)汞，硫化汞，氯化乙基汞，氯化汞铵，氯化甲基汞，醋酸(亚)汞，二甲基汞，二乙基汞，氯化高汞的废物
HW30	含铊废物	含铊及其化合物废物	含铊，溴化亚铊，氢氧化

		——有色金属冶炼及农药生产 ——铊化合物生产及使用	(亚)铊，碘化亚铊，硝酸亚铊，碳酸亚铊，硫酸亚铊，氧化亚铊，硫化亚铊，三氧化二铊，三硫化二铊，氟化亚铊，氯化(亚)铊，铬酸铊，氯酸铊，醋酸铊的废物
HW31	含铅废物	含铅及其化合物废物 ——铅冶炼及电解过程中的残渣及铅尘 ——铅(酸)蓄电池生产中产生的废铅渣及铅酸(污泥) ——报废的铅蓄电池 ——铅铸造业及制品业的废铅渣及水处理污泥 ——铅化合物制造和使用过程中产生的废物	含铅，乙酸铅，溴化铅，氢氧化铅，碘化铅，碳酸铅，硝酸铅，氧化铅，硫酸铅，铬酸铅，氯化铅，氟化铅，硫化铅，高氯酸铅，碱性硅酸铅，四烷基铅，四氧化铅，二氧化铅的废物
HW32	无机氟化物废物	含无机氟化物的废物(不包括氟化钙、氟化镁)	含氟化铊，氟硼酸，氟硅酸锌，氢氟酸，氟硅酸，六氟化硫，氟化钠，五氟化硫，二氟磷，氟硫酸，氟硼酸铵，氟硅酸铵，氟化铵，氟化钾，氟化铬，五氟化碘，氟氢化钾，氟氢化纳，氟硅酸钠的废物
HW33	无机氰化物废物	从无机氰化物生产、使用过程中产生的含无机氰化物的废物(不包括 HW07 类热处理含氰废物) ——金属制品业的电解除油、表面硬化化学工艺中产生的含氰废物 ——电镀业和电子零件制造业中电镀工艺、镀层剥除工艺中产生的含氰废物 ——金矿开采与筛选过程中产生的含氰废物 ——首饰加工的化学抛光工艺产生的含氰废物 ——其他生产、实验、化验分析过程中产生的含氰废物及包装物	含氢氰酸，氰化蚀，氰化钾，氰化锂，氰化汞，氰化铅，氰化铜，氰化锌，氰化钡，氰化钙，氰化亚铜，氰化银，氰溶体，汞氰化钾，氰化镍，铜氰化钠，铜氰化钾，镍氰化钾，溴化氰，氰化钴的废物
HW34	废酸	从工业生产、配制、使用过程中产生的废酸液、固态酸及酸渣(pH<2 的液态酸) ——工业化学品制造 ——化学分析及测试 ——金属及其他制品的酸蚀、出光、除锈(油)及清洗 ——废水处理 ——纺织印染前处理	废硫酸、硝酸、盐酸、磷酸、(次)氯酸、溴酸、氢氟酸、氢溴酸、硼酸、砷酸、硒酸、氰酸、氯磺酸、碘酸、王水
HW35	废碱	从工业生产、配制使用过程中产生的废碱	废氢氧化钠、氢氧化钾、氢

		液、固态碱及碱渣(pH>12.5的液态碱) ——工业化学品制造 ——化学分析及测试 ——金属及其他制品的碱蚀、出光、除锈(油)及清洗 ——废水处理 ——纺织印染前处理 ——造纸废液	氧化钙、氢氧化锂、碳酸(氢)钠、碳酸(氢)钾、硼砂、(次)氯酸钠、(次)氯酸钾、(次)氯酸钙、磷酸钠石棉尘，石棉
HW36	石棉废物	从生产和使用过程中产生的石棉废物 ——石棉矿开采及其石棉产品加工 ——石棉建材生产 ——含石棉设施的保养(石棉隔膜，热绝缘体等) ——车辆制动器衬片的生产与更换	废纤维，废石棉绒，石棉隔热废料，石棉尾矿渣
HW37	有机磷化合物废物	从农药以外其他有机磷化合物生产、配制和使用过程中产生的含有机磷废物 ——生产过程中产生的反应残余物 ——生产过程中过滤物、催化剂(包括载体)及废弃的吸附剂 ——废水处理污泥 ——配制，使用过程中的过剩物、残渣及其包装物	含氯硫磷，硫磷嗪，磷酰胺，丙基磷酸四乙酯，四磷酸六乙酯，硝基硫磷酯，苯腈磷，磷酰酯类化合物，苯硫磷，异丙膦，三氯氧磷，磷酸三丁酯的废物
HW38	有机氰化物废物	从生产、配制和使用过程中产生的含有机氰化物的废物 ——在合成、缩合等反应中产生的高浓度废液及反应残余物 ——在催化、精馏、过滤过程中产生的废催化剂、釜残及过滤介质物 ——生产、配制过程中产生的不合格产品 ——废水处理污泥	含乙腈，丙烯腈，己二腈，氨丙腈，氯丙烯腈，氰基乙酸，氰基氯戊烷，乙醇腈，丙腈，四甲基琥珀腈，溴苯甲腈，苯腈，乳酸腈，丙酮腈，丁基腈，苯基异丙酸酯，氰酸酯类的废物
HW39	含酚废物	酚、酚化合物的废物(包括氯酚类和硝基酚类) ——生产过程中产生的高浓度废液及反应残余物 ——生产过程中产生的吸附过滤物，废催化剂，精馏釜残液(包括石油、化工、煤气生产中产生的含酚类化合物废物)	含氨基苯酚，溴酚，氯甲苯酚，煤焦油，二氯酚，二硝基苯酚，对苯二酚，三羟基苯，五氯酚(钠)，硝基苯酚，三氯酚，氯酚，甲酚，硝基苯甲酚，苦味酸，二硝基苯酚钠，苯酚胺的废物
HW40	含醚废物	从生产、配制和使用过程中产生的含醚废物 ——生产、配制过程中产生的醚类残液、反应残余物、水处理污泥及过滤渣 ——配制、使用过程中产生的含醚类有机混合溶剂	含苯甲醚，乙二醇单丁醚，甲乙醚，丙烯醚，二氯乙醚，苯乙基醚，二苯醚，二氧基乙醇乙醚，乙二醇甲基醚，乙二醇醚，异丙醚，二氯二甲醚，甲基氯甲醚，丙醚，四氯丙醚，三硝基苯甲醚，乙二醇二乙醚，亚乙基二醇

			丁基醚，二甲醚，丙烯基苯基醚，甲基丙基醚，乙二醇异丙基醚，乙二醇苯醚，乙二醇戊基醚，氯甲基乙醚，丁醚，乙醚，二甘醇二乙基醚，乙二醇二甲基醚，乙二醇单乙醚的废物
HW41	废卤化有机溶剂	从卤化有机溶剂生产、配制、使用过程中产生的废溶剂 ——生产、配制过程中产生的高浓度残液、吸附过浊物、反应残渣、水处理污泥及废载体 ——生产、配制过程中产生的报废产 ——生产、配制、使用过程中产生的废物卤化有机溶剂。包括化学分析，塑料橡胶制品制造，电子零件清洗、化工产品制造、印染涂料调配、商业干洗、家庭装饰使用的废溶剂	含二氯甲烷，氯仿，四氯化碳，二氯乙烷，二氯乙烯，氯苯，二氯二氟甲烷，溴仿，二氯丁烷，三氯苯，二氯丙烷，二溴乙烷，四氯乙烷，三氯乙烷，三氯乙烯，三氯三氟乙烷，四氯乙烯，五氯乙烷，溴乙烷，溴苯，三氯氟甲烷的废物
HW42	废有机溶剂	从有机溶剂的生产、配制和使用中产生的其他废有机溶剂(不包括 HW41 类的卤化有机溶剂) ——生产、配制和使用过程中产生的废溶剂和残余物。包括化学分析，塑料橡胶制品制造、电子零件清洗、化工产品制造、印染染料调配，商业干洗和家庭装饰使用过的废溶剂	含糠醛，环已烷，石脑油，苯，甲苯，二甲苯，四氢呋喃，乙酸丁酯，乙酸甲酯。硝基苯，甲基异丁基酮，环已酮，二乙基酮，乙酸异丁酯，丙烯醛二聚物，异丁醇，乙二醇，甲醇，苯乙酮，异戊烷，环戊酮，环戊醇，丙醛，二丙基酮，苯甲酸乙酯，丁酸，丁酸丁酯，丁酸乙酯，丁酸甲酯，异丙醇，N，N一二甲基乙酰胺，甲醛，二乙基酮，丙烯醛，乙醛，乙酸乙酯，丙酮，甲基乙基酮，甲基乙烯酮，甲基丁酮，甲基丁醇，苯甲醇的废物
HW43	含多氯苯并呋喃类废物	含任何多氯苯同系物的并呋喃类废物	多氯苯并呋喃同系物废物
HW44	含多氯苯并二恶英废物	含任何多氯苯并二恶英同系物的废物	多氯苯并二恶英同系物废物
HW45	含有机卤化物废物	从其他有机卤化物的生产、配制、使用过程中产生的废物(不包括上述 HW39，HW41，HW42，HW43，HW44 类别的废物) ——生产、配制过程中产生的高浓度残液、吸附过滤物、反应残渣、水处理污泥及废	含苄基氯，苯甲酰氯，三氯乙醛，1一氯辛烷，氯代二硝基苯，氯乙酸，氯硝基苯，2一氯丙酸，3一氯丙烯酸，氯甲苯胺，乙酰溴，乙酰氯，

		催化剂、废产品 ——生产、配制过程中产生的报废产品 ——化学分析、塑料橡胶制品制造、电子零件清洗，化工产品制造、印染染料调配，商业、家庭使用产生的卤化有机废物	二溴甲烷，苄基溴，1—溴—2—氯乙烷，二氯乙酰甲酯，氟乙酰胺，二氯萘醌，二氯醋酸，二溴氯丙烷，溴萘酚，碘代甲烷，2，4，5—三氯苯酚，三氯酚，1，4—二氯丁烷，2，4，6—三溴苯酚，二氯丁胺，1—氨基—4 溴蒽醌—2—磺酸的废物
HW46	含镍废物	含镍化合物的废物 ——镍化合物生产过程中产生的反应残余物及废品 ——使用报废的镍催化剂 ——电镀工艺中产生的镍残渣及槽液 ——分析、化验、测试过程中产生的含镍废物	含溴化镍，硝酸镍，硫酸镍，氯化镍，一硫化镍，一氧化镍，氧化镍，氢氧化镍，氢氧化高镍的废物
HW47	含钡废物	含钡化合物的废物(不包括硫酸钡) ——钡化合物生产过程中产生的反应残余物及其废品 ——热处理工艺中的盐浴渣 ——分析、化验、测试中产生的含钡废物	含溴酸钡，氢氧化钡，硝酸钡，碳酸钡，氯化钡，氟化钡，硫化钡，氧化钡，氟硅酸钡，氯酸钡，醋酸钡，过氧化钡，碘酸钡，叠氮钡，多硫化钡的废物

危险废物污染防治技术政策

2002-11-17

1、总则

1.1 为引导危险废物管理和处理处置技术的发展，促进社会和经济的可持续发展，根据《中华人民共和国固体废物污染环境防治法》等有关法规、政策和标准，制定本技术政策。本政策将随社会经济、技术水平的发展适时修订。

1.2 本技术政策所称危险废物是指列入国家危险废物名录或根据国家规定的危险废物鉴别标准和鉴别方法认定的具有危险特性的废物。

本技术政策所称特殊危险废物是指毒性大、或环境风险大、或难于管理、或不宜用危险废物的通用方法进行管理和处理处置，而需特别注意的危险废物，如医院临床废物、多氯联苯类废物、生活垃圾焚烧飞灰、废电池、废矿物油、含汞废日光灯管等。

1.3 我国危险废物管理的阶段性目标是：

到 2005 年，重点区域和重点城市产生的危险废物得到妥善贮存，有条件的实现安全处置；实现医院临床废物的环境无害化处理处置；将全国危险废物产生量控制在 2000 年末的水平；在全国实施危险废物申报登记制度、转移联单制度和许可证制度。

到 2010 年，重点区域和重点城市的危险废物基本实现环境无害化处理处置。

到 2015 年，所有城市的危险废物基本实现环境无害化处理处置。

1.4 本技术政策适用于危险废物的产生、收集、运输、分类、检测、包装、综合利用、贮存和处理处置等全过程污染防治的技术选择，并指导相应设施的规划、立项、选址、设计、施工、运营和管理，引导相关产业的发展。

1.5 本技术政策的总原则是危险废物的减量化、资源化和无害化。

1.6 鼓励并支持跨行政区域的综合性危险废物集中处理处置设施的建设和运营。

1.7 危险废物的收集运输单位、处理处置设施的设计、施工和运营单位应具有相应的技术资质。

1.8 各级政府应通过制定鼓励性经济政策等措施加快建立符合环境保护要求的危险废物收集、贮存、处理处置体系，积极推动危险废物的污染防治工作。

2、危险废物的减量化

2.1 危险废物减量化适用于任何产生危险废物的工艺过程。各级政府应通过经济和其他政策措施促进企业清洁生产，防止和减少危险废物的产生。企业应积极采用低废、少废、无废工艺，禁止采用《淘汰落后生产能力、工艺和产品的目录》中明令淘汰的技术工艺和设备。

2.2 对已经产生的危险废物，必须按照国家有关规定申报登记，建设符合标准的专门设施和场所妥善保存并设立危险废物标示牌，按有关规定自行处理处置或交由持有危险废物经营许可证的单位收集、运输、贮存和处理处置。在处理处置过程中，应采取措施减少危险废物的体积、重量和危险程度。

3、 危险废物的收集和运输

3.1 危险废物要根据其成分，用符合国家标准的专门容器分类收集。

3.2 装运危险废物的容器应根据危险废物的不同特性而设计，不易破损、变形、老化，能有效地防止渗漏、扩散。装有危险废物的容器必须贴有标签，在标签上详细标明危险废物的名称、重量、成分、特性以及发生泄漏、扩散污染事故时的应急措施和补救方法。

3.3 居民生活、办公和第三产业产生的危险废物（如废电池、废日光灯管等）应与生活垃圾分类收集，通过分类收集提高其回收利用和无害化处理处置，逐步建立和完善社会源危险废物的回收网络。

3.4 鼓励发展安全高效的危险废物运输系统，鼓励发展各种形式的专用车辆，对危险废物的运输要求安全可靠，要严格按照危险废物运输的管理规定进行危险废物的运输，减少运输过程中的二次污染和可能造成的环境风险。

3.5 鼓励成立专业化的危险废物运输公司对危险废物实行专业化运输，运输车辆需有特殊标志。

4、危险废物的转移

4.1 危险废物的越境转移应遵从《控制危险废物越境转移及其处置的巴塞尔公约》的要求，危险废物的国内转移应遵从《危险废物转移联单管理办法》及其它有关规定的要求。

4.2 各级环境保护行政主管部门应按照国家和地方制定的危险废物转移管理办法对危险废物的流向进行有效控制，禁止在转移过程中将危险废物排放至环境中。

5、危险废物的资源化

5.1 已产生的危险废物应首先考虑回收利用，减少后续处理处置的负荷。回收利用过程应达到国家和地方有关规定的要求，避免二次污染。

5.2 生产过程中产生的危险废物，应积极推行生产系统内的回收利用。生产系统内无法回收利用的危险废物，通过系统外的危险废物交换、物质转化、再加工、能量转化等措施实现回收利用。

5.3 各级政府应通过设立专项基金、政府补贴等经济政策和其他政策措施鼓励企业对已经产生的危险废物进行回收利用，实现危险废物的资源化

5.4 国家鼓励危险废物回收利用技术的研究与开发，逐步提高危险废物回收利用技术和装备水平，积极推广技术成熟、经济可行的危险废物回收利用技术。

6、危险废物的贮存

6.1 对已产生的危险废物，若暂时不能回收利用或进行处理处置的，其产生单位须建设专门的危险废物贮存设施进行贮存，并设立危险废物标志，或委托具有专门危险废物贮存设施的单位进行贮存，贮存期限不得超过国家规定。贮存危险废物的单位需拥有相应的许可证。禁止将危险废物以任何形式转移给无许可证的单位，或转移到非危险废物贮存设施中。危险废物贮存设施应有相应的配套设施并按有关规定进行管理。

6.2 危险废物的贮存设施应满足以下要求：

6.2.1 应建有堵截泄漏的裙脚，地面与裙脚要用坚固防渗的材料建造。应有隔离设施、报警装置和防风、防晒、防雨设施；

6.2.2 基础防渗层为粘土层的，其厚度应在 1 米以上，渗透系数应小于 1.010－7 厘米/秒；基础防渗层也可用厚度在 2 毫米以上的高密度聚乙烯或其他人工防渗材料组成，渗透系数应小于 1.010－10 厘米/秒；

6.2.3 须有泄漏液体收集装置及气体导出口和气体净化装置；

6.2.4 用于存放液体、半固体危险废物的地方，还须有耐腐蚀的硬化地面，地面无裂隙；

6.2.5 不相容的危险废物堆放区必须有隔离间隔断；

6.2.6 衬层上需建有渗滤液收集清除系统、径流疏导系统、雨水收集池。

6.2.7 贮存易燃易爆的危险废物的场所应配备消防设备，贮存剧毒危险废物的场所必须有专人 24 小时看管。

6.3 危险废物的贮存设施的选址与设计、运行与管理、安全防护、环境监测及应急措施、以及关闭等须遵循《危险废物贮存污染控制标准》的规定。

7、 危险废物的焚烧处置

7.1 危险废物焚烧可实现危险废物的减量化和无害化，并可回收利用其余热。焚烧处置适用于不宜回收利用其有用组分、具有一定热值的危险废物。易爆废物不宜进行焚烧处置。焚烧设施的建设、运营和污染控制管理应遵循《危险废物焚烧污染控制标准》及其他有关规定。

7.2 危险废物焚烧处置应满足以下要求:

7.2.1 危险废物焚烧处置前必须进行前处理或特殊处理，达到进炉的要求，危险废物在炉内燃烧均匀、完全;

7.2.2 焚烧炉温度应达到 1100C 以上，烟气停留时间应在 2.0 秒以上，燃烧效率大于 99.9%，焚毁去除率大于 99.99%，焚烧残渣的热灼减率小于 5%（医院临床废物和含多氯联苯废物除外）;

7.2.3 焚烧设施必须有前处理系统、尾气净化系统、报警系统和应急处理装置。

7.2.4 危险废物焚烧产生的残渣、烟气处理过程中产生的飞灰，须按危险废物进行安全填埋处置。

7.3 危险废物的焚烧宜采用以旋转窑炉为基础的焚烧技术，可根据危险废物种类和特征选用其他不同炉型，鼓励改造并采用生产水泥的旋转窑炉附烧或专烧危险废物。

7.4 鼓励危险废物焚烧余热利用。对规模较大的危险废物焚烧设施，可实施热电联产。

7.5 医院临床废物、含多氯联苯废物等一些传染性的、或毒性大、或含持久性有机污染成分的特殊危险废物宜在专门焚烧设施中焚烧。

8、 危险废物的安全填埋处置

8.1 危险废物安全填埋处置适用于不能回收利用其组分和能量的危险废物。

8.2 未经处理的危险废物不得混入生活垃圾填埋场，安全填埋为危险废物的最终处置手段。

8.3 危险废物安全填埋场必须按入场要求和经营许可证规定的范围接收危险废物，达不到入场要求的，须进行预处理并达到填埋场入场要求。

8.4 危险废物安全填埋场须满足以下要求:

8.4.1 有满足要求的防渗层，不得产生二次污染。

天然基础层饱和渗透系数小于 1.010-7 厘米/秒，且厚度大于 5 米时，可直接采用天然基础层作为防渗层；天然基础层饱和渗透系数为 1.010-7-1.010-6 厘米/秒时，可选用复合衬层作为防渗层，高密度聚乙烯的厚度不得低于 1.5 毫米；天然基础层饱和渗透系数大于 1.010-6 厘米/秒时，须采用双人工合成衬层(高密度聚乙烯)作为防渗层，上层厚度在 2.0 毫米以上，下层厚度在 1.0 毫米以上。

8.4.2 要严格按照作业规程进行单元式作业，做好压实和覆盖;

8.4.3 要做好清污水分流，减少渗沥水产生量，设置渗沥水导排设施和处理设施。对易产生气体的危险废物填埋场，应设置一定数量的排气孔、气体收集系统、净化系统和报警系统;

8.4.4 填埋场运行管理单位应自行或委托其他单位对填埋场地下水、地表水、大气要进行定期监测;

8.4.5 填埋场终场后，要进行封场处理，进行有效的覆盖和生态环境恢复;

8.4.6 填埋场封场后，经监测、论证和有关部门审定，才可以对土地进行适宜的非

农业开发和利用。

8.5 危险废物填埋须满足《危险废物填埋污染控制标准》的规定。

9、特殊危险废物污染防治

9.1 医院临床废物（不含放射性废物）

9.1.1 鼓励医院临床废物的分类收集，分别进行处理处置。人体组织器官、血液制品、沾染血液、体液的织物、传染病医院的临床废物、病人生活垃圾以及混合收集的医院临床废物宜建设专用焚烧设施进行处置，专用焚烧设施应符合《危险废物焚烧污染控制标准》的要求。

9.1.2 城市应建设集中处置设施，收集处置城市和城市所在区域的医院临床废物。

9.1.3 禁止一次性医疗器具和敷料的回收利用。

9.2 含多氯联苯废物

9.2.1 含多氯联苯废物应尽快集中到专用的焚烧设施中进行处置，不宜采用其它途径进行处置，其专用焚烧设施应符合国家《危险废物焚烧污染控制标准》的要求。

9.2.2 含多氯联苯废物的管理、贮存和处置还需遵循《防止含多氯联苯电力装置及其废物污染环境的规定》的规定。

9.2.3 对集中封存年限超过二十年的或未超过二十年但已造成环境污染的含多氯联苯废物，应限期进行焚烧处置。

9.2.4 对于新退出使用的含多氯联苯电力装置原则上必须进行焚烧处置，确有困难的可进行暂时性封存，但封存年限不应超过三年，暂存库和集中封存库的选址和设计必须符合《含多氯联苯（PCBs）废物的暂存库和集中封存库设计规范》的要求，集中封存库的建设必须进行环境影响评价。

9.2.5 应加强含多氯联苯危险废物的清查及其贮存设施的管理，并对含多氯联苯危险废物的处置过程进行跟踪管理。

9.3 生活垃圾焚烧飞灰

9.3.1 生活垃圾焚烧产生的飞灰必须单独收集，不得与生活垃圾、焚烧残渣等其它废物混合，也不得与其它危险废物混合。

9.3.2 生活垃圾焚烧飞灰不得在产生地长期贮存，不得进行简易处置，不得排放，生活垃圾焚烧飞灰在产生地必须进行必要的固化和稳定化处理之后方可运输，运输需使用专用运输工具，运输工具必须密闭。

9.3.3 生活垃圾焚烧飞灰须进行安全填埋处置。

9.4 废电池

9.4.1 国家和地方各级政府应制定技术、经济政策淘汰含汞、镉的电池。生产企业应按照国家法律和产业政策，调整产品结构，按期淘汰含汞、镉电池。

9.4.2 在含汞、镉的电池被淘汰之前，城市生活垃圾处理单位应建立分类收集、贮存、处理设施，对废电池进行有效的管理。

9.4.3 提倡废电池的分类收集，避免含汞、镉废电池混入生活垃圾焚烧设施。

9.4.4 废铅酸电池必须进行回收利用，不得用其它办法进行处置，其收集、运输环节必须纳入危险废物管理。鼓励发展年处理规模在 2 万吨以上的废铅酸电池回收利用，淘汰小型的再生铅企业，鼓励采用湿法再生铅生产工艺。

9.5 废矿物油

9.5.1 鼓励建立废矿物油收集体系，禁止将废矿物油任意抛洒、掩埋或倒入下水道以及用作建筑脱模油，禁止继续使用硫酸/白土法再生废矿物油。

9.5.2 废矿物油的管理应遵循《废润滑油回收与再生利用技术导则》等有关规定，鼓励采用无酸废油再生技术，采用新的油水分离设施或活性酶对废油进行回收利用，鼓

励重点城市建设区域性的废矿物油回收设施，为所在区域的废矿物油产生者提供服务。

9.6 废日光灯管

9.6.1 各级政府应制定技术、经济政策调整产品结构，淘汰高污染日光灯管，鼓励建立废日光灯管的收集体系和资金机制。

9.6.2 加强废日光灯管产生、收集和处理处置的管理，鼓励重点城市建设区域性的废日光灯管回收处理设施，为该区域的废日光灯管的回收处理提供服务。

10、危险废物处理处置相关的技术和设备

10.1 鼓励研究开发和引进高效危险废物收集运输技术和设备。

10.2 鼓励研究开发和引进高效、实用的危险废物资源化利用技术和设备，包括危险废物分选和破碎设备、热处理设备、大件危险废物处理和利用设备、社会源危险废物处理和利用设备。

10.3 加快危险废物处理专用监测仪器设备的开发和国产化，包括焚烧设施在线烟气测试仪器等。

10.4 鼓励研究开发高效、实用的危险废物焚烧成套技术和设备，包括危险废物焚烧炉技术、危险废物焚烧污染控制技术和危险废物焚烧余热回收利用技术等。

10.5 鼓励研究和开发高效、实用的安全填埋处理关键技术和设备，包括新型填埋防渗衬层和覆盖材料、填埋专用机具、危险废物填埋场渗沥水处理技术以及危险废物填埋场封场技术。

10.6 鼓励研究与开发危险废物鉴别技术及仪器设备，鼓励危险废物管理技术和方法的研究。

10.7 鼓励研究开发废旧电池和废日光灯管的处理处置和回收利用技术。

医疗废物管理条例

（中华人民共和国国务院令第３８０号《医疗废物管理条例》已经２００３年6月4日国务院第十次常务会议通过，现予公布，自公布之日起施行。

总理温家宝 二００三年六月十六日）

第一章 总 则

第一条 为了加强医疗废物的安全管理，防止疾病传播，保护环境，保障人体健康，根据《中华人民共和国传染病防治法》和《中华人民共和国固体废物污染环境防治法》，制定本条例。

第二条 本条例所称医疗废物，是指医疗卫生机构在医疗、预防、保健以及其他相关活动中产生的具有直接或者间接感染性、毒性以及其他危害性的废物。

医疗废物分类目录，由国务院卫生行政主管部门和环境保护行政主管部门共同制定、公布。

第三条 本条例适用于医疗废物的收集、运送、贮存、处置以及监督管理等活动。

医疗卫生机构收治的传染病病人或者疑似传染病病人产生的生活垃圾，按照医疗废物进行管理和处置。

医疗卫生机构废弃的麻醉、精神、放射性、毒性等药品及其相关的废物的管理，依照有关法律、行政法规和国家有关规定、标准执行。

第四条 国家推行医疗废物集中无害化处置，鼓励有关医疗废物安全处置技术的研究与开发。

县级以上地方人民政府负责组织建设医疗废物集中处置设施。

国家对边远贫困地区建设医疗废物集中处置设施给予适当的支持。

第五条 县级以上各级人民政府卫生行政主管部门，对医疗废物收集、运送、贮存、处置活动中的疾病防治工作实施统一监督管理；环境保护行政主管部门，对医疗废物收集、运送、贮存、处置活动中的环境污染防治工作实施统一监督管理。

县级以上各级人民政府其他有关部门在各自的职责范围内负责与医疗废物处置有关的监督管理工作。

第六条 任何单位和个人有权对医疗卫生机构、医疗废物集中处置单位和监督管理部门及其工作人员的违法行为进行举报、投诉、检举和控告。

第二章 医疗废物管理的一般规定

第七条 医疗卫生机构和医疗废物集中处置单位，应当建立、健全医疗废物管理责任制，其法定代表人为第一责任人，切实履行职责，防止因医疗废物导致传染病传播和环境污染事故。

第八条 医疗卫生机构和医疗废物集中处置单位，应当制定与医疗废物安全处置有关的规章制度和在发生意外事故时的应急方案；设置监控部门或者专（兼）职人员，负责检查、督促、落实本单位医疗废物的管理工作，防止违反本条例的行为发生。

第九条 医疗卫生机构和医疗废物集中处置单位，应当对本单位从事医疗废物收集、运送、贮存、处置等工作的人员和管理人员，进行相关法律和专业技术、安全防护以及紧急处理等知识的培训。

第十条 医疗卫生机构和医疗废物集中处置单位，应当采取有效的职业卫生防护措施，为从事医疗废物收集、运送、贮存、处置等工作的人员和管理人员，配备必要的防护用品，定期进行健康检查；必要时，对有关人员进行免疫接种，防止其受到健康损害。

第十一条 医疗卫生机构和医疗废物集中处置单位，应当依照《中华人民共和国固体废物污染环境防治法》的规定，执行危险废物转移联单管理制度。

第十二条 医疗卫生机构和医疗废物集中处置单位，应当对医疗废物进行登记，登

记内容应当包括医疗废物的来源、种类、重量或者数量、交接时间、处置方法、最终去向以及经办人签名等项目。登记资料至少保存3年。

第十三条 医疗卫生机构和医疗废物集中处置单位，应当采取有效措施，防止医疗废物流失、泄漏、扩散。

发生医疗废物流失、泄漏、扩散时，医疗卫生机构和医疗废物集中处置单位应当采取减少危害的紧急处理措施，对致病人员提供医疗救护和现场救援；同时向所在地的县级人民政府卫生行政主管部门、环境保护行政主管部门报告，并向可能受到危害的单位和居民通报。

第十四条 禁止任何单位和个人转让、买卖医疗废物。

禁止在运送过程中丢弃医疗废物；禁止在非贮存地点倾倒、堆放医疗废物或者将医疗废物混入其他废物和生活垃圾。

第十五条 禁止邮寄医疗废物。

禁止通过铁路、航空运输医疗废物。

有陆路通道的，禁止通过水路运输医疗废物；没有陆路通道必需经水路运输医疗废物的，应当经设区的市级以上人民政府环境保护行政主管部门批准，并采取严格的环境保护措施后，方可通过水路运输。

禁止将医疗废物与旅客在同一运输工具上载运。

禁止在饮用水源保护区的水体上运输医疗废物。

第三章 医疗卫生机构对医疗废物的管理

第十六条 医疗卫生机构应当及时收集本单位产生的医疗废物，并按照类别分置于防渗漏、防锐器穿透的专用包装物或者密闭的容器内。

医疗废物专用包装物、容器，应当有明显的警示标识和警示说明。

医疗废物专用包装物、容器的标准和警示标识的规定，由国务院卫生行政主管部门和环境保护行政主管部门共同制定。

第十七条 医疗卫生机构应当建立医疗废物的暂时贮存设施、设备，不得露天存放医疗废物；医疗废物暂时贮存的时间不得超过2天。

医疗废物的暂时贮存设施、设备，应当远离医疗区、食品加工区和人员活动区以及生活垃圾存放场所，并设置明显的警示标识和防渗漏、防鼠、防蚊蝇、防蟑螂、防盗以及预防儿童接触等安全措施。

医疗废物的暂时贮存设施、设备应当定期消毒和清洁。

第十八条 医疗卫生机构应当使用防渗漏、防遗撒的专用运送工具，按照本单位确定的内部医疗废物运送时间、路线，将医疗废物收集、运送至暂时贮存地点。

运送工具使用后应当在医疗卫生机构内指定的地点及时消毒和清洁。

第十九条 医疗卫生机构应当根据就近集中处置的原则，及时将医疗废物交由医疗废物集中处置单位处置。

医疗废物中病原体的培养基、标本和菌种、毒种保存液等高危险废物，在交医疗废物集中处置单位处置前应当就地消毒。

第二十条 医疗卫生机构产生的污水、传染病病人或者疑似传染病病人的排泄物，应当按照国家规定严格消毒；达到国家规定的排放标准后，方可排入污水处理系统。

第二十一条 不具备集中处置医疗废物条件的农村，医疗卫生机构应当按照县级人民政府卫生行政主管部门、环境保护行政主管部门的要求，自行就地处置其产生的医疗废物。自行处置医疗废物的，应当符合下列基本要求：

（一）使用后的一次性医疗器具和容易致人损伤的医疗废物，应当消毒并作毁形处理；

（二）能够焚烧的，应当及时焚烧；

（三）不能焚烧的，消毒后集中填埋。

第四章 医疗废物的集中处置

第二十二条 从事医疗废物集中处置活动的单位，应当向县级以上人民政府环境保护行政主管部门申请领取经营许可证；未取得经营许可证的单位，不得从事有关医疗废物集中处置的活动。

第二十三条 医疗废物集中处置单位，应当符合下列条件：

（一）具有符合环境保护和卫生要求的医疗废物贮存、处置设施或者设备；

（二）具有经过培训的技术人员以及相应的技术工人；

（三）具有负责医疗废物处置效果检测、评价工作的机构和人员；

（四）具有保证医疗废物安全处置的规章制度。

第二十四条 医疗废物集中处置单位的贮存、处置设施，应当远离居（村）民居住区、水源保护区和交通干道，与工厂、企业等工作场所有适当的安全防护距离，并符合国务院环境保护行政主管部门的规定。

第二十五条 医疗废物集中处置单位应当至少每2天到医疗卫生机构收集、运送一次医疗废物，并负责医疗废物的贮存、处置。

第二十六条 医疗废物集中处置单位运送医疗废物，应当遵守国家有关危险货物运输管理的规定，使用有明显医疗废物标识的专用车辆。医疗废物专用车辆应当达到防渗漏、防遗撒以及其他环境保护和卫生要求。

运送医疗废物的专用车辆使用后，应当在医疗废物集中处置场所内及时进行消毒和清洁。

运送医疗废物的专用车辆不得运送其他物品。

第二十七条 医疗废物集中处置单位在运送医疗废物过程中应当确保安全，不得丢弃、遗撒医疗废物。

第二十八条 医疗废物集中处置单位应当安装污染物排放在线监控装置，并确保监控装置经常处于正常运行状态。

第二十九条 医疗废物集中处置单位处置医疗废物，应当符合国家规定的环境保护、卫生标准、规范。

第三十条 医疗废物集中处置单位应当按照环境保护行政主管部门和卫生行政主管部门的规定，定期对医疗废物处置设施的环境污染防治和卫生学效果进行检测、评价。检测、评价结果存入医疗废物集中处置单位档案，每半年向所在地环境保护行政主管部门和卫生行政主管部门报告一次。

第三十一条 医疗废物集中处置单位处置医疗废物，按照国家有关规定向医疗卫生机构收取医疗废物处置费用。

医疗卫生机构按照规定支付的医疗废物处置费用，可以纳入医疗成本。

第三十二条 各地区应当利用和改造现有固体废物处置设施和其他设施，对医疗废物集中处置，并达到基本的环境保护和卫生要求。

第三十三条 尚无集中处置设施或者处置能力不足的城市，自本条例施行之日起，设区的市级以上城市应当在1年内建成医疗废物集中处置设施；县级市应当在2年内建成医疗废物集中处置设施。县（旗）医疗废物集中处置设施的建设，由省、自治区、直辖市人民政府规定。

在尚未建成医疗废物集中处置设施期间，有关地方人民政府应当组织制定符合环境保护和卫生要求的医疗废物过渡性处置方案，确定医疗废物收集、运送、处置方式和处置单位。

第五章 监督管理

第三十四条 县级以上地方人民政府卫生行政主管部门、环境保护行政主管部门，应当依照本条例的规定，按照职责分工，对医疗卫生机构和医疗废物集中处置单位进行监督检查。

第三十五条 县级以上地方人民政府卫生行政主管部门，应当对医疗卫生机构和医疗废物集中处置单位从事医疗废物的收集、运送、贮存、处置中的疾病防治工作，以及工作人员的卫生防护等情况进行定期监督检查或者不定期的抽查。

第三十六条 县级以上地方人民政府环境保护行政主管部门，应当对医疗卫生机构和医疗废物集中处置单位从事医疗废物收集、运送、贮存、处置中的环境污染防治工作进行定期监督检查或者不定期的抽查。

第三十七条 卫生行政主管部门、环境保护行政主管部门应当定期交换监督检查和抽查结果。在监督检查或者抽查中发现医疗卫生机构和医疗废物集中处置单位存在隐患时，应当责令立即消除隐患。

第三十八条 卫生行政主管部门、环境保护行政主管部门接到对医疗卫生机构、医疗废物集中处置单位和监督管理部门及其工作人员违反本条例行为的举报、投诉、检举和控告后，应当及时核实，依法作出处理，并将处理结果予以公布。

第三十九条 卫生行政主管部门、环境保护行政主管部门履行监督检查职责时，有权采取下列措施：

（一）对有关单位进行实地检查，了解情况，现场监测，调查取证；

（二）查阅或者复制医疗废物管理的有关资料，采集样品；

（三）责令违反本条例规定的单位和个人停止违法行为；

（四）查封或者暂扣涉嫌违反本条例规定的场所、设备、运输工具和物品；

（五）对违反本条例规定的行为进行查处。

第四十条 发生因医疗废物管理不当导致传染病传播或者环境污染事故，或者有证据证明传染病传播或者环境污染的事故有可能发生时，卫生行政主管部门、环境保护行政主管部门应当采取临时控制措施，疏散人员，控制现场，并根据需要责令暂停导致或者可能导致传染病传播或者环境污染事故的作业。

第四十一条 医疗卫生机构和医疗废物集中处置单位，对有关部门的检查、监测、调查取证，应当予以配合，不得拒绝和阻碍，不得提供虚假材料。

第六章 法律责任

第四十二条 县级以上地方人民政府未依照本条例的规定，组织建设医疗废物集中处置设施或者组织制定医疗废物过渡性处置方案的，由上级人民政府通报批评，责令限期建成医疗废物集中处置设施或者组织制定医疗废物过渡性处置方案；并可以对政府主要领导人、负有责任的主管人员，依法给予行政处分。

第四十三条 县级以上各级人民政府卫生行政主管部门、环境保护行政主管部门或者其他有关部门，未按照本条例的规定履行监督检查职责，发现医疗卫生机构和医疗废物集中处置单位的违法行为不及时处理，发生或者可能发生传染病传播或者环境污染事故时未及时采取减少危害措施，以及有其他玩忽职守、失职、渎职行为的，由本级人民政府或者上级人民政府有关部门责令改正，通报批评；造成传染病传播或者环境污染事故的，对主要负责人、负有责任的主管人员和其他直接责任人员依法给予降级、撤职、开除的行政处分；构成犯罪的，依法追究刑事责任。

第四十四条 县级以上人民政府环境保护行政主管部门，违反本条例的规定发给医疗废物集中处置单位经营许可证的，由本级人民政府或者上级人民政府环境保护行政主

管部门通报批评，责令收回违法发给的证书；并可以对主要负责人、负有责任的主管人员和其他直接责任人员依法给予行政处分。

第四十五条 医疗卫生机构、医疗废物集中处置单位违反本条例规定，有下列情形之一的，由县级以上地方人民政府卫生行政主管部门或者环境保护行政主管部门按照各自的职责责令限期改正，给予警告；逾期不改正的，处２０００元以上５０００元以下的罚款：

（一）未建立、健全医疗废物管理制度，或者未设置监控部门或者专（兼）职人员的；

（二）未对有关人员进行相关法律和专业技术、安全防护以及紧急处理等知识的培训的；

（三）未对从事医疗废物收集、运送、贮存、处置等工作的人员和管理人员采取职业卫生防护措施的；

（四）未对医疗废物进行登记或者未保存登记资料的；

（五）对使用后的医疗废物运送工具或者运送车辆未在指定地点及时进行消毒和清洁的；

（六）未及时收集、运送医疗废物的；

（七）未定期对医疗废物处置设施的环境污染防治和卫生学效果进行检测、评价，或者未将检测、评价效果存档、报告的。

第四十六条 医疗卫生机构、医疗废物集中处置单位违反本条例规定，有下列情形之一的，由县级以上地方人民政府卫生行政主管部门或者环境保护行政主管部门按照各自的职责责令限期改正，给予警告，可以并处５０００元以下的罚款；逾期不改正的，处５０００元以上３万元以下的罚款：

（一）贮存设施或者设备不符合环境保护、卫生要求的；

（二）未将医疗废物按照类别分置于专用包装物或者容器的；

（三）未使用符合标准的专用车辆运送医疗废物或者使用运送医疗废物的车辆运送其他物品的；

（四）未安装污染物排放在线监控装置或者监控装置未经常处于正常运行状态的。

第四十七条 医疗卫生机构、医疗废物集中处置单位有下列情形之一的，由县级以上地方人民政府卫生行政主管部门或者环境保护行政主管部门按照各自的职责责令限期改正，给予警告，并处５０００元以上１万元以下的罚款；逾期不改正的，处１万元以上３万元以下的罚款；造成传染病传播或者环境污染事故的，由原发证部门暂扣或者吊销执业许可证件或者经营许可证件；构成犯罪的，依法追究刑事责任：

（一）在运送过程中丢弃医疗废物，在非贮存地点倾倒、堆放医疗废物或者将医疗废物混入其他废物和生活垃圾的；

（二）未执行危险废物转移联单管理制度的；

（三）将医疗废物交给未取得经营许可证的单位或者个人收集、运送、贮存、处置的；

（四）对医疗废物的处置不符合国家规定的环境保护、卫生标准、规范的；

（五）未按照本条例的规定对污水、传染病病人或者疑似传染病病人的排泄物，进行严格消毒，或者未达到国家规定的排放标准，排入污水处理系统的；

（六）对收治的传染病病人或者疑似传染病病人产生的生活垃圾，未按照医疗废物进行管理和处置的。

第四十八条 医疗卫生机构违反本条例规定，将未达到国家规定标准的污水、传染病病人或者疑似传染病病人的排泄物排入城市排水管网的，由县级以上地方人民政府建设行政主管部门责令限期改正，给予警告，并处５０００元以上１万元以下的罚款；逾

期不改正的，处1万元以上3万元以下的罚款；造成传染病传播或者环境污染事故的，由原发证部门暂扣或者吊销执业许可证件；构成犯罪的，依法追究刑事责任。

第四十九条 医疗卫生机构、医疗废物集中处置单位发生医疗废物流失、泄漏、扩散时，未采取紧急处理措施，或者未及时向卫生行政主管部门和环境保护行政主管部门报告的，由县级以上地方人民政府卫生行政主管部门或者环境保护行政主管部门按照各自的职责责令改正，给予警告，并处1万元以上3万元以下的罚款；造成传染病传播或者环境污染事故的，由原发证部门暂扣或者吊销执业许可证件或者经营许可证件；构成犯罪的，依法追究刑事责任。

第五十条 医疗卫生机构、医疗废物集中处置单位，无正当理由，阻碍卫生行政主管部门或者环境保护行政主管部门执法人员执行职务，拒绝执法人员进入现场，或者不配合执法部门的检查、监测、调查取证的，由县级以上地方人民政府卫生行政主管部门或者环境保护行政主管部门按照各自的职责责令改正，给予警告；拒不改正的，由原发证部门暂扣或者吊销执业许可证件或者经营许可证件；触犯《中华人民共和国治安管理处罚条例》，构成违反治安管理行为的，由公安机关依法予以处罚；构成犯罪的，依法追究刑事责任。

第五十一条 不具备集中处置医疗废物条件的农村，医疗卫生机构未按照本条例的要求处置医疗废物的，由县级人民政府卫生行政主管部门或者环境保护行政主管部门按照各自的职责责令限期改正，给予警告；逾期不改正的，处１０００元以上５０００元以下的罚款；造成传染病传播或者环境污染事故的，由原发证部门暂扣或者吊销执业许可证件；构成犯罪的，依法追究刑事责任。

第五十二条 未取得经营许可证从事医疗废物的收集、运送、贮存、处置等活动的，由县级以上地方人民政府环境保护行政主管部门责令立即停止违法行为，没收违法所得，可以并处违法所得1倍以下的罚款。

第五十三条 转让、买卖医疗废物，邮寄或者通过铁路、航空运输医疗废物，或者违反本条例规定通过水路运输医疗废物的，由县级以上地方人民政府环境保护行政主管部门责令转让、买卖双方、邮寄人、托运人立即停止违法行为，给予警告，没收违法所得；违法所得５０００元以上的，并处违法所得2倍以上5倍以下的罚款；没有违法所得或者违法所得不足５０００元的，并处５０００元以上2万元以下的罚款。

承运人明知托运人违反本条例的规定运输医疗废物，仍予以运输的，或者承运人将医疗废物与旅客在同一工具上载运的，按照前款的规定予以处罚。

第五十四条 医疗卫生机构、医疗废物集中处置单位违反本条例规定，导致传染病传播或者发生环境污染事故，给他人造成损害的，依法承担民事赔偿责任。

第七章 附 则

第五十五条 计划生育技术服务、医学科研、教学、尸体检查和其他相关活动中产生的具有直接或者间接感染性、毒性以及其他危害性废物的管理，依照本条例执行。

第五十六条 军队医疗卫生机构医疗废物的管理由中国人民解放军卫生主管部门参照本条例制定管理办法。

第五十七条 本条例自公布之日起施行。

医疗器械监督管理条例

颁布日期：2000年1月4日

第一章 总则

第一条 为了加强对医疗器械的监督管理，保证医疗器械的安全、有效，保障人体健康和生命安全，制定本条例。

第二条 在中华人民共和国境内从事医疗器械的研制、生产、经营、使用、监督管理的单位或者个人，应当遵守本条例。

第三条 本条例所称医疗器械，是指单独或者组合使用于人体的仪器、设备、器具、材料或者其他物品，包括所需要的软件；其用于人体体表及体内的作用不是用药理学、免疫学或者代谢的手段获得，但是可能有这些手段参与并起一定的辅助作用；其使用旨在达到下列预期目的：

(一)对疾病的预防、诊断、治疗、缓解；

(二)对损伤或者残疾的诊断、治疗、缓解、补偿；

(三)对解剖或者生理过程的研究、调节；

(四)妊娠控制。

第四条 国务院药品监督管理部门负责全国的医疗器械监督管理工作。

县级以上地方人民政府药品监督管理部门负责本行政区域内的医疗器械监督管理工作。

国务院药品监督管理部门应当配合国务院经济综合管理部门，贯彻实施国家医疗器械产业政策。

第五条 国家对医疗器械实行分类管理。

第一类是指，通过常规管理足以保证其安全性、有效性的医疗器械。

第二类是指，对其安全性、有效性应当加以控制的医疗器械。

第三类是指，植入人体；用于支持、维持生命；对人体具有潜在危险，对其安全性、有效性必须严格控制的医疗器械。

医疗器械分类目录由国务院药品监督管理部门依据医疗器械分类规则，商国务院卫生行政部门制定、调整、公布。

第六条 生产和使用以提供具体量值为目的的医疗器械，应当符合计量法的规定。具体产品目录由国务院药品监督管理部门会同国务院计量行政管理部门制定并公布。

第二章 医疗器械的管理

第七条 国家鼓励研制医疗器械新产品。医疗器械新产品，是指国内市场尚未出现过的或者安全性、有效性及产品机理未得到国内认可的全新的品种。

第二类、第三类医疗器械新产品的临床试用，应当按照国务院药品监督管理部门的规定，经批准后进行。

完成临床试用并通过国务院药品监督管理部门组织专家评审的医疗器械新产品，由国务院药品监督管理部门批准，并发给新产品证书。

第八条 国家对医疗器械实行产品生产注册制度。

生产第一类医疗器械，由设区的市级人民政府药品监督管理部门审查批准，并发给产品生产注册证书。

生产第二类医疗器械，由省、自治区、直辖市人民政府药品监督管理部门审查批准，并发给产品生产注册证书。

生产第三类医疗器械，由国务院药品监督管理部门审查批准，并发给产品生产注册证书。

生产第二类、第三类医疗器械，应当通过临床验证。

第九条 省、自治区、直辖市人民政府药品监督管理部门负责审批本行政区域内的第二类医疗器械的临床试用或者临床验证。国务院药品监督管理部门负责审批第三类医疗器械的临床试用或者临床验证。

临床试用或者临床验证应当在省级以上人民政府药品监督管理部门指定的医疗机构进行。医疗机构进行临床试用或者临床验证，应当符合国务院药品监督管理部门的规定。进行临床试用或者临床验证的医疗机构的资格，由国务院药品监督管理部门会同国务院卫生行政部门认定；

第十条 医疗机构根据本单位的临床需要，可以研制医疗器械，在执业医师指导下在本单位使用。

医疗机构研制的第二类医疗器械，应当报省级以上人民政府药品监督管理部门审查批准；医疗机构研制的第三类医疗器械，应当报国务院药品监督管理部门审查批准。

第十一条 首次进口的医疗器械，进口单位应当提供该医疗器械的说明书、质量标准、检验方法等有关资料和样品以及出口国(地区)批准生产、销售的证明文件，经国务院药品监督管理部门审批注册，领取进口注册证书后，方可向海关申请办理进口手续。

第十二条 申报注册医疗器械，应当按照国务院药品监督管理部门的规定提交技术指标、检测报告和其它有关资料。

设区的市级人民政府药品监督管理部门应当自受理申请之日起 30 个工作日内，作出是否给予注册的决定；不予注册的，应当书面说明理由。

省、自治区、直辖市人民政府药品监督管理部门应当自受理申请之日起 60 个工作日内，作出是否给予注册的决定；不予注册的，应当书面说明理由。

国务院药品监督管理部门应当自受理申请之日起 90 个工作日内，作出是否给予注册的决定；不予注册的，应当书面说明理由。

第十三条 医疗器械产品注册证书所列内容发生变化的，持证单位应当自发生变化之日起 30 日内，申请办理变更手续或者重新注册。

第十四条 医疗器械产品注册证书有效期 4 年。持证单位应当在产品注册证书有效期届满前 6 个月内，申请重新注册。

连续停产 2 年以上的，产品生产注册证书自行失效。

第十五条 生产医疗器械，应当符合医疗器械国家标准；没有国家标准的，应当符合医疗器械行业标准。

医疗器械国家标准由国务院标准化行政主管部门会同国务院药品监督管理部门制定。医疗器械行业标准由国务院药品监督管理部门制定。

第十六条 医疗器械的使用说明书、标签、包装应当符合国家有关标准或者规定。

第十七条 医疗器械及其外包装上应当按照国务院药品监督管理部门的规定，标明产品注册证书编号。

第十八条 国家对医疗器械实施再评价及淘汰制度。具体办法由国务院药品监督管理部门商国务院有关部门制定。

第三章 医疗器械生产、经营和使用的管理

第十九条 医疗器械生产企业应当符合下列条件：
(一)具有与其生产的医疗器械相适应的专业技术人员；
(二)具有与其生产的医疗器械相适应的生产场地及环境；
(三)具有与其生产的医疗器械相适应的生产设备；
(四)具有对其生产的医疗器械产品进行质量检验的机构或者人员及检验设备。

第二十条 开办第一类医疗器械生产企业，应当向省、自治区、直辖市人民政府药品监督管理部门备案。

开办第二类、第三类医疗器械生产企业，应当经省、自治区、直辖市人民政府药品监督管理部门审查批准，并发给《医疗器械生产企业许可证》。无《医疗器械生产企业许可证》的，工商行政管理部门不得发给营业执照。

《医疗器械生产企业许可证》有效期5年，有效期届满应当重新审查发证。具体办法由国务院药品监督管理部门制定。

第二十一条 医疗器械生产企业在取得医疗器械产品生产注册证书后，方可生产医疗器械。

第二十二条 国家对部分第三类医疗器械实行强制性安全认证制度。具体产品目录由国务院药品监督管理部门会同国务院质量技术监督部门制定。

第二十三条 医疗器械经营企业应当符合下列条件
(一)具有与其经营的医疗器械相适应的经营场地及环境；
(二)具有与其经营的医疗器械相适应的质量检验人员；
(三)具有与其经营的医疗器械产品相适应的技术培训、维修等售后服务能力。

第二十四条 开办第一类医疗器械经营企业，应当向省、自治区、直辖市人民政府药品监督管理部门备案。

开办第二类、第三类医疗器械经营企业，应当经省、自治区、直辖市人民政府药品监督管理部门审查批准，并发给《医疗器械经营企业许可证》。无《医疗器械经营企业许可证》的，工商行政管理部门不得发给营业执照。

《医疗器械经营企业许可证》有效期5年，有效期届满应当重新审查发证。具体办法由国务院药品监督管理部门制定。

第二十五条 省、自治区、直辖市人民政府药品监督管理部门应当自受理医疗器械生产企业、经营企业许可证申请之日起30个工作日内，作出是否发证的决定；不予发证的，应当书面说明理由。

第二十六条 医疗器械经营企业和医疗机构应当从取得《医疗器械生产企业许可证》的生产企业或者取得《医疗器械经营企业许可证》的经营企业购进合格的医疗器械，并验明产品合格证明。

医疗机构不得使用未经注册、无合格证明、过期、失效或者淘汰的医疗器械。

第二十七条 医疗机构对一次性使用的医疗器械不得重复使用；使用过的，应当按照国家有关规定销毁，并作记录。

第二十八条 国家建立医疗器械质量事故报告制度和医疗器械质量事故公告制度。具体办法由国务院药品监督管理部门会同国务院卫生行政部门、计划生育行政管理部门制定。

第四章 医疗器械的监督

第二十九条 县级以上人民政府药品监督管理部门设医疗器械监督员。医疗器械监督员对本行政区域内的医疗器械生产企业、经营企业和医疗机构进行监督、检查；必要时，可以按照国务院药品监督管理部门的规定抽取样品和索取有关资料，有关单位、人员不得拒绝和隐瞒。监督员对所取得的样品、资料负有保密义务。

第三十条 国家对医疗器械检测机构实行资格认可制度。经国务院药品监督管理部门会同国务院质量技术监督部门认可的检测机构，方可对医疗器械实施检测。

医疗器械检测机构及其人员对被检测单位的技术资料负有保密义务，并不得从事或者参与同检测有关的医疗器械的研制、生产、经营和技术咨询等活动。

第三十一条 对已经造成医疗器械质量事故或者可能造成医疗器械质量事故的产品及有关资料，县级以上地方人民政府药品监督管理部门可以予以查封、扣押。

第三十二条 对不能保证安全、有效的医疗器械，由省级以上人民政府药品监督管理部门撤销其产品注册证书。被撤销产品注册证书的医疗器械不得生产、销售和使用，已经生产或者进口的，由县级以上地方人民政府药品监督管理部门负责监督处理。

第三十三条 设区的市级以上地方人民政府药品监督管理部门违反本条例规定实施的产品注册，由国务院药品监督管理部门责令限期改正；逾期不改正的，可以撤销其违法注册的医疗器械产品注册证书，并予以公告。

第三十四条 医疗器械广告应当经省级以上人民政府药品监督管理部门审查批准；未经批准的，不得刊登、播放、散发和张贴。

医疗器械广告的内容应当以国务院药品监督管理部门或者省、自治区、直辖市人民政府药品监督管理部门批准的使用说明书为准。

第五章 罚 则

第三十五条 违反本条例规定，未取得医疗器械产品生产注册证书进行生产的，由县级以上人民政府药品监督管理部门责令停止生产，没收违法生产的产品和违法所得，违法所得 1 万元以上的，并处违法所得 3 倍以上 5 倍以下的罚款；没有违法所得或者违法所得不足 1 万元的，并处 1 万元以上 3 万元以下的罚款；情节严重的，由省、自治区、

直辖市人民政府药品监督管理部门吊销其((医疗器械生产企业许可证》；构成犯罪的，依法追究刑事责任。

第三十六条 违反本条例规定，未取得《医疗器械生产企业许可证》生产第二类、第三类医疗器械的，由县级以上人民政府药品监督管理部门责令停止生产，没收违法生产的产品和违法所得，违法所得 1 万元以上的，并处违法所得 3 倍以上 5 倍以下的罚款；没有违法所得或者违法所得不足 1 万元的，并处 1 万元以上 3 万元以下的罚款；构成犯罪的，依法追究刑事责任。

第三十七条 违反本条例规定，生产不符合医疗器械国家标准或者行业标准的医疗器械的，由县级以上人民政府药品监督管理部门予以警告，责令停止生产，没收违法生产的产品和违法所得，违法所得 5000 元以上的，并处违法所得 3 倍以上 5 倍以下的罚款；没有违法所得或者违法所得不足 5000 元的，并处 5000 元以上 2 万元以下的罚款；情节严重的，由原发证部门吊销产品生产注册证书；构成犯罪的，依法追究刑事责任。

第三十八条 违反本条例规定，未取得《医疗器械经营企业许可证》经营第二类、第三类医疗器械的，由县级以上人民政府药品监督管理部门责令停止经营，没收违法经营的产品和违法所得，违法所得 5000 元以上的，并处违法所得 2 倍以上 5 倍以下的罚款；没有违法所得或者违法所得不足 5000 元的，并处 5000 元以上 2 万元以下的罚款；构成犯罪的，依法追究刑事责任。

第三十九条 违反本条例规定，经营无产品注册证书、无合格证明、过期、失效、淘汰的医疗器械的，或者从无《医疗器械生产企业许可证》、((医疗器械经营企业许可证》的企业购进医疗器械的，由县级以上人民政府药品监督管理部门责令停止经营，没收违法经营的产品和违法所得，违法所得 5000 元以上的，并处违法所得 2 倍以上 5 倍以下的罚款；没有违法所得或者违法所得不足 5000 元的，并处 5000 元以上 2 万元以下的罚款；情节严重的，由原发证部门吊销《医疗器械经营企业许可证》；构成犯罪的，依法追究刑事责任。

第四十条 违反本条例规定，办理医疗器械注册申报时，提供虚假证明、文件资料、样品，或者采取其他欺骗手段，骗取医疗器械产品注册证书的，由原发证部门撤销产品注册证书，两年内不受理其产品注册申请，并处 1 万元以上 3 万元以下的罚款；对已经进行生产的，并没收违法生产的产品和违法所得，违法所得 1 万元以上的，并处违法所得 3 倍以上 5 倍以下的罚款；没有违法所得或者违法所得不足 1 万元的，并处 1 万元以上 3 万元以下的罚款；构成犯罪的，依法追究刑事责任。

第四十一条 违反本条例第三十四条有关医疗器械广告规定的，由工商行政管理部门依照国家有关法律、法规进行处理。

第四十二条 违反本条例规定，医疗机构使用无产品注册证书、无合格证明、过期、失效、淘汰的医疗器械的，或者从无《医疗器械生产企业许可证》、《医疗器械经营企业许可证》的企业购进医疗器械的，由县级以上人民政府药品监督管理部门责令改正，给予警告，没收违法使用的产品和违法所得，违法所得 5000 元以上的，并处违法所得 2 倍以上 5 倍以下的罚款；没有违法所得或者违法所得不足 5000 元的，并处 5000 元以上 2 万元以下的罚款；对主管人员和其他直接责任人员依法给予纪律处分；构成犯罪的，依法追究刑事责任。

第四十三条 违反本条例规定，医疗机构重复使用一次性使用的医疗器械的，或者对应当销毁未进行销毁的，由县级以上人民政府药品监督管理部门责令改正，给予警告，可以处5000元以上3万元以下的罚款；情节严重的，可以对医疗机构处3万元以上5万元以下的罚款，对主管人员和其他直接责任人员依法给予纪律处分；构成犯罪的，依法追究刑事责任。

第四十四条 违反本条例规定，承担医疗器械临床试用或者临床验证的医疗机构提供虚假报告的，由省级以上人民政府药品监督管理部门责令改正，给予警告，可以处1万元以上3万元以下罚款；情节严重的，撤销其临床试用或者临床验证资格，对主管人员和其他直接责任人员依法给予纪律处分；构成犯罪的，依法追究刑事责任。

第四十五条 违反本条例规定，医疗器械检测机构及其人员从事或者参与同检测有关的医疗器械的研制、生产、经营、技术咨询的，或者出具虚假检测报告的，由省级以上人民政府药品监督管理部门责令改正，给予警告，并处1万元以上3万元以下的罚款；情节严重的，由国务院药品监督管理部门撤销该检测机构的检测资格，对主管人员和其他直接责任人员依法给予纪律处分；构成犯罪的，依法追究刑事责任。

第四十六条 违反本条例规定，医疗器械监督管理人员滥用职权、徇私舞弊、玩忽职守，构成犯罪的，依法追究刑事责任；尚不构成犯罪的，依法给予行政处分。

第六章 附 则

第四十七条 非营利的避孕医疗器械产品的管理办法，由国务院药品监督管理部门会同国务院有关部门另行制定。

第四十八条 本条例自2000年4月1日起施行。

消毒管理办法

卫生部第27号令

《消毒管理办法》的修订已于2001年12月29日部务会通过，现予以发布，自2002年7月1日起施行。1992年8月31日发布的《消毒管理办法》同时废止。

部 长： 张文康

第一章 总则

第一条 为了加强消毒管理，预防和控制感染性疾病的传播，保障人体健康，根据《中华人民共和国传染病防治法》及其实施办法的有关规定，制定本办法。

第二条 本办法适用于医疗卫生机构、消毒服务机构以及从事消毒产品生产、经营活动的单位和个人。

其他需要消毒的场所和物品管理也适用于本办法。

第三条 卫生部主管全国消毒监督管理工作。

铁路、交通卫生主管机构依照本办法负责本系统的消毒监督管理工作。

第二章 消毒的卫生要求

第四条 医疗卫生机构应当建立消毒管理组织，制定消毒管理制度，执行国家有关规范、标准和规定，定期开展消毒与灭菌效果检测工作。

第五条 医疗卫生机构工作人员应当接受消毒技术培训、掌握消毒知识，并按规定严格执行消毒隔离制度。

第六条 医疗卫生机构使用的进入人体组织或无菌器官的医疗用品必须达到灭菌要求。各种注射、穿刺、采血器具应当一人一用一灭菌。凡接触皮肤、粘膜的器械和用品必须达到消毒要求。

医疗卫生机构使用的一次性使用医疗用品用后应当及时进行无害化处理。

第七条 医疗卫生机构购进消毒产品必须建立并执行进货检查验收制度。

第八条 医疗卫生机构的环境、物品应当符合国家有关规范、标准和规定。排放废弃的污水、污物应当按照国家有关规定进行无害化处理。运送传染病病人及其污染物品的车辆、工具必须随时进行消毒处理。

第九条 医疗卫生机构发生感染性疾病暴发、流行时，应当及时报告当地卫生行政部门，并采取有效消毒措施。

第十条 加工、出售、运输被传染病病原体污染或者来自疫区可能被传染病病原体污染的皮毛，应当进行消毒处理。

第十一条 托幼机构应当健全和执行消毒管理制度，对室内空气、餐(饮)具、毛巾、玩具和其他幼儿活动的场所及接触的物品定期进行消毒。

第十二条 出租衣物及洗涤衣物的单位和个人，应当对相关物品及场所进行消毒。

第十三条 从事致病微生物实验的单位应当执行有关的管理制度、操作规程，对实验的器材、污染物品等按规定进行消毒，防止实验室感染和致病微生物的扩散。

第十四条 殡仪馆、火葬场内与遗体接触的物品及运送遗体的车辆应当及时消毒。

第十五条 招用流动人员200人以上的用工单位，应当对流动人员集中生活起居的场所及使用的物品定期进行消毒。

第十六条 疫源地的消毒应当执行国家有关规范、标准和规定。

第十七条 公共场所、食品、生活饮用水、血液制品的消毒管理，按有关法律、法规的规定执行。

第八条　生产企业的企业名称、法定代表人或企业负责人发生变更的，企业应向省级药品监督管理局申请办理《医疗器械生产企业许可证》的变更手续后，向国家药品监督管理局申请办理《医疗器械产品注册证》的变更。国家、省级药品监督管理局应自受理申请之日起30个工作日内给予变更。

企业名称变更后，无菌器械的小、中、大包装标注的企业名称应在半年之内变更。新包装启用后，旧包装即停止使用，新、旧包装不得混用。

第九条　生产企业在原厂址或异地新建、改建、扩建洁净厂房的，经所在地省级药品监督管理部门对其质量体系进行初审后，由国家药品监督管理局组织质量体系现场审查和产品抽样检测，合格后方能生产。

第十条　生产企业连续停产一年以上的，须经省级药品监督管理局对现场质量体系进行审查和产品抽查，合格后方可恢复生产，连续停产二年以上的，其产品注册证书自行失效。

第十一条　留样观察或已售出的无菌器械产品出现质量问题，生产企业必须立即封存该批号产品，并通知有关单位停止销售和使用。造成人身伤亡事故的，要在24小时内，报告所在地省级药品监督管理部门。

第十二条　监督检查中，发现生产企业有不符合《生产实施细则》要求的，由实施监督检查的药品监督管理部门责令其限期整改。

第十三条　生产企业不得有下列行为：

（一）伪造或冒用他人厂名、厂址或生产企业证件；

（二）出租或出借本生产企业有效证件；

（三）违反规定采购零部件或产品包装；

（四）伪造或变造生产购销票据、生产原始记录、产品批号；

（五）对不合格品、废弃零部件、过期或废弃产品包装不按规定处理；

（六）擅自增加产品型号、规格；

（七）企业销售人员代销非本企业生产的产品；

（八）向城乡集贸市场提供无菌器械或直接参与城乡集贸市场无菌器械交易。

第三章　经营的监督管理

第十四条　经营企业应具有与其经营无菌器械相适应的营业场地和仓库。产品储存区域应避光、通风、无污染，具有防尘、防污染、防蚊蝇、防虫鼠和防异物混入等设施，符合产品标准的储存规定。

第十五条　经营企业应建立无菌器械质量跟踪制度，做到从采购到销售能追查到每批产品的质量情况。

无菌器械的购销记录必须真实、完整。购销记录应有：购销日期、购销对象、购销数量、产品名称、生产单位、型号规格、生产批号、灭菌批号、产品有效期；经办人、负责人签名等。

第十六条　经营企业应保存完整的无菌器械购销记录和有效证件，无菌器械购销记录及有效证件必须保存到产品有效期满后二年。

第十七条　经营企业销售人员销售无菌器械，应出具下列证明：

（一）加盖本企业印章的《医疗器械经营企业许可证》、《医疗器械产品注册证》的复印件及产品合格证；

（二）加盖本企业印章和企业法定代表人印章或签字的企业法定代表人的委托授权书原件，委托授权书应明确其授权范围；

（三）销售人员的身份证。

第十八条　经营企业发现不合格无菌器械，应立即停止销售，及时报告所在地药品监督管理部门。经验证为不合格的，经营企业必须及时通知该批无菌器械的经营企业和使用单位停止销售或使用。对不合格产品，应在所在地药品监督管理部门监督下予以处理。

对已销售给个人使用的不合格无菌器械，经营企业应向社会公告，主动收回不合格产品。

第十九条　经营企业经营不合格无菌器械，经营者不能指明不合格品生产者的，视为经营无产品注册证的产品；不能指明不合格品供货者的，视为从无《医疗器械经营企业许可证》的企业购进产品。

第二十条　经营无菌器械不得有下列行为：

（一）经营无有效证件、证照不齐、无产品合格证的无菌器械；

（二）伪造或冒用《医疗器械经营企业许可证》；

（三）出租或出借《医疗器械经营企业许可证》；

（四）经营不合格、过期或已淘汰无菌器械；

（五）无购销记录或伪造、变造购销记录；

（六）从非法渠道采购无菌器械；

（七）向城乡集贸市场提供无菌器械或直接参与城乡集贸市场无菌器械交易。

第四章　使用的监督

第二十一条　医疗机构应从具有《医疗器械生产企业许可证》或《医疗器械经营企业许可证》的企业购进无菌器械。

医疗机构应建立无菌器械采购、验收制度，严格执行并做好记录。采购记录至少应包括：购进产品的企业名称、产品名称、型号规格、产品数量、生产批号、灭菌批号、产品有效期等。按照记录应能追查到每批无菌器械的进货来源。

（一）从生产企业采购无菌器械，应验明生产企业销售人员出具的证明，所出具证明的内容按第七条规定。

（二）从经营企业采购无菌器械，应验明经营企业销售人员出具的证明，所出具证明的内容按第十七条规定。

第二十二条　医疗机构应建立无菌器械使用后销毁制度。使用过的无菌器械必须按规定销毁，使其零部件不再具有使用功能，经消毒无害化处理，并做好记录。

医疗机构不得重复使用无菌器械。

第二十三条　医疗机构发现不合格无菌器械，应立即停止使用、封存，并及时报告所在地药品监督管理部门，不得擅自处理。

经验证为不合格的无菌器械，在所在地药品监督管理部门的监督下予以处理。

第二十四条　医疗机构使用不合格无菌器械，不能指明不合格品生产者的，视为使用无产品注册证的产品；不能指明不合格品供货者的，视为从无《医疗器械经营企业许可证》的企业购进产品。

第二十五条　医疗机构使用无菌器械发生严重不良事件时，应在事件发生后24小时内，报告所在地省级药品监督管理部门和卫生行政部门。

第二十六条　医疗机构不得有下列行为：
（一）从非法渠道购进无菌器械；
（二）使用小包装已破损、标识不清的无菌器械；
（三）使用过期、已淘汰无菌器械；
（四）使用无《医疗器械产品注册证》、无医疗器械产品合格证的无菌器械。

第五章　无菌器械的监督检查

第二十七条　国家药品监督管理局负责编制全国无菌器械的抽查计划，并组织实施。省级药品监督管理局负责编制本辖区无菌器械的抽查计划，报国家药品监督管理局备案后组织实施。

国家药品监督管理局和各省、自治区、直辖市药品监督管理局公布无菌器械抽查结果。

第二十八条　生产、经营企业和医疗机构对抽查结果有异议的，可以自收到检验报告之日起15日内，向实施抽查的药品监督管理部门或上一级药品监督管理部门申请复验，由受理复验的药品监督管理部门做出复验结论。

第六章　罚则

第二十九条　未取得《医疗器械产品注册证》生产无菌器械的，依据《医疗器械监督管理条例》第三十五条处罚。

已取得《无菌器械产品注册证》的企业新建、改建厂房未经批准擅自生产的；伪造他人厂名、厂址、产品批号的；伪造或冒用《医疗器械产品注册证》，擅自增加无菌器械型号、规格的，依据《医疗器械监督管理条例》第三十五条处罚。

第三十条　未取得《医疗器械生产企业许可证》生产无菌器械的，伪造或冒用他人《医疗器械生产企业许可证》的，依据《医疗器械监督管理条例》第三十六条处罚。

第三十一条　生产不符合国家标准或行业标准的无菌器械的，依据《医疗器械监督管理条例》第三十七条处罚。

第三十二条　未取得《医疗器械经营企业许可证》经营无菌器械的，依据《医疗器械监督管理条例》第三十八条处罚。

第三十三条　经营无产品注册证、无合格证明、过期、失效、淘汰的无菌器械的，或者从非法渠道购进无菌器械的，依据《医疗器械监督管理条例》第三十九条处罚。

第三十四条　办理无菌器械注册申报时，提供虚假证明、文件资料、样品，或者采取其他欺骗手段，骗取无菌器械产品注册证书的，依据《医疗器械监督管理条例》第四十条处罚。

第三十五条　医疗机构使用无《医疗器械产品注册证》、无合格证明、过期、失效、淘汰无菌器械的，或者从非法渠道购进无菌器械的，依据《医疗器械监督管理条例》第四十二条处罚。

第三十六条　医疗机构重复使用无菌器械的，或者对应当销毁未进行销毁的，按《医疗器械监督管理条例》第四十三条处罚。

第三十七条　无菌器械的生产、经营企业和医疗机构违反本办法规定，有下列行为之一的，由县级以上药品监督管理部门责令改正，给予警告，并处1万元以上3万以下罚款：

（一）生产企业违反《生产实施细则》规定生产的；

（二）生产企业伪造产品原始记录及购销票据的；

（三）生产企业销售其他企业无菌器械的；

（四）生产、经营企业将有效证件出租、出借给他人使用的；

（五）经营不合格无菌器械的；

（六）医疗机构未建立使用后销毁制度或伪造、变造无菌器械采购、使用后销毁记录的；

（七）生产、经营企业、医疗机构向城乡集贸市场提供无菌器械或直接参与城乡集贸市场无菌器械交易的。

第三十八条　无菌器械生产企业违反规定采购零配件和产品包装的或销售不合格无菌器械的，由县级以上药品监督管理部门予以警告，责令改正，并处以5000元以上2万以下罚款。

第三十九条　无菌器械经营企业，无购销记录或伪造购销记录，伪造生产批号、灭菌批号、产品有效期的，由县级以上药品监督管理部门予以警告，责令停止经营，并处以5000元以上2万元以下罚款。

第四十条　无菌器械的生产、经营企业和医疗机构违反本办法规定，有下列行为之一的，由县级以上药品监督管理部门责令改正，给予警告：

（一）发现不合格无菌器械，不按规定报告，擅自处理的；

（二）对废弃零部件、过期或废弃的产品包装，不按规定处理的；

（三）经营或使用小包装已破损、标识不清的无菌器械的；

（四）使用无菌器械发生严重不良事件时，不按规定报告的。

第七章　附则

第四十一条　本办法由国家药品监督管理局负责解释。

第四十二条　本办法自颁布之日起实施。

附件：

一次性使用无菌医疗器械产品目录

序号	产品名称	产品标准	产品类别
1	一次性使用无菌注射器	GB15810－1995	三类
2	一次性使用输液器	GB8368－1998	三类
3	一次性使用输血器	GB8369－1998	三类
4	一次性使用滴定管式输液器	YY0286－1996	三类
5	一次性使用无菌注射针	GB15811－1995	三类
6	一次性使用静脉输液针	YY0028－90	三类
7	一次性使用塑料血袋	GB14232－93	三类
8	一次性使用采血器	YY0115－93	三类

危险废物转移联单管理办法

第一条 为加强对危险废物转移的有效监督，实施危险废物转移联单制度，根据《中华人民共和国固体废物污染环境防治法》有关规定，制定本办法。

第二条 本办法适用于在中华人民共和国境内从事危险废物转移活动的单位。

第三条 国务院环境保护行政主管部门对全国危险废物转移联单（以下简称联单）实施统一监督管理。

各省、自治区人民政府环境保护行政主管部门对本行政区域内的联单实施监督管理。

省辖市级人民政府环境保护行政主管部门对本行政区域内联单具体实施监督管理；在直辖市行政区域和设有地区行政公署的行政区域，由直辖市人民政府和地区行政公署环境保护行政主管部门具体实施监督管理。

前款规定的省辖市级人民政府、直辖市人民政府和地区行政公署环境保护行政主管部门，本办法以下统一简称为"环境保护行政主管部门"。

第四条 危险废物产生单位在转移危险废物前，须按照国家有关规定报批危险废物转移计划；经批准后，产生单位应当向移出地环境保护行政主管部门申请领取联单。

产生单位应当在危险废物转移前三日内报告移出地环境保护行政主管部门，并同时将预期到达时间报告接受地环境保护行政主管部门。

第五条 危险废物产生单位每转移一车、船（次）同类危险废物，应当填写一份联单。

每车、船（次）有多类危险废物的，应当按每一类危险废物填写一份联单。

加盖公章，经交付危险废物运输单位核实验收签字后，将联单第一联副联自留存档，将联单第二联交移出地环境保护行政主管部门，联单第一联正联及其余各联交付运输单位随危险废物转移运行。

第七条 危险废物运输单位应当如实填写联单的运输单位栏目，按照国家有关危险物品运输的规定，将危险废物安全运抵联单载明的接受地点，并将联单第一联、第二联副联、第三联、第四联、第五联随转移的危险废物交付危险废物接受单位。

第八条 危险废物接受单位应当按照联单填写的内容对危险废物核实验收，如实填写联单中接受单位栏目并加盖公章。

接受单位应当将联单第一联，第二联副联自接受危险废物之日起十日内交付产生单位，联单第一联由产生单位自留存档，联单第二联副联由产生单位在二日内报送移出地环境保护行政主管部门；接受单位将联单第三联交付运输单位存档；将联单第四联自留存档；将联单第五联自接受危险废物之日起二日内报送接受地环境保护行政主管部门。

第九条 危险废物接受单位验收发现危险废物的名称、数量、特性、形态、包装方式与联单填写内容不符的，应当及时向接受地环境保护行政主管部门报告，并通知产生单位。

第十条 联单保存期限为五年；贮存危险废物的，其联单保存期限与危险废物贮存期限相同。

环境保护行政主管部门认为有必要延长联单保存期限的，产生单位、运输单位和接受单位应当按照要求延期保存联单。

第十一条 省辖市级以上人民政府环境保护行政主管部门有权检查联单运行的情况，也可以委托县级人民政府环境保护行政主管部门检查联单运行的情况。

被检查单位应当接受检查，如实汇报情况。

第十二条 转移危险废物采用联运方式的，前一运输单位须将联单各联交付后一运输单位随危险废物转移运行，后一运输单位必须按照联单的要求核对联单产生单位栏目事项和前一运输单位填写的运输单位栏目事项，经核对无误后填写联单的运输单位栏目并签字。经后一运输单位签字的联单第三联的复印件由前一运输单位自留存档，经接受单位签字的联单第三联由最后一运输单位自留存档。

第十三条 违反本办法有下列行为之一的，由省辖市级以上地方人民政府环境保护行政主管部门责令限期改正，并处以罚款：

（一）未按规定申领、填写联单的；

（二）未按规定运行联单的；

（三）未按规定期限向环境保护行政主管部门报送联单的；

（四）未在规定的存档期限保管联单的；

（五）拒绝接受有管辖权的环境保护行政主管部门对联单运行情况进行检查的。

有前款第（一）项、第（三）项行为之一的，依据《中华人民共和国固体废物污染环境防治法》有关规定，处五万元以下罚款；有前款第（二）项、第（四）项行为之一的，处三万元以下罚款；有前款第（五）项行为的，依据《中华人民共和国固体废物污染环境防治法》有关规定，处一万元以下罚款。

第十四条 联单由国务院环境保护行政主管部门统一制定由省、自治区、直辖市人民政府环境保护行政主管部门印制。

联单共分五联，颜色分别为：第一联，白色；第二联，红色；第三联，黄色；第四联，蓝色；第五联，绿色。

联单编号由十位阿拉数字组成。第一位、第二位数字为省级行政区划代码，第三位、第四位数字为省辖市级行政区划代码，第五位、第六位数字为危险废物类别代码，其余四位数字由发放空白联单的危险废物移出地省辖市级人民政府环境保护行政主管部门按照危险废物转移流水号依次编制。联单由直辖市人民政府环境保护行政主管部门发放的，其编号第三位、第四位数字为零。

第十五条 本办法由国务院环境保护行政主管部门负责解释。

第十六条 本办法自一九九九年十月一日起施行。

消毒管理办法

卫生部第27号令

《消毒管理办法》的修订已于2001年12月29日部务会通过，现予以发布，自2002年7月1日起施行。1992年8月31日发布的《消毒管理办法》同时废止。

部 长： 张文康

第一章 总则

第一条 为了加强消毒管理，预防和控制感染性疾病的传播，保障人体健康，根据《中华人民共和国传染病防治法》及其实施办法的有关规定，制定本办法。

第二条 本办法适用于医疗卫生机构、消毒服务机构以及从事消毒产品生产、经营活动的单位和个人。

其他需要消毒的场所和物品管理也适用于本办法。

第三条 卫生部主管全国消毒监督管理工作。

铁路、交通卫生主管机构依照本办法负责本系统的消毒监督管理工作。

第二章 消毒的卫生要求

第四条 医疗卫生机构应当建立消毒管理组织，制定消毒管理制度，执行国家有关规范、标准和规定，定期开展消毒与灭菌效果检测工作。

第五条 医疗卫生机构工作人员应当接受消毒技术培训、掌握消毒知识，并按规定严格执行消毒隔离制度。

第六条 医疗卫生机构使用的进入人体组织或无菌器官的医疗用品必须达到灭菌要求。各种注射、穿刺、采血器具应当一人一用一灭菌。凡接触皮肤、粘膜的器械和用品必须达到消毒要求。

医疗卫生机构使用的一次性使用医疗用品用后应当及时进行无害化处理。

第七条 医疗卫生机构购进消毒产品必须建立并执行进货检查验收制度。

第八条 医疗卫生机构的环境、物品应当符合国家有关规范、标准和规定。排放废弃的污水、污物应当按照国家有关规定进行无害化处理。运送传染病病人及其污染物品的车辆、工具必须随时进行消毒处理。

第九条 医疗卫生机构发生感染性疾病暴发、流行时，应当及时报告当地卫生行政部门，并采取有效消毒措施。

第十条 加工、出售、运输被传染病病原体污染或者来自疫区可能被传染病病原体污染的皮毛，应当进行消毒处理。

第十一条 托幼机构应当健全和执行消毒管理制度，对室内空气、餐(饮)具、毛巾、玩具和其他幼儿活动的场所及接触的物品定期进行消毒。

第十二条 出租衣物及洗涤衣物的单位和个人，应当对相关物品及场所进行消毒。

第十三条 从事致病微生物实验的单位应当执行有关的管理制度、操作规程，对实验的器材、污染物品等按规定进行消毒，防止实验室感染和致病微生物的扩散。

第十四条 殡仪馆、火葬场内与遗体接触的物品及运送遗体的车辆应当及时消毒。

第十五条 招用流动人员200人以上的用工单位，应当对流动人员集中生活起居的场所及使用的物品定期进行消毒。

第十六条 疫源地的消毒应当执行国家有关规范、标准和规定。

第十七条 公共场所、食品、生活饮用水、血液制品的消毒管理，按有关法律、法规的规定执行。

第三章　消毒产品的生产经营

第十八条 消毒产品应当符合国家有关规范、标准和规定。

第十九条 消毒产品的生产应当符合国家有关规范、标准和规定，对生产的消毒产品应当进行检验，不合格者不得出厂。

第二十条 消毒剂、消毒器械、卫生用品和一次性使用医疗用品的生产企业应当取得所在地省级卫生行政部门发放的卫生许可证后，方可从事消毒产品的生产。

第二十一条 省级卫生行政部门应当自受理消毒产品生产企业的申请之日起一个月内作出是否批准的决定。对符合《消毒产品生产企业卫生规范》要求的，发给卫生许可证；对不符合的，不予批准，并说明理由。

第二十二条 消毒产品生产企业卫生许可证编号格式为：(省、自治区、直辖市简称)卫消证字(发证年份)第 XXXX 号。

消毒产品生产企业卫生许可证的生产项目分为消毒剂类、消毒器械类、卫生用品类和一次性使用医疗用品类。

第二十三条 消毒产品生产企业卫生许可证有效期为四年，每年复核一次。

消毒产品生产企业卫生许可证有效期满前三个月，生产企业应当向原发证机关申请换发卫生许可证。经审查符合要求的，换发新证。新证延用原卫生许可证编号。

第二十四条 消毒产品生产企业迁移厂址或者另设分厂(车间)，应当按本办法规定向生产场所所在地的省级卫生行政部门申请消毒产品生产企业卫生许可证。

产品包装上标注的厂址、卫生许可证号应当是实际生产地地址和其卫生许可证号。

第二十五条 取得卫生许可证的消毒产品生产企业变更企业名称、法定代表人或者生产类别的，应当向原发证机关提出申请，经审查同意，换发新证。新证延用原卫生许可证编号。

第二十六条 卫生用品和一次性使用医疗用品在投放市场前应当向省级卫生行政部门备案。备案时按照卫生部制定的卫生用品和一次性使用医疗用品备案管理规定的要求提交资料。

省级卫生行政部门自受理申请之日起十五日内对符合要求的，发给备案凭证。备案文号格式为：(省、自治区、直辖市简称)卫消备字(发证年份)第 XXXX 号。不予备案的，应当说明理由。

备案凭证在全国范围内有效。

第二十七条 进口卫生用品和一次性使用医疗用品在首次进入中国市场销售前应当向卫生部备案。备案时按照卫生部制定的卫生用品和一次性使用医疗用品备案管理规定的要求提交资料。必要时，卫生部可以对生产企业进行现场审核。

卫生部自受理申请之日起十五日内对符合要求的，发给备案凭证。备案文号格式为：卫消备进字(发证年份)第 XXXX 号。不予备案的，应当说明理由。

第二十八条 生产消毒剂、消毒器械应当按照本办法规定取得卫生部颁发的消毒剂、消毒器械卫生许可批件。

第二十九条 生产企业申请消毒剂、消毒器械卫生许可批件的审批程序是：

(一)生产企业应当按卫生部消毒产品申报与受理规定的要求，向所在地省级卫生行政部门提出申请，由省级卫生行政部门对其申报资料和样品进行初审；

(二)省级卫生行政部门自受理之日起一个月内完成对申报资料完整性、合法性和规范性的审查，审查合格的方可报卫生部审批；

(三)卫生部自受理申报之日起四个月内作出是否批准的决定。

卫生部对批准的产品，发给消毒剂、消毒器械卫生许可批件，批准文号格式为：卫消准字(年份)第 XXXX 号。不予批准的，应当说明理由。

第三十条 申请进口消毒剂、消毒器械卫生许可批件的，应当直接向卫生部提出申

请，并按照卫生部消毒产品申报与受理规定的要求提交有关材料。必要时，卫生部可以对生产企业现场进行审核。

卫生部应当自受理申报之日起四个月内做出是否批准的决定。对批准进口的，发给进口消毒剂、消毒器械卫生许可批件，批准文号格式为：卫消进准字(年份)第 XXXX 号。不予批准的，应当说明理由。

第三十一条 消毒剂、消毒器械卫生许可批件的有效期为四年。有效期满前六个月，生产企业或者进口产品代理商应当按照卫生部消毒产品申报与受理规定的要求提出换发卫生许可批件申请。获准换发的，卫生许可批件延用原批准文号。

第三十二条 经营者采购消毒产品时，应当索取下列有效证件：

(一)生产企业卫生许可证复印件；

(二)产品备案凭证或者卫生许可批件复印件。

有效证件的复印件应当加盖原件持有者的印章。

第三十三条 消毒产品的命名、标签(含说明书)应当符合卫生部的有关规定。

消毒产品的标签(含说明书)和宣传内容必须真实，不得出现或暗示对疾病的治疗效果。

第三十四条 禁止生产经营下列消毒产品：

(一)无生产企业卫生许可证、产品备案凭证或卫生许可批件的；

(二)产品卫生质量不符合要求的。

第四章 消毒服务机构

第三十五条 消毒服务机构应当向省级卫生行政部门提出申请，取得省级卫生行政部门发放的卫生许可证后方可开展消毒服务。

消毒服务机构卫生许可证编号格式为：(省、自治区、辖市简称)卫消服证字(发证年份)第 XXXX 号，有效期四年，每年复核一次。有效期满前三个月，消毒服务机构应当向原发证机关申请换发卫生许可证。经审查符合要求的，换发新证。新证延用原卫生许可证编号。

第三十六条 消毒服务机构应当符合以下要求：

(一)具备符合国家有关规范、标准和规定的消毒与灭菌设备；

(二)其消毒与灭菌工艺流程和工作环境必须符合卫生要求；

(三)具有能对消毒与灭菌效果进行检测的人员和条件，建立自检制度；

(四)用环氧乙烷和电离辐射的方法进行消毒与灭菌的，其安全与环境保护等方面的要求按国家有关规定执行；

(五)从事用环氧乙烷和电离辐射进行消毒服务的人员必须经过省级卫生行政部门的专业技术培训，以其他消毒方法进行消毒服务的人员必须经过设区的市(地)级以上卫生行政部门组织的专业技术培训，取得相应资格证书后方可上岗工作。

第三十七条 消毒服务机构不得购置和使用不符合本办法规定的消毒产品。

第三十八条 消毒服务机构应当接受当地卫生行政部门的监督。

第五章 监督

第三十九条 县级以上卫生行政部门对消毒工作行使下列监督管理职权：

(一)对有关机构、场所和物品的消毒工作进行监督检查；

(二)对消毒产品生产企业执行《消毒产品生产企业卫生规范》情况进行监督检查；

(三)对消毒产品的卫生质量进行监督检查；

(四)对消毒服务机构的消毒服务质量进行监督检查；

(五)对违反本办法的行为采取行政控制措施；

(六)对违反本办法的行为给予行政处罚。

第四十条 有下列情形之一的，省级以上卫生行政部门可以对已获得卫生许可批件和备案凭证的消毒产品进行重新审查：

(一)产品配方、生产工艺真实性受到质疑的；

(二)产品安全性、消毒效果受到质疑的；

(三)产品宣传内容、标签(含说明书)受到质疑的。

第四十一条 消毒产品卫生许可批件的持有者应当在接到省级以上卫生行政部门重新审查通知一个月内，按照通知的有关要求提交材料。超过上述期限未提交有关材料的，视为放弃重新审查，省级以上卫生行政部门可以注销产品卫生许可批准文号或备案文号。

第四十二条 省级以上卫生行政部门自收到重新审查所需的全部材料之日起一个月内，应当作出重新审查决定。有下列情形之一的，注销产品卫生许可批准文号或备案文号：

(一)擅自更改产品名称、配方、生产工艺的；

(二)产品安全性、消毒效果达不到要求的；

(三)夸大宣传的。

第四十三条 消毒产品检验机构应当经省级以上卫生行政部门认定。未经认定的，不得从事消毒产品检验工作。

消毒产品检验机构出具的检验和评价报告，应当客观、真实，符合有关规范、标准和规定。

消毒产品检验机构出具的检验报告，在全国范围内有效。

第四十四条 对出具虚假检验报告或者疏于管理难以保证检验质量的消毒产品检验机构，由省级以上卫生行政部门责令改正，并予以通报批评；情节严重的，取消认定资格。被取消认定资格的检验机构二年内不得重新申请认定。

第六章 罚则

第四十五条 医疗卫生机构违反本办法第四、五、六、七、八、九条规定的，由县级以上地方卫生行政部门责令限期改正，可以处 5000 元以下罚款；造成感染性疾病暴发的，可以处 5000 元以上 20000 元以下罚款。

第四十六条 加工、出售、运输被传染病病原体污染或者来自疫区可能被传染病病原体污染的皮毛，未按国家有关规定进行消毒处理的，应当按照《传染病防治法实施办法》第六十八条的有关规定给予处罚。

第四十七条 消毒产品生产经营单位违反本办法第三十三、三十四条规定的，由县级以上地方卫生行政部门责令其限期改正，可以处 5000 元以下罚款；造成感染性疾病暴发的，可以处 5000 元以上 20000 元以下的罚款。

第四十八条 消毒服务机构违反本办法规定，有下列情形之一的，由县级以上卫生行政部门责令其限期改正，可以处 5000 元以下的罚款；造成感染性疾病发生的，可以处 5000 元以上 20000 元以下的罚款：

(一)消毒后的物品未达到卫生标准和要求的；

(二)未取得卫生许可证从事消毒服务业务的。

第七章 附则

第四十九条 本办法下列用语的含义：

感染性疾病：由微生物引起的疾病。

消毒产品：包括消毒剂、消毒器械(含生物指示物、化学指示物和(灭菌物品包装物)、

卫生用品和一次性使用医疗用品。

消毒服务机构：指为社会提供可能被污染的物品及场所、卫生用品和一次性使用医疗用品等进行消毒与灭菌服务的单位。

医疗卫生机构：指医疗保健、疾病控制、采供血机构及与上述机构业务活动相同的单位。

第五十条 本办法由卫生部负责解释。

第五十一条 本办法自2002年7月1日起施行。1992年8月31日卫生部发布的《消毒管理办法》同时废止。

中 华 人 民 共 和 国 国 家 标 准

GB 19218—2003

医疗废物焚烧炉技术要求

（试行）

Technical standard for medical waste incinerator

2003-06-30 发布　　2003-06-30 实施

国 家 环 境 保 护 总 局

国 家 质 量 监 督 检 验 检 疫 总 局 发 布

国 家 发 展 和 改 革 委 员 会

前 言

为贯彻《中华人民共和国环境保护法》和《中华人民共和国固体废物污染环境防治法》，防治医疗废物焚烧炉对环境的污染，保护环境，保障人体健康，制定本标准。

本标准由国家环境保护总局科技标准司、国家标准化管理委员会工交部、国家发展和改革委员会环境和资源综合利用司提出。

本标准由中国环境科学研究院固体废物污染控制技术研究所负责起草。

本标准为试行标准，自 2003 年 6 月 30 日起实施，试行期限为一年。

医疗废物焚烧炉技术要求 （试行）

1.适用范围

本标准适用于处理医疗废物的焚烧炉的设计、制造。

2.引用标准

下列文件中的条款通过本标准引用而成为本标准的条款。凡是注日期的引用文件，其随后所有的修改单（不包括勘误的内容）或修订版均不适用于本部分，然而鼓励根据本部分达成协议的各方研究是否可使用这些文件的最新版本。凡是不注日期的引用文件，其最新版本适用于本部分。

GB 8978—1996 污水综合排放标准

GB 18484—2001 危险废物焚烧污染控制标准

GB/T 16157—1996 固定污染源排气中颗粒物测定与气态污染物采样方法

HJ/T 20—1998 工业固体废物采样制样技术规范

3. 定义

3.1 医疗废物： 医院、卫生防疫单位、病员疗养院、医学研究单位等产生的感染性废物，主要包括：

1) 医院临床感染性废物，包括病人手术或尸解后的废物（如组织、受污染材料和仪器等）以及被血液或人体体液污染的废医疗材料、废医疗仪器以及其它废物（如废敷料、废医用手套、废注射器、废输液器、废输血器等）；

2) 医院血透析产生的废物（如废弃的设备、试管、过滤器、围裙、手套等）；

3) 临床、教学、实验、研究等医学活动中产生的含有菌落及病原株培养液和保菌液的废弃物以及感染的动物尸体；

4) 传染病房产生的所有废物（如排泄物、废敷料、生活垃圾以及病人接触过的任何其他废设备、废材料）；

5) 医院产生的废弃锋利物，包括废针头、废皮下注射针、废解剖刀、废手术刀、废输液器、废手术锯、碎玻璃等；

6) 医院废水处理产生的污泥；

7) 过期的药物性和化学性废物。

3.2 焚烧炉：采用热力技术处理废物使之分解并达到无害化的装置，包括进料装置、炉体、烟气净化装置、控制系统、报警系统和应急处理系统等。

3.3 热灼减率：指焚烧残渣经灼热减少的质量占原焚烧残渣质量的百分数。其计算方法如下：

$$P=(A-B)/A \times 100\%$$

式中：P——热灼减率，%；

A——干燥后原始焚烧残渣在室温下的质量，g；

B——焚烧残渣经 600℃（±25℃）3h 灼热后冷却至室温的质量，g。

3.4 烟气停留时间：燃烧所产生的烟气从最后的助燃空气喷射口或燃烧器出口到烟道冷风引射口之间的停留时间。

3.5 焚烧炉温度：焚烧炉燃烧室出口中心的温度。

3.6 参考状态：温度在 273.16K，压力在 101.325kPa，氧含量 11%（干烟气）时的气体状态。

4.基本要求

4.1 焚烧炉的设计应该保证其使用寿命不低于 10 年。

4.2 焚烧炉所采用耐火材料的技术性能应该满足焚烧炉燃烧气氛的要求，质量应满足所选择耐火材料对应的技术标准，能够承受焚烧炉工作状态的交变热应力。

4.3 焚烧炉炉体外观要求严整规矩，无明显凹凸疤痕或破损；漆面光洁、牢固、无明显挂漆、漆粒；表面处理件应光滑，无锈蚀。

4.4 焚烧炉炉门应启闭灵活，严密轻巧。炉门尺寸应该与医疗废物包装尺寸相配套，避免在进料时使医疗废物包装散开、破碎。

4.5 焚烧炉应该采用密闭的自动进料装置，并能与自动卸料装置相衔接，尽量避免操作人员与医疗废物接触。

4.6 焚烧炉应该设置二次燃烧室；二次燃烧室应配备助燃空气和辅助燃烧装置。

4.7 焚烧炉炉床设计应防止液体或未充分燃烧的废物溢漏，保证未充分燃烧的医疗废物不通过炉床遗漏进炉渣，并能使空气沿炉床体均匀分配。

4.8 焚烧炉应具有完整的烟气净化装置。烟气净化装置应包括酸性气体去除装置、除尘装置及二噁英控制装置，并具有防腐蚀措施。

除尘装置应优先选择布袋除尘器；如果选择湿式除尘装置，必须配备完整的废水处理设施。不得使用静电除尘和机械除尘装置。

4.9 焚烧炉应该设置监测系统、控制系统、报警系统和应急处理安全防爆装置。监测系统能在线显示焚烧炉燃烧温度和炉膛压力等表征焚烧炉运行工况参数。

4.10 焚烧炉烟气净化装置应该设有烟气在线自动监测系统，监测烟气排放状况。

5.技术性能要求

5.1 医疗废物焚烧炉的技术性能要求见表 1。

5.2 焚烧炉主燃烧室炉膛容积热负荷和断面热负荷的选择应满足废物在 1000Kcal/h 低位热值时，炉膛中心温度不低于 750℃的要求。炉膛尺寸的选择应保证医疗废物在炉膛内足够的停留时间，确保废物充分燃尽。

5.3 医疗废物焚烧炉出口烟气中的氧气含量应为 6%－10%（干烟气）。

5.4 医疗废物焚烧炉运行过程中要保证系统处于负压状态，避免有害气体逸出。

5.5 炉体表面温度不得高于 50℃。

5.6 焚烧炉排气筒高度应该按照 GB18484 的规定执行。

表 1 医疗废物焚烧炉的技术性能指标

焚烧炉温度（℃）	烟气停留时间（S）	焚烧残渣的热灼减率（%）
≥850	≥2.0	<5

6.环境保护技术指标

6.1 医疗废物焚烧炉排放气体在参考状态下的排放限值不应高于 GB18484-2001 规定的限值（见附表 1）。

6.2 其他环境保护技术指标见表 2。

表 2 医疗废物焚烧炉环境保护设备技术指标限值

序号	项目	单位	限值
1	噪声	dB(A)	≤85
2	残留物含菌量		无

6.3 医疗废物焚烧炉如有污水排放，在排放前应该进行消毒处理。污水的监测项目应有 pH 值、F^-、NO_3^-、Hg、As、Pb、Cd 以及粪大肠菌群和总余氯（见附表 2）。

6.4 医疗废物焚烧飞灰按照危险废物进行安全处置。

7.焚烧炉的安全要求

7.1 焚烧炉的燃烧器应设有安全保护装置。燃烧器启动后点火不正常时安全保护装置应能自动切断燃料供应并报警。

7.2 焚烧炉停止运行前（包括正常停炉和安全程序停炉）必须有对燃烧室进行冷却的程序。当燃烧室温度下降到设定值时，冷却程序停止，焚烧炉停止工作。

7.3 焚烧炉必须有防爆措施及装置。

7.4 焚烧炉的电源必须有漏电保护装置。

7.5 在常温下和相对湿度不超过 85%的条件下，电器回路绝缘电阻不得小于 2MΩ，并能承受 1min 工频（50Hz）、电压 1500V 的实验，不得有击穿和短路现象。

7.6 各连接件必须定位准确，连接可靠。

7.7 控制箱与各被控设备之间的连接线必须有金属硬、软管保护。

7.8 炉体所附油气路及其所属附件应安装牢固，连接处不得有泄露。

8. 检验方法

8.1 焚烧炉温度取测量焚烧炉燃烧室出口中心的温度值，用热电偶测定。

8.2 烟气停留时间和炉膛热负荷根据设计文件检查确定。

8.3 热灼减率的测定：按照 HJ/T20 采取和制备样品，依据本技术要求 3.3 条要求测定、计算，取三次平均值作为判定值。

8.4 医疗废物焚烧炉系统排放气体污染物的分析测试方法按 GB18484 的规定执行（见附表 3）。

8.5 医疗废物焚烧炉产生的污水，其排放污染物按 GB8978 规定的方法检测（见附表 4）。

8.6 氧气浓度测定按 GB/T16157 中的有关规定执行。

8.7 电器绝缘电阻用 500V 兆欧表测量；绝缘强度经受 50Hz、1500V 交流电压耐压试验，历时 1min。

8.7 燃油或燃气燃烧器的安全点火时间为 5s—7s。如果发生点火失败或故障熄火，安全保护装置应能自动切断燃料供应。重新点火前的停止扫气时间不得低于 30s。

每隔 3min 试验一次，连续试验 10 次，成功次数不得低于 9 次。

附表 1 医疗废物焚烧炉大气污染物排放限值[1)]

序号	污染物	不同焚烧容量时的最高允许排放浓度限值（mg/m^3）		
		≤300(kg/h)	300～2500(kg/h)	≥2500 (kg/h)
1	烟气黑度	林格曼 1 级		
2	烟尘	100	80	65
3	一氧化碳（CO）	100	80	80
4	二氧化硫（SO_2）	400	300	200
5	氟化氢（HF）	9.0	7.0	5.0
6	氯化氢（HCl）	100	70	60
7	氮氧化物（以 NO_2 计）	500		
8	汞及其化合物(以 Hg 计)	0.1		
9	镉及其化合物(以 Cd 计)	0.1		
10	砷、镍及其化合物（以 As+Ni 计）	1.0		
11	铅及其化合物(以 Pb 计)	1.0		
12	铬、锡、锑、铜、锰及其化合物（以 Cr+Sn+Sb+Cu+Mn 计）	4.0		
13	二恶英类	0.5TEQng/m^3		

1) 在测试计算过程中，以 11%O_2（干气）作为换算基准。换算公式为：

$$c=10/(21-Os)\times c_s$$

式中：c——标准状态下被测污染物经换算后的浓度（mg/m^3）；

Os——排气中氧气的浓度（%）；

c_s——标准状态下被测污染物的浓度（mg/m^3）。

附表 2 医疗废物焚烧炉污水排放限值

序号	污染物	最高允许排放浓度* （mg/L）		
		一级	二级	三级
1	pH	6～9	6～9	6～9
2	F^-	10	10	20
3	Hg	0.05		
4	As	0.1		
5	Pb	0.5		
6	Cd	1.0		
7	粪大肠菌群数	100 个/L	500 个/L	1000 个/L
8	总余氯	<0.5**	>6.5(接触时间≥1.5h)	>5(接触时间≥1.5h)

注：* 排入 GB3838 中III类水域和排入 GB3097 中二类海域的污水，执行一级标准；排入 GB3838 中Ⅳ、Ⅴ类水域和排入 GB3097 中三类海域的污水，执行二级标准；排入设置二级污水处理厂的城镇排水系统的污水，执行三级标准。

** 加氯消毒后须进行脱氯处理，达到本标准。

附表 3 医疗废物焚烧炉排放气体的分析方法

序号	污染物	分析方法	方法来源
1	烟气黑度	林格曼烟度法	GB/T5468-91
2	烟尘	重量法	GB/T16157-1996
3	一氧化碳（CO）	非分散红外吸收法	HJ/T44-1999
4	二氧化硫（SO_2）	甲醛吸收副玫瑰苯胺分光光度法	1）
5	氟化氢（HF）	滤膜·氟离子选择电极法	1）
6	氯化氢（HCl）	硫氰酸汞分光光度法	HJ/T27-1999
		硝酸银容量法	1）
7	氮氧化物	盐酸萘乙二胺分光光度法	HJ/T 43-1999
8	汞	冷原子吸收分光光度法	1）
9	镉	原子吸收分光光度法	1）
10	铅	火焰原子吸收分光光度法	1）
11	砷	二乙基二硫代氨基甲酸银分光光度法	1）
12	铬	二苯碳酰二肼分光光度法	1）
13	锡	原子吸收分光光度法	1）
14	锑	5-Br-PADAP 分光光度法	1）
15	铜	原子吸收分光光度法	1）
16	锰	原子吸收分光光度法	1）
17	镍	原子吸收分光光度法	1）

1） 《空气和废气监测分析方法》，中国环境科学出版社，北京，1990 年。

2） 《固体废弃物试验分析评价手册》，中国环境科学出版社，北京，1992 年，P332～359。

附表 4 医疗废物焚烧炉污水的分析方法

序号	污染物	分析方法	方法来源
1	pH	玻璃电极法	GB6920—86
2	F^-	离子选择电极法	GB7484—87
3	Hg	冷原子吸收光度法	GB7468—87
4	As	二乙基二硫代氨基甲酸银分光光度法	GB7485—87
5	Pb	原子吸收分光光度法	GB7475—87
6	Cd	原子吸收分光光度法	GB7475—87
7	粪大肠菌群数	多管发酵法	《水和废水监测分析方法（第四版）》，中国环境科学出版社，2002 年
8	总余氯	N,N-二乙基-1,4-苯二胺分光光度法 N,N-二乙基-1,4-苯二胺滴定法	GB11898-89 GB11897-89

中 华 人 民 共 和 国 国 家 标 准

GB 19217-2003

医疗废物转运车技术要求
（试行）

Technical standard for medical waste transport vehicle

2003—06—30 发布　　2003—06—30 实施

国 家 环 境 保 护 总 局
国家质量监督检验检疫总局　发布
国 家 发 展 和改革委员会

前　　言

为贯彻《中华人民共和国环境保护法》和《中华人民共和国固体废物污染环境防治法》，防止和控制医疗废物对环境的污染，保护环境，保障人体健康，制定本标准。

本标准参考了 QC/T 450—2000《保温车、冷藏车技术条件》，增加了对医疗废物污染控制的有关环境保护要求。

本标准的附录 A 是规范性附录。

本标准由国家环境保护总局科技标准司、国家标准化管理委员会工交部、国家发展和改革委员会产业政策司提出。

本标准由中国环境科学研究院环境标准研究所等单位起草。

本标准为试行标准，自 2003 年 6 月 30 日起实施，试行期限为一年。

医疗废物转运车技术要求（试行）

1 主题内容与适用范围

1.1 主题内容

本标准规定了医疗废物运输转运车的有关方面的特殊要求。

1.2 适用范围

本标准适用于已定型的保温车、冷藏车进行适当改造，用于运输医疗废物的专用货车。

2 引用标准

QC/T 450—2000 保温车、冷藏车技术条件
QC/T 449—2000 保温车、冷藏车性能试验方法
GB/T 18411-2001 道路车辆产品标牌

3 定义

本标准采用下列定义。

3.1 漏气量

单位时间内空气的漏气量，用 V 表示，单位为 m^3/h。漏气量用来衡量车厢的气密性能。

3.2 总漏热率

单位温差内热功率的消耗量。总漏热率用来综合衡量车厢的漏热性能，由下式确定：

$$U_a=Q/(\theta_i-\theta_e)$$

式中：U_a——总漏热率，W/K；

Q——车厢内加热稳定时的总耗功率，W；

θ_i——车厢内部平均温度，即为各感温元件指示温度的算术平均值，K；

θ_e——车厢外部平均温度，即为各感温元件指示温度的算术平均值，K。

4 要求

4.1 一般要求

除本标准规定的内容外，医疗废物转运车应符合 QC/T 450—2000 的要求。

4.2 整车

4.2.1 驾驶室应与货厢完全隔开，以保证驾驶人员的安全。

4.2.2 附属设备

车辆应配备专用的箱子，放置因意外发生事故后防止污染扩散的用品：

a） 消毒器械及消毒剂；

b） 收集工具及包装袋；

c） 人员卫生防护用品等。

4.3 车厢

4.3.1 车厢容积

医疗废物转运车可按医疗废物装载比重 $200Kg/m^3$ 设计车厢容积，并要求满载后车厢容积留有 1/4 的空间不装载，以利于内部空气循环，便于消毒和冷藏降温。

应当按照最大允许装载质量和医疗废物装载比重 $200Kg/m^3$ 计算限制装载线高度，并在车厢侧壁予以标识。

4.3.2 车厢内部尺寸的设计

医疗废物采用加盖长方体专用周转箱盛装专用塑料袋密封包装的医疗废物。周转箱外形推荐尺寸为（长×宽×高）：600mm×500mm×400mm。 $V=0.12\ m^3\times 200\ Kg/m^3=0.24\ Kg$

车厢内部尺寸应参考周转箱外形尺寸和车辆装载质量要求进行设计。

4.3.3 车厢内部材料

车厢内部表面，应采用耐腐蚀、便于消毒和清洗的材料，表面平整，具有一定强度，车厢底部周边及转角应圆滑，不留死角；车厢的密封材料同样应耐腐蚀。

4.3.4 车厢性能

4.3.4.1 气密性能

车厢应具有良好的密封性能。在车厢内外压差为（100±10）Pa 的条件下，将测得的漏气量转化为标准状况（273K，1.013×10^5Pa）下的漏气量，其值应符合表 1 的规定。

表 1

车厢容积，m^3	漏气量，m^3/h
≤5	≤5～13
>5～10	≤10～20
>10～20	≤18～35

>20～30	> 25～50
>30～40	> 35～60
>40	> 40～70

4.3.4.2 隔热性能

如用户有要求，则车厢应具有良好的隔热性能。当车厢平均壁温为 293—298K，内外温差不小于 20K 时，其车厢的总漏热率应符合表 2 的规定。

表 2

车厢容积，m^3	总漏热率，W/K
≤5	≤ 5～10
>5～10	≤ 10～15
>10～20	≤ 16～25
>20～30	≤ 25～35
>30～40	≤ 30～45
>40	≤ 50～70

注：平均壁温规定为车厢内、外温度的算术平均值。

如用户要求恒温冷藏功能，按照冷藏车标准执行。

4.3.4.3 液体防渗和排出要求

车厢应经防渗处理，在装载货物时，即使车箱内部有液体，也不会渗漏到箱体保温层和外部环境中。

车厢底部应设置具有良好气密性的排水孔，在清洗车厢内部时，能够有效收集和排出污水，不可使清洗污水直接漫流到外部环境中；正常运输使用时应具有良好气密性。

4.3.5 货物固定装置

为保证在非满载运输车辆紧急启、停或事故时医疗废物周转箱不会翻转，应在车厢内部设置有对货物进行固定的装置。

4.3.6 车厢颜色

车厢外部颜色为白色或银灰色。

5 检验方法

5.1 对本标准第 4.3.4.1 和 4.3.4.2 条所规定的车厢气密性能和隔热性能的检验，应按照 QC/T 449—2000 的规定在车辆定型试验时进行。

5.2 本标准第 4.3.4.3 条所规定的车厢液体防渗和排出性能要求，采用下述方法进行检验。

液体防渗试验方法：开启车厢后门，向车厢内灌注带颜色（可以是红色）自来水 10L，关闭车厢后门，在城市道路正常行驶 1 小时后，车厢外部无明显渗漏。

清洗污水排出试验：现场清洗车厢 15-20min，检查污水是否从车厢后部漫流到箱外，并是否可靠收集。

5.3 本标准第 4 章所规定的其他特殊环境保护要求，如车厢易于消毒和清洗性能等，可采用检查车辆设计制造文件和外观检查的方法进行检验。

6 标志和警示说明

6.1 医疗废物转运车应在明显部位固定产品标牌。标牌应符合 GB/T 18411-2001 的规定，包括以下内容：

a）产品名称、品牌与型号；

b）发动机型号；

c）发动机最大净功率，kW ；

d）最大设计总质量，kg；
e）最大设计装载质量，kg；
f）车厢内容积，m^3；
g）车厢内调温范围，℃；
h）生产序号及生产日期；
i）制造厂名称及 VIN 。

6.2 医疗废物转运车应在车辆的前部、后部及车厢两侧喷涂附录 A 所示警示性标志；

6.3 驾驶室两侧应标明医疗废物处置转运单位名称。

6.4 警示说明

医疗废物转运车应在驾驶室明显部位标注车辆运输医疗废物的警示说明，应包括但不限于以下内容：

“本车仅适用于采用专用周转箱盛装专用塑料袋密封包装的医疗废物运输。

本车不适用于其他方式的医疗废物运输。

本车未经国家认可部门检验批准，禁止用于医疗废物以外的其他货物运输。

7 运输、贮存和报废

7.1 运输

医疗废物转运车在铁路（或水路）运输时应以自驶（或拖拽）方式上下车（船），若必须用吊装方式装卸时，应防止损伤产品。

7.2 贮存

医疗废物转运车停用时，应将车厢内、外进行彻底清洗、消毒、凉干，锁上车厢门和驾驶室；停放在通风、防潮、防暴晒、无腐蚀气体侵害的场所。停用期间不得用于其他目的运输。

7.3 报废

车辆报废时，车厢部分应进行严格消毒后再进行废物处理。

附录 A　　（规范性附录）

医疗废物转运车标志

A.1 医疗废物转运车上须印制或设立医疗废物警示图形标识，标识样式如下图：

比例为 1:1，标志图形和文字颜色　　为黑色，底色为醒目的橘红色。

APPENDIX F

MEDICAL WASTE REGULATIONS DEVELOPED AND PROMULGATED BY TIANJIN

天津市人民政府文件

津政发〔2003〕91号

批转市环保局关于集中处置医疗废物意见的通知

各区、县人民政府，各委、局，各直属单位：

市人民政府领导同志同意市环保局《关于集中处置医疗废物的意见》，现转发给你们，望遵照执行。

天津市人民政府

二〇〇三年八月六日

关于集中处置医疗废物的意见

为了加强医疗废物的安全管理，防止疾病传播，保护环境，保障人民群众身体健康，根据《医疗废物管理条例》（国务院令第380号，以下简称《条例》），现就我市医疗废物集中处置工作提出如下意见：

一、市环保局、市卫生局按照各自职责分工，负责组织对《条例》的贯彻实施。市卫生局负责对全市医疗卫生机构医疗废物的监督管理，市环保局负责对医疗废物收集和集中处置工作的监督管理。

二、对医疗废物集中处置的范围是：市内六区各级各类医疗卫生机构产生的医疗废物；环城四区和塘沽区、大港区、汉沽区、武清区、宝坻区、静海县、宁河县、蓟县以及天津经济技术开发区、天津港保税区二级（含二级）以上医院产生的医疗废物。

不具备集中处置医疗废物条件的农村，医疗卫生机构应当按照县级人民政府卫生行政主管部门、环境保护行政主管部门的要求，自行就地处置其产生的医疗废物。自行处置医疗废物的，应当符合下列基本要求：

（一）使用后的一次性医疗器具和容易致人损伤的医疗废物，应当消毒并作毁形处理；

（二）能够焚烧的，应当及时焚烧；

（三）不能焚烧的，消毒后集中填埋。

三、医疗卫生机构收集本单位产生的医疗废物，要按照类别分置于防渗漏、防锐器穿透的专用包装物或者密闭的容器内，并按照《条例》规定具备医疗废物安全暂时贮存设施、设备。医疗废物中病原体的培养基、标本和菌种、毒种保存液等高危险废物，传染病病人或疑似传染病病人产生的医疗废物、生活垃圾，在交收集运输单位前要就地严格消毒。市危险废物处理处置中心负责医疗废物的集中处置，并委托专门队伍负责收集、运输医疗废物，收集运输医疗废物要采用专用收集容器收集和专用运输车辆运输。医疗废物专用运输车辆、包装物和容器要有明显的警示标志和警示说明。

四、医疗卫生机构与市危险废物处理处置中心按照共同核定的医疗废物产生量，每年签订一次委托处置合同。市危险废物处理处置中心按照每公斤3元的收费标准向医疗卫生机构收取医疗废物处置费用。医疗卫生机构要在每月月末向市危险废物处理处置中心交纳医疗废物处置费。医疗废物处置费纳入医疗成本。

五、医疗卫生机构产生的医疗废物暂时贮存的时间不得超过两天，收集运输单位每两天到医疗卫生机构收集、运输一次医疗废物。医疗卫生机构未按规定及时收集医疗废物和未按时交纳医疗废物处置费用的，收集运输单位及市危险废物处理处置中心未按规定及时收集和处置医疗废物的，由环境保护行政主管部门参照《条例》第四十五条的规定依法处理。

六、禁止将医疗废物混入其他废物和生活垃圾。混入生活垃圾的，收集运输单位应拒绝收运，并及时向环保部门举报。医疗卫生机构应严格禁止各类人员捡拾医疗废物。未经市环境保护行政主管部门批准，任何单位和个人不得从事医疗废物的收集、运输作业。生活垃圾处理场（厂）不得接纳、处置医疗废物。医疗废物集中处置范围内的医疗卫生机构在用的焚烧炉停止使用。对违反上述规定的单位，由环境保护行政主管部门参照《条例》第四十七条的规定依法处理。

七、市环保局和市卫生局按照各自的职责分工，分别对从事医疗废物收集、运输、贮存、处置的人员进行相关法律、专业技术、安全防护以及紧急处理等知识的培训，经考核合格后持证上岗。

八、医疗废物的处置实行全过程严格管理。医疗废物的分类、贮存、收集、运输、处置，执行医疗废物转移联单制度。医疗废物转移联单分别由医疗卫生机构、市危险废物处理处置中心、环保部门保存3年。医疗废物转移联单由市环保局制定。

九、市环保局、市卫生局和医疗卫生机构、收集运输单位、市危险废物处理处置中心要建立健全医疗废物管理责任制，按照《条例》规定分别制定医疗废物安全处置的规章制度和发生意外事故的应急预案以及监督检查方案。

十、医疗卫生机构、医疗废物收集运输单位和市危险废物处理处置中心，要采取有效的职业卫生防护措施，为从事医疗废物

收集、运送、贮存、处置等工作的人员配备必要的防护用品，定期进行健康检查。必要时，对有关人员进行免疫接种，防止其受到健康损害。

十一、市市容委、市公安局、市交通局、市安全监管局按照各自的职责范围，做好医疗废物集中处置的相关工作。

十二、本意见自2003年9月1日起实施。本意见中未做具体规定的，依照《条例》有关规定执行。

天津市环境保护局

二OO三年八月一日

主题词：环保　医疗　污染　管理　意见　通知

（共印550份）

抄送：市委办公厅，市委各部、委，市人大常委会办公厅，市政协办公厅，市纪委办公厅，市高法院，市检察院，天津警备区，各人民团体。

天津市人民政府办公厅　　2003年8月6日印发

天津市卫生局文件

津卫后〔2003〕403号

关于印发《天津市医疗卫生机构医疗废物管理暂行规定》通知

各区、县卫生局，市局直属各单位，各医学院校附属医院，部队、企业医院，各社会办医单位：

为认真贯彻执行《医疗废物管理条例》（国务院第380号令），加强医疗卫生机构医疗废物的安全管理，防治疾病传播，保护环境，保护人体健康，保证全市医疗废物实现无害化处理处置，结合我市卫生行业实际情况，制定《天津市医疗卫生机构医疗废物管理暂行规定》。现发给你们，请遵照执行。

二〇〇三年八月六日

主题词：卫生　后勤　医疗废物　规定　通知

抄送：市环保局

天津市卫生局办公室　　二〇〇三年八月六日　印发

（共印550份）

天津市医疗卫生机构医疗废物管理暂行规定

第一章　总　则

第一条　为了加强医疗卫生机构医疗废物的安全管理工作，有效预防和控制医疗废物对人体健康和环境的危害，根据国务院《医疗废物管理条例》和国家有关规定，结合我市卫生行业实际情况，制定本办法。

第二条　本规定所称“医疗废物”，是指医疗卫生机构在医疗、预防、保健以及其他相关活动中产生的具有直接或者间接感染性、毒性以及其他危害性的废物和医疗机构收治的传染病病人或者疑似传染病病人产生的生活垃圾。

医疗卫生机构废弃的麻醉、精神、放射性、毒性等药品及其相关的废物的管理，依照有关法律、行政法规和国家有关规定标准执行。

第三条　各级各类医疗卫生机构，必须按照全市医疗废物处置的要求，负责收集、转运、暂存本单位的医疗废物。

第四条　市卫生行政部门主管全市医疗卫生机构医疗废物管理的卫生监督管理。

区县卫生行政部门负责本行政区的医疗卫生机构医疗废物管理的卫生监督管理。

市和区县卫生监督机构在卫生行政部门的领导下，负责医疗卫生机构医疗废物管理的监督检查。

第二章　医疗卫生机构的管理职责

第五条　各医疗卫生机构必须建立、健全医疗废物管理责任制，其主要负责人是第一责任人，切实保证医疗废物的安全管理，有效防止医疗废物流失、泄露、扩散。

第六条　医疗卫生机构应当针对本机构产生医疗废物的实际情况，制定和落实医疗废物管理的有关制度、实施方案、工作流程、基本要求和发生医疗废物泄漏、扩散等意外事故的应急方案。

第七条　医疗卫生机构制定的医疗废物管理实施方案应当包括以下内容:

（一）医疗废物分类方法和收集容器要求;

（二）医疗废物收集路线和时间;

（三）医疗废物在医疗卫生机构内部运转过程中的登记交接规定以及医疗废物转移管理制度;

（四）医疗废物管理过程中的特殊操作程序;

（五）医疗单位废物分类收集、转运、暂存工作过程中工作人员职业卫生安全防护;

（六）其他应当依法规范内容。

第八条　医疗卫生机构应当根据本机构医疗废物产生和管理的实际需要，设置或确定负责医疗废物管理的监控部门或配备专（兼）职人员，履行下列医疗废物管理职责:

（一）负责指导、监督和检查医疗废物分类收集、转运、

暂存工作的落实情况;

（二）检查和指导医疗废物分类收集、转运、暂存及处置过程中职业卫生安全防护工作;

（三）及时分析、处理医疗废物管理工作中的问题;

（四）发生医疗废物流失、泄露、扩散时，负责组织应急处理工作。

（五）负责组织有关医疗废物管理的人员培训工作。

第九条　医疗卫生机构应当根据医疗废物管理中所需要的专业技术、职业卫生安全防护、应急处理和法律法规知识等，制定相应的培训计划，定期对有关医务人员工作人员和管理人员进行培训、教育和技能训练。

第三章　医疗废物的收集转运和处理

第十条　医疗卫生机构应当建立严格的医疗废物分类管理制度，禁止将医疗废物在非收集、暂存地点倾倒、丢弃或者将医疗废物混入生活垃圾。

第十一条　医疗卫生机构应当设专人严格做好分类收集医疗废物工作，收集医疗废物必须符合下列卫生要求:

（一）感染性废物、病理性废物、损伤性废物、药物性废物及化学性废物等必须分类包装，不得混合收集;

（二）医疗废物中病原体的培养基、标本和菌种、毒种保存液等高危险废物，要先在产生场所就地高压蒸汽灭菌或者化

学消毒处理，然后按感染性废物收集处置；

（三）传染病人或疑似传染病人产生的医疗废物、生活垃圾要就地严格消毒。

（四）禁止将生活垃圾与医疗废物混装，一旦发生混装时，应当按医疗废物处理；

（五）医疗废物收集点，必须设置明显的医疗废物分类收集方法的示意图和文字说明。

第十二条　医疗废物的包装物或者容器，必须符合下列卫生要求：

（一）包装物或者容器外表面必须有明显标有警示标志和文字标识；

（二）包装物或者容器的性能与盛装的医疗废物类别相适应；

（三）包装物或者容器体表不得有破损、渗漏或者其他缺陷；

（四）包装物或者容器外表面不得沾有任何医疗废物，外表面被污染时，应当进行消毒处理，必要时增加一层包装。

第十三条　医疗卫生机构必须指定专人负责，每天从病房、门诊、急诊、实验室、手术室等各医疗废物产生点，向医疗机构内部医疗废物暂存场所转送医疗废物，转送医疗废物必须符合下列要求：

（一）每天按照固定的时间和专门的路线转送医疗废物；

（二）使用专门的运送工具转送医疗废物，转送医疗废物运送工具不得挪作他用；

（三）转送医疗废物前，必须检查包装物或者容器的标识及封口是否符合要求，没有标识或者标识不明确的不得转送；

（四）做好个人防护防止医疗废物直接接触身体；

（五）严禁扔、摔装有医疗废物的包装物或容器，避免造成包装破损和医疗废物的泄露；

（六）转送结束后对转运工具进行清洁和消毒处理后备用。

第十四条　医疗卫生机构内建立的医疗废物暂存场所必须达到以下要求：

（一）医疗废物的暂存场所必须与生活垃圾存放地分开，地基高度应确保设施内不受雨水冲击。

（二）必须与医疗区、食品加工区和人员活动密集区隔开，方便废物装卸人员及转运车辆的出入。

（三）应有严密的封闭措施，设专人管理，避免非工作人员进出。

（四）具有防渗漏、防蚊蝇、防鼠、防蟑螂、防盗等安全措施。

（五）应设有水源，保证暂存库房清洁冲洗用。

第十五条　医疗卫生机构将医疗废物交由医疗废物处置单位处置时，必须建立登记、核对、签字制度，并注明日期和时间。

医疗废物转送出去后，要及时对暂存场所进行清洁和消毒处理。

第十六条　尚未纳入医疗废物集中处置范围的医疗卫生机构，按照当地卫生行政部门和环境保护行政部门的规定，自行就地处置其产生的医疗废物，必须符合以下要求：

（一）使用后的一次性医疗器具和容易致人损伤的医疗废物，应当消毒并进行毁形；

（二）能够焚烧的，应当及时焚烧；

（三）不能焚烧的，应当消毒后集中填埋。

第十七条　医疗卫生机构产生的医疗污水、传染病病人或者疑似传染病病人的排泄物，应当按照国家规定严格消毒；达到国家规定的排放标准后，方可排入污水处理系统。

第四章　人员培训和职业安全防护

第十八条　医疗卫生机构应当对本单位从事医疗废物收集、运送、暂存、处置等工作的人员和管理人员，进行相关法律知识和专业技术、安全防护以及紧急处理等知识的培训，增强有关工作人员对医疗废物管理工作的认识，掌握医疗废物处置的正确方法和发泄露等紧急情况下的处理措施和规程，做好医疗废物的管理。

第十九条　医疗卫生机构中的医疗废物管理人员和有关工作人员，应当达到以下要求：

（一）熟悉国家相关法律、法规和规章，掌握本机构制度的医疗废物管理的规章制度，工作规范和流程；

（二）掌握医疗废物分类、收集、转送、暂存的正确方法和操作程序；

（三）掌握医疗废物分类中的安全知识、专业技术、职业卫生安全防护等知识；

（四）掌握医学废物处置过程中容易发生伤害的医疗废物处置方法和预防措施；

（五）掌握当发生医疗废物泄露、扩散时应当采取的应急处理措施，能够开展事故调查。

第二十条　医疗卫生机构应当采取有效的职业卫生安全防护措施，根据接触医疗废物种类及风险性大小的不同，采取相应的防护措施，为从事医疗废物收集、转送、暂存和处置的工作人员配备必要的防护用品，定期进行健康检查，必要时，对有关人员进行免疫接种，防止其受到健康伤害。

第二十一条　医疗卫生机构发生医疗废物泄漏、扩散时，应当立即向所在地区县卫生行政部门和环境保护行政部门报告，并采取必要的应急处理措施。

第五章　监　督

第二十二条　市卫生行政部门在职责范围内，依照《医疗废物管理条例》和本规定，对医疗卫生机构医疗废物的管理工

作进行监督管理。依法履行下列职责:

（一）制定全市卫生行业医疗废物管理规划和管理制度;

（二）对全市卫生行业医疗废物管理工作进行督察指导;

（三）协调、解决医疗废物管理工作中产生的有关问题;

（四）对医疗卫生机构执行《医疗废物管理条例》和本规定的情况实施监督检查;

（五）对涉嫌违反规定的场所、设备、运输工具和物品予以查封或者暂扣;

（六）对违反《医疗废物管理条例》和本办法的单位和个人，依法给予行政处罚;

（七）法律、法规、规章规定的其他职责。

区县卫生行政部门根据职责分工，在本行政区域内履行上述有关的职责。

第二十三条　市和区县卫生监督机构在卫生行政部门的领导下，对医疗卫生机构的下列事项进行日常监督检查。

（一）医疗废物管理的规章制度及落实情况;

（二）医疗废物分类收集、内部转运、暂存等工作状况;

（三）有关医疗废物管理的资料和记录;

（四）医疗废物管理工作中，相关人员的安全防护工作;

（五）对医疗废物收集、暂存进行现场监测;

（六）其他依法应当监督检查的情况。

第二十四条　卫生行政部门及其卫生监督机构，履行监督

检查职责时，可以依法采取下列措施：

（一）对医疗卫生机构进行实地检查，了解情况，现场监测，调查取证；

（二）查阅或者复制医疗废物管理的有关资料，采集样品；

（三）责令违反《医疗废物管理条例》规定的单位和个人停止违法行为；

（四）查封或者暂扣涉嫌违反《医疗废物管理条例》规定的场所、设备、运输工具和物品；

（五）对违反《医疗废物管理条例》规定的行为进行查处。

第二十五条　发生因医疗废物管理不当导致有传染病传播的可能时，卫生行政部门按照《传染病防治法》和《医疗废物管理条例》的规定采取控制措施。

第二十六条　医疗卫生机构对卫生行政部门的检查、监测、调查取证等工作，必须予以配合，不得拒绝和阻碍，不得提供虚假材料。

第二十七条　对违反本规定的医疗卫生机构，由市和区县卫生行政部门，依据《医疗废物管理条例》的规定予以行政处罚。对负有责任的领导和直接责任人依法给予行政处分或者纪律处分。

第六章　附　则

第二十八条　本规定自文到之日起施行。

2003年8月6日

天津市环境保护局文件

津环保固[2003]207号　　签发：王亚平

关于印发《天津市医疗废物污染环境防治检查规范（试行）》的通知

各区县环保局、市环境监察总队、市环境监测中心、市固体废物及有毒化学品管理中心：

为认真贯彻执行国务院《医疗废物管理条例》，落实市政府《批转市环保局关于集中处置医疗废物意见的通知》，加强对我市医疗废物的安全管理，防治疾病传播，保护环境，保护人体健康，结合我市医疗废物污染环境防治的实际情况，配合我市开展医疗废物集中处置工作的需要，特制定《天津市医疗废物污染环境防治检查规范（试行）》。现印发给你们，望遵照执行。

附件：天津市医疗废物污染环境防治检查规范（试行）

二〇〇三年八月十一日

主题词：环保　医疗废物　规范　试行　通知

抄送：市市容委、市卫生局

抄报：国家环保总局，市政府

天津市环境保护局办公室　　2003年8月11日印发

附件：

天津市医疗废物污染环境防治检查规范（试行）

说　明

为贯彻《医疗废物管理条例》，加强对本市医疗废物的安全管理，防止医疗废物收集、运送、贮存、处置过程造成环境污染，防止疾病传播，保护环境，保障人体健康，特制定本规范。

本规范规定了环境保护行政主管部门对医疗废物污染环境防治监督的一般要求，对医疗废物的收集、运送、贮存、处置活动的检查、监测等要求。

本规范由天津市环境保护局负责解释。

1　主题内容与适用范围

1．1　主题内容

本规范规定了环境保护行政主管部门对医疗废物污染环境防治监督的一般要求，对医疗废物的收集、运送、贮存、处置活动的检查、监测等要求。

1．2　适用范围

本规范适用于本市环境保护行政主管部门对医疗废物收集、运送、贮存、处置活动的监督、检查、监测。

2　执行法规和标准

本规范执行下列法规、标准。当下列法规、标准被修订时，应使用最新版本。

2．1　行政法规

中华人民共和国固体废物污染环境防治法

医疗废物管理条例

危险废物转移联单管理办法

天津市危险废物污染环境防治办法

天津市危险废物经营许可证管理办法

天津市危险废物转移联单实施细则

2．2　技术法规

GB 18484—2001	危险废物焚烧污染控制标准
GB 18597—2001	危险废物贮存污染控制标准
GB 18598—2001	危险废物填埋污染控制标准
GB 19218—2003	医疗废物焚烧炉技术要求（试行）
GB 19217—2003	医疗废物转运车技术要求（试行）
GB 16297—1996	大气污染物综合排放标准
GB 8978—1996	污水综合排放标准
GB 14554—1993	恶臭污染物排放标准
GB/T 16157—1996	固定污染源排气中颗粒物测定与气态污染物采样方法
QC/T 449—2000	保温车、冷藏车性能试验方法

3 定义

3.1 医疗废物

医院、卫生防疫单位、病员疗养院、医学研究单位等产生的感染性废物，主要包括：

a. 医院临床感染性废物，包括病人手术或尸解后的废物（如组织、受污染材料和仪器等）以及被血液或人体体液污染的废医疗材料、废医疗仪器以及其它废物（如废敷料、废医用手套、废注射器、废输液器、废输血器等）；

b. 医院血透析产生的废物（如废弃的设备、试管、过滤器、围裙、手套等）；

c. 临床、教学、实验、研究等医学活动中产生的含有菌落及病原株培养液和保菌液的废弃物以及感染的动物尸体；

d. 传染病房产生的所有废物（如排泄物、废敷料、生活垃圾以及病人接触过的任何其他废设备、废材料）；

e. 医院产生的废弃锋利物，包括废针头、废皮下注射针、废解剖刀、废手术刀、废输液器、废手术锯、碎玻璃等；

f. 医院废水处理产生的污泥；

g. 过期的药物性和化学性废物。

3.2 医疗废物焚烧炉

采用热力技术处理医疗废物，使之分解并达到无害化的装置，包括进料装置、炉体、烟气净化装置、控制系统、报警系统和应急处理系统等。

3.3 医疗废物处理残余物填埋设施

处置医疗废物处理残余物（包括焚烧残渣、焚烧飞灰等）的一种陆地处置设施，它由若干个处置单元和构筑物组成，处置场有界限规定，主要包括废物预处理设施、废物填埋设施和渗滤液收集处理设施。

3.4 医疗废物贮存设施

按规定设计、建造或改建的用于专门存放医疗废物的设施。

3.5 医疗废物运送车辆

按规定设计的用于专门转运医疗废物的车辆。

4 检查方式

4.1 实地检查

检查人员到达现场，进行实地勘察、了解情况、调查取证、查阅或者复制有关资料。

4.2 现场监测

监测人员到达现场，进行实地检测，采集样品。

4.3 定期检查

定期检查至少每6个月进行1次。

4.5 不定期抽查

不定期抽查可随时进行。

4.6 单独检查

由环境保护行政主管部门或环境保护监测部门进行检查。

4.6 联合检查

由环保、卫生等医疗废物管理部门联合进行检查。

5 检查要求

5．1　医疗废物污染环境防治检查工作由市、区（县）环境保护行政主管部门或环境保护行政主管部门授权的执法部门以及环境保护监测部门的派员实施。

5．2　检查时，检查人员除应履行法规规定的检查程序和手续外，还应认真填写《医疗废物污染环境防治检查表》。检查表一式二份，检查表填写完成后，负责检查的环境保护行政主管部门留存一份，医疗废物产生、收集单位或医疗废物集中处置单位留存一份。

5．3　对于检查中发现的违反法规规定的问题和隐患，环境保护行政主管部门要提出书面整改意见，并限期改正。检查过后要按时对整改情况进行复查，督促整改落实情况。

对于检查中发现的重大隐患，或一时难以解决的隐患，由检查单位提出要求，采取有效的临时性控制措施，防止发生问题，并及时向上级主管部门以书面形式报告。

5．4　检查中发现的违反管理规定的行为，应按照《中华人民共和国固体废物污染环境防治法》、《医疗废物管理条例》等法律法规的规定进行处罚。

5．5　监测部门监测对监测的结果，要按照规定出据监测报告。

5．6　检查人员要按照法律法规规定，认真履行监督检查职责。不履行监督检查职责的检查人员要承担法律规定的行政责任和刑事责任。

6　检查内容

6．1　一般要求

此项内容适用于所有医疗废物收集、运送、贮存、处置活动的单位。

6．1．1　管理制度

建立、健全医疗废物污染环境防治管理制度。

a．管理制度；

b．岗位责任制度；

c．操作规程；

d．事故应急方案（包括应急组织、指挥、人员、资金、车辆、工具、设备、设施、照明设备、通讯工具、联络方法、报警电话、防护用品、消毒药剂、处理方法、处置规程、急救措施、警戒措施等）。

6．1．2　管理机构和人员

设置医疗废物管理监控部门或者专（兼）职人员。

6．1．3　业务培训

对从事医疗废物收集、运送、贮存、处置等工作人员进行相关业务知识的培训。

a．法律知识；

b．专业技术知识；

c．安全防护知识；

d．应急处理知识；

e．培训合格证。

6．1．4　医疗废物转移手续

a．执行医疗废物经营许可证制度；

b．执行医疗废物转移联单制度；

c．执行医疗废物登记制度。

登记内容包括医疗废物的来源、种类、重量或数量、交接时间、处置方法、最终去向、经办人签名，并保存登记资料3年。

6．2　分类要求

6．2．1　医疗废物产生单位

医疗废物产生单位包括医疗废物的收集活动。

a．及时收集本单位产生的医疗废物，并按照类别分置于防渗漏、防锐器穿透的专用包装物或者密闭的容器内。

b．医疗废物专用包装物、容器，有明显的警示标识和警示说明。

c．建立医疗废物的暂时贮存设施、设备，不得露天存放医疗废物。医疗废物暂时贮存的时间不得超过2天。

d．暂时贮存设施、设备，远离医疗区、食品加工区和人员活动区以及生活垃圾存放场所，并设置明显的警示标识和防渗漏、防鼠、防蚊蝇、防蟑螂、防盗以及预防儿童接触等安全措施。

e、医疗废物的暂时贮存设施、设备定期消毒和清洁。

f．应当使用防渗漏、防遗撒的专用运送工具，按照本单位确定的内部医疗废物运送时间、路线，将医疗废物收集、运送至暂时贮存地点。

g．运送工具使用后在医疗卫生机构内指定的地点及时消毒和清洁。

h．及时将医疗废物交由医疗废物集中处置单位处置。

i．医疗废物中病原体的培养基、标本和菌种、毒种保存液等高危险废物，在交医疗废物集中处置单位处置前应当就地消毒。

j．采取有效措施，防止医疗废物流失、泄漏、扩散。

k．不得转让、买卖医疗废物。

l．不得在运送过程中丢弃医疗废物，不得自行处置医疗废物，不得在非贮存地点倾倒、堆放医疗废物或者将医疗废物混入其他废物和生活垃圾。

m．医疗卫生机构产生的污水、传染病病人或者疑似传染病病人的排泄物，按照国家规定严格消毒；达到国家规定的排放标准后，方可排入污水处理系统。

n．不具备集中处置医疗废物条件的农村医疗卫生机构自行处置医疗废物的，符合下列基本要求：

i）使用后的一次性医疗器具和容易致人损伤的医疗废物，应当消毒并作毁形处理；

ii）能够焚烧的，应当及时焚烧；

iii）不能焚烧的，消毒后集中填埋。

6．2．2　集中处置单位

医疗废物集中处置单位包括医疗废物的运送、贮存、处理、处置内容。

6．2．2．1　持有环境保护行政主管部门核发的《医疗废物处置经营许可证》、《医疗废物收集运输经营许可证》。

6．2．2．2　有负责医疗废物处置效果检测、评价工作的机构和人员。

6．2．2．3　市环境保护行政主管部门对医疗废物集中处置单位每6个月组织1次检查、监测工作。监测工作由市环境保护行政主管部门认定的具有监测资格的专业单位承担。

6．2．2．4　污染防治措施

a．及时到医疗卫生单位收集、运送医疗废物（至少每2天收集、运送1次）。及时处理、处置医疗废物（医疗废物在常温下贮存期不得超过1天，于5℃以下冷藏的不得超过7天）。

b．运送医疗废物，应当遵守国家有关危险货物运输管理的规定，使用有明显医疗废物标识的专用车辆。

c．运送医疗废物的专用车辆使用后，应当在医疗废物集中处置场所内及时进行消毒和清洁。每次运送医疗废物后对运送车辆都要进行消毒。

d．运送医疗废物的专用车辆不得运送其他物品。

e．运送医疗废物过程中应当确保安全，不得丢弃、遗撒医疗废物。

f. 安装污染物排放在线监控装置，并确保监控装置经常处于正常运行状态。

g. 处置医疗废物符合国家规定的环境保护标准、规范。

h. 定期对医疗废物处置设施的环境污染防治和卫生学效果进行检测、评价，检测、评价结果存入单位档案，每6个月向市环境保护行政主管部门报告1次。

i. 采取有效措施，防止医疗废物流失、泄漏、扩散。

j. 不得转让、买卖医疗废物。

h. 不得在运送过程中丢弃医疗废物；不得在非贮存地点倾倒、堆放医疗废物或者将医疗废物混入其他废物和生活垃圾。

i. 医疗废物焚烧炉排放的污水，要进行严格消毒，并经过污水处理系统处理，达到国家规定的排放标准，方可排放。

j. 医疗废物焚烧残余物、飞灰，按照危险废物进行处置。

k. 医疗废物贮存设施泄漏液、清洗液、浸出液必须符合GB8978《污水综合排放标准》的要求方可排放，气体导出口排出的气体经处理后，应满足GB16297《大气污染物综合排放标准》和GB14554《恶臭污染物排放标准的要求》。

l. 医疗废物贮存设施内清理出来的泄漏物，一律按危险废物处理。

6.2.2.2 处置设施、设备

处置设施、设备包括贮存、运送、处理、处置以及污染物排放在线监控设施、设备、装置。

6.2.2.2.1 有符合环境保护要求的医疗废物贮存、处理、处置设施或者设备。

a. 医疗废物贮存设施的污染环境防治管理要求按照GB18597《危险废物贮存污染控制标准》执行。

b. 医疗废物焚烧设施的污染环境防治管理要求按照GB18484《危险废物焚烧污染控制标准》和GB19218《医疗废物焚烧炉技术要求（试行）》执行。

c. 医疗废物填埋设施的污染环境防治管理要求按照GB18598《危险废物填埋污染控制标准》执行。

6.2.2.2.2 安装污染物排放在线监控装置，在线监控装置经常处于正常运行状态。

6.2.2.2.3 使用符合标准的专用车辆运送医疗废物。

a. 驾驶室应与货厢完全隔开，以保证驾驶人员的安全。

b. 车辆应配备专用的箱子，放置因意外发生事故后防止污染扩散的用品：

i)消毒器械及消毒剂；

ii)收集工具及包装袋；

iii)人员卫生防护用品等。

c. 货物固定装置

d. 医疗废物转运车辆的前部、后部及车厢两侧喷涂附录警示性标志.

e. 医疗废物转运车辆的其他污染环境防治管理要求按照GB19217《医疗废物转运车辆技术要求（试行）》执行。

7 监测内容

7.1 医疗废物焚烧炉污染控制监测

a. 医疗废物焚烧炉大气污染物排放限值按照附表2执行。

b. 医疗废物焚烧炉污水排放限值按照附表3执行。

c. 焚烧炉排气筒中烟尘或气态污染物监测的采样点数目及采样点位置的设置，执行GB/T16157《固定污染源排气中颗粒物测定与气态污染物采样方法》。

d. 在焚烧设施于正常状态下运行 1h 后，开始以 1 次/h 的频次采集气样，每次采样时间不得低于 45min，连续采样三次，分别测定。以平均值作为判定值。

e. 医疗废物焚烧炉排放气体的分析方法按照附表 4 执行。

f. 医疗废物焚烧炉污水的分析方法按照附表 5 执行。

7. 2 医疗废物贮存设施污染控制监测

按国家污染源管理要求对医疗废物贮存设施进行监测。

7. 3 医疗废物处理残余物填埋设施污染控制监测

7. 3. 1 填埋场污染控制要求

a. 严禁将集排水系统收集的渗滤液直接排放，必须对其进行处理并达到 GB8978《污水综合排放标准》中第一类污染物最高允许排放浓度的要求及第二类污染物最高允许排放浓度标准要求后方可排放。

b. 危险废物填埋场废物渗滤液第二类污染物排放控制项目为：pH 值，悬浮物（SS），五日生化需氧量（BOD_5），化学需氧量（COD_{Cr}），氨氮（NH_3-N），磷酸盐（以 P 计）。

c. 填埋场渗滤液不应对地下水造成污染。填埋场地下水污染评价指标及其限值按照 GB/T14848《地下水水质标准执行》。

d. 地下水监测因子应根据填埋废物特性由当地环境保护行政主管部门确定，必须具有代表性，能表示废物特性的参数。常规测定项目为：浊度，pH 值，可溶性固体，氯化物，硝酸盐（以 N 计），亚硝酸盐（以 N 计），氨氮，大肠杆菌总数。

e. 填埋场排出的气体应按照 GB16297《大气污染物综合排放标准》中无组织排放的规定执行。监测因子应根据填埋废物特性由当地环境保护行政主管部门确定，必须具有代表性，能表示废物特性的参数。

7. 3. 2 监测要求

对填埋场的监督性监测的项目和频率应按照有关环境监测技术规范进行，监测结果应定期报送当地环保部门，并接受当地环保部门的监督检查。

7. 3. 2. 1 填埋场渗滤液

a. 利用填埋场的每个集水井进行水位和水质监测。

b. 采样频率应根据填埋物特性、覆盖层和降水等条件加以确定，应能充分反映填埋场渗滤液变化情况。渗滤液水质和水位监测频率至少为每月一次。

7. 3. 2. 2 地下水

7. 3. 2. 2. 1 地下水监测井布设应满足下列要求：

a. 在填埋场上游应设置一眼监测井，以取得背景水源数值。在下游至少设置三眼井，组成三维监测点，以适应于下游地下水的羽流几何型流向；

b. 监测井应设在填埋场的实际最近距离上，并且位于地下水上下游相同水力坡度上；

c. 监测井深度应足以采取具有代表性的样品。

7. 3. 2. 2. 2 取样频率

a. 填埋场运行的第一年，应每月至少取样一次；在正常情况下，取样频率为每季度至少一次。

b. 发现地下水质出现变坏现象时，应加大取样频率，并根据实际情况增加监测项目，查出原因以便进行补救。

7. 3. 2. 3 大气

a. 采样点布设及采样方法按照 GB16297《大气污染物综合排放标准》的规定执行

b. 污染源下风方向应为主要监测范围。

c. 超标地区、人口密度大和距工业区近的地区加大采样点密度。

d. 采样频率。填埋场运行期间，应每月取样一次，如出现异常，取样频率应适当增加。

7．4　医疗废物运送车辆污染控制监测

7．4．1 车厢性能

a．气密性能

车厢应具有良好的密封性能。在车厢内外压差为（100±10）Pa 的条件下，将测得的漏气量转化为标准状况（273K，1.013×10^5Pa）下的漏气量，其值应符合附表 6 的规定。

b．隔热性能

车厢应具有良好的隔热性能。当车厢平均壁温为 293—298K，内外温差不小于 20K 时，其车厢的总漏热率应符合附表 7 的规定。

7．4．2　检验方法

a．车厢气密性能和隔热性能的检验，应按照 QC/T 449《保温车、冷藏车性能试验方法》的规定在车辆定型试验时进行。

b．车厢液体防渗和排出性能要求，采用下述方法进行检验。

液体防渗试验方法：开启车厢后门，向车厢内灌注带颜色（可以是红色）自来水 10L，关闭车厢后门，在城市道路正常行驶 1 小时后，车厢外部无明显渗漏。

清洗污水排出试验：现场清洗车厢 15-20min，检查污水是否从车厢后部漫流到箱外，并是否可靠收集。

c、其他特殊环境保护要求，如车厢易于消毒和清洗性能等，可采用检查车辆设计制造文件和外观检查的方法进行检验。

附表 1　医疗废物焚烧炉的技术性能指标

焚烧炉温度（℃）	烟气停留时间（S）	焚烧残渣的热灼减率（%）
≥850	≥2.0	<5

附表 2　医疗废物焚烧炉大气污染物排放限值[1)]

序号	污染物	不同焚烧容量时的最高允许排放浓度限值（mg/m³）		
		≤300(kg/h)	300～2500(kg/h)	≥2500(kg/h)
1	烟气黑度	林格曼 1 级		
2	烟尘	100	80	65
3	一氧化碳（CO）	100	80	80
4	二氧化硫（SO2）	400	300	200
5	氟化氢（HF）	9.0	7.0	5.0
6	氯化氢（HCl）	100	70	60
7	氮氧化物（以 NO2 计）	500		
8	汞及其化合物(以 Hg 计)	0.1		
9	镉及其化合物(以 Cd 计)	0.1		
10	砷、镍及其化合物（以 As+Ni 计）	1.0		
11	铅及其化合物(以 Pb 计)	1.0		
12	铬、锡、锑、铜、锰及其化合物（以 Cr+Sn+Sb+Cu+Mn 计）	4.0		
13	二恶英类	0.5TEQng/m³		

在测试计算过程中，以 11%O_2（干气）作为换算基准，换算公式为：

$$c=10/(21-O_s)\times c_s$$

式中：c——标准状态下被测污染物经换算后的浓度（mg/m³）；

O_s——排气中氧气的浓度（%）；

c_s——标准状态下被测污染物的浓度（mg/m3）。

附表 3　医疗废物焚烧炉污水排放限值

序号	污染物	最高允许排放浓度*（mg/L）		
		一级	二级	三级
1	pH	6～9	6～9	6～9
2	F-	10	10	20
3	Hg	0.05		
4	As	0.1		
5	Pb	0.5		
6	Cd	1.0		
7	粪大肠菌群数	100 个/L	500 个/L	1000 个/L

8	总余氯	<0.5**	>6.5(接触时间≥1.5h)	>5(接触时间≥1.5h)

注：* 排入 GB3838 中Ⅲ类水域和排入 GB3097 中二类海域的污水，执行一级标准；
排入 GB3838 中Ⅳ、Ⅴ类水域和排入 GB3097 中三类海域的污水，执行二级标准；
排入设置二级污水处理厂的城镇排水系统的污水，执行三级标准。
** 加氯消毒后须进行脱氯处理，达到本标准。

附表 4 医疗废物焚烧炉排放气体的分析方法

序号	污染物	分析方法	方法来源
1	烟气黑度	林格曼烟度法	GB/T5468-91
2	烟尘	重量法	GB/T16157-1996
3	一氧化碳（CO）	非分散红外吸收法	HJ/T44-1999
4	二氧化硫（SO_2）	甲醛吸收副玫瑰苯胺分光光度法	1）
5	氟化氢（HF）	滤膜·氟离子选择电极法	1）
6	氯化氢（HCl）	硫氰酸汞分光光度法	HJ/T27-1999
		硝酸银容量法	1）
7	氮氧化物	盐酸萘乙二胺分光光度法	HJ/T 43-1999
8	汞	冷原子吸收分光光度法	1）
9	镉	原子吸收分光光度法	1）
10	铅	火焰原子吸收分光光度法	1）
11	砷	二乙基二硫代氨基甲酸银分光光度法	1）
12	铬	二苯碳酰二肼分光光度法	1）
13	锡	原子吸收分光光度法	1）
14	锑	5-Br-PADAP 分光光度法	1）
15	铜	原子吸收分光光度法	1）
16	锰	原子吸收分光光度法	1）
17	镍	原子吸收分光光度法	1）

1） 《空气和废气监测分析方法》，中国环境科学出版社，北京，1990 年。
2） 《固体废弃物试验分析评价手册》，中国环境科学出版社，北京，1992 年，P332～359。

附表 5 医疗废物焚烧炉污水的分析方法

序号	污染物	分析方法	方法来源
1	pH	玻璃电极法	GB6920—86
2	F^-	离子选择电极法	GB7484—87
3	Hg	冷原子吸收光度法	GB7468—87
4	As	二乙基二硫代氨基甲酸银分光光度法	GB7485—87
5	Pb	原子吸收分光光度法	GB7475—87
6	Cd	原子吸收分光光度法	GB7475—87
7	粪大肠菌群数	多管发酵法	《水和废水监测分析方法（第

			四版)》，中国环境科学出版社，2002年
8	总余氯	N,N-二乙基-1,4-苯二胺分光光度法 N,N-二乙基-1,4-苯二胺滴定法	GB11898-89 GB11897-89

附表6　医疗废物运送车车厢气密性能检测指标

车厢容积，m^3	漏气量，m^3/h
≤5	>5～13
>5～10	> 10～20
>10～20	> 18～35
>20～30	> 25～50
>30～40	> 35～60
>40	> 40～70

附表7　医疗废物运送车车厢隔热性能检测指标

车厢容积，m^3	总漏热率，W/K
≥5	> 5～10
>5～10	> 10～15
>10～20	> 16～25
>20～30	> 25～35
>30～40	> 30～45
>40	> 50～70

注：平均壁温规定为车厢内、外温度的算术平均值。

天津市环境保护局文件

津环保固[2003]206号　　签发：王亚平

关于认真贯彻市政府《批转市环保局关于集中处置医疗废物意见的通知》的通知

各区县环保局、市环境监察总队、市环境监测中心、市固体废物及有毒化学品管理中心：

为认真贯彻市政府《批转市环保局关于集中处置医疗废物意见的通知》（以下简称《通知》），做好我市医疗废物集中处置工作，现将有关问题通知如下：

一、认真贯彻《医疗废物管理条例》

各区、县环保局要认真组织学习和宣传贯彻国务院颁布的《医疗废物管理条例》，积极落实市政府《通知》，提高对医疗废物污染环境防治重要性的认识，按照《通知》的各项规定，组织落实好各项具体工作，确保9月1日我市医疗废物集中处置工作的顺利实施。

二、做好监督检查工作

各区、县环保局要依据《医疗废物管理条例》和《通知》规

定的职责范围，与卫生行政主管部门积极配合，认真履行医疗废物监督管理职责。环境保护管理、监察、监测等部门要按照工作职责分工，切实做好对医疗废物污染环境防治的监督管理工作。

（一）环保部门监督管理的职责范围：

1、医疗卫生机构产生、收集、暂存医疗废物的污染环境防治监督管理；

2、集中处置医疗废物单位收集、运送、贮存、处置医疗废物的污染环境防治监督管理。

（二）环保部门内部职责分工：

1、医疗卫生机构的医疗废物污染环境防治日常监督管理和现场执法检查由区、县环保局和市环境监察总队负责；

2、医疗废物集中处置单位的医疗废物污染环境防治监督管理，《医疗废物处置经营许可证》、《医疗废物收集、运送经营许可证》、《危险废物转移联单》、《医疗废物交接记录单》、《医疗废物运送登记卡》的管理由天津市固体废物及有毒化学品管理中心负责；

3、医疗废物集中处置单位的环境监测由市环境监测中心负责；

4、医疗废物污染环境事故处理按照《天津市环境污染与生态破坏事故处理办法》（津环保办[2002]289号）的规定执行。

（三）监督管理的主要内容：

1、严格执行医疗废物分类收集;

2、建立、健全各项医疗废物管理规章制度;

3、采取有效的医疗废物污染环境防治措施;

4、认真执行医疗废物转移手续。

5、国务院《医疗废物管理条例》和市政府《通知》规定环保部门的其他职责。

在监督检查中发现违反《医疗废物管理条例》和《通知》规定的单位和个人，各级环保部门应严格依法行政。对于转让、买卖医疗废物，自行处理处置医疗废物，在运送过程中丢弃医疗废物，在非贮存地点倾倒、堆放医疗废物或者将医疗废物混入其他废物和生活垃圾的严重违法行为要严肃查处，造成严重污染环境事故的要依法追究责任者的刑事责任。

对于医疗废物污染环境防治检查、监测工作的具体范围、内容和程序，按照市局制定的《天津市医疗废物污染环境防治检查规范（试行）》执行。《天津市医疗废物污染环境防治检查规范（试行）》由市环保局另行制定下发。

三、执行医疗废物转移监督管理制度

根据国家对医疗废物转移管理的有关规定，我市医疗废物转移执行，医疗废物收集运送经营许可证制度、医疗废物处置经营许可证制度、医疗废物转移联单制度和医疗废物登记制度。

医疗废物集中处置单位必须持有市环保局核发的《医疗废物处置经营许可证》，医疗废物收集、运送单位必须持有市环保

局核发的《医疗废物收集运输经营许可证》。医疗卫生机构转移医疗废物必须办理危险废物转移手续。医疗卫生机构和医疗废物集中处置单位对医疗废物的收集、运送、处置环节必须认真做好登记。

医疗废物转移联单制度和医疗废物登记制度的具体要求是:

（一）医疗卫生机构

1、医疗卫生机构与医疗废物集中处置单位每年签定一次《医疗废物委托处置协议》;

2、转移医疗废物，必须向所在地区、县环保局提出申请，并填写《危险废物转移申请书》，经区、县环保局审核，报市固体废物及有毒化学品管理中心批准。医疗废物转移审批手续每年办理一次;

3、每次转移医疗废物要认真填写《医疗废物转移交接记录单》;

4、根据《医疗废物转移交接记录单》记载的医疗废物每月实际产生数量填写《危险废物转移联单》。《危险废物转移联单》每月办理运行一次。

5、医疗卫生机构每月将填写完的《医疗废物转移交接记录单》复印件报所在地区、县环保局登记备案。

（二）集中处置单位

1、收集医疗废物的人员必须佩带《医疗废物收集运送证》。

2、收集医疗废物人员每次到医疗卫生机构收集医疗废物必须认真填写《医疗废物运送登记卡》;

3、将运行的《危险废物转移联单》，每月向市固体废物及有毒化学品管理中心报送一次;

《医疗废物处置经营许可证》、《医疗废物收集运输经营许可证》、《危险废物转移联单》、《医疗废物交接记录单》、《医疗废物运送登记卡》和《医疗废物收集运输证》由市环保局统一制做。《医疗废物处置经营许可证》、《医疗废物收集运输经营许可证》和《医疗废物收集运输证》由市环保局核发。《危险废物转移申请书》、《危险废物转移联单》和《医疗废物交接记录单》由医疗卫生机构所在地区、县环保局发放。

特此通知

附件：1、医疗废物交接记录单

2、医疗废物运送登记卡

二〇〇三年八月十一日

主题词：环保　医疗废物　意见　通知

抄送：市市容委、市卫生局

抄报：国家环保总局，市政府

天津市环境保护局办公室　　2003年8月11日印发

天津市环境保护局

医疗废物分类包装使用的包装物说明

一、塑料袋

1、 黄色—700×550mm 塑料袋： 感染性废物

2、 红色—700×550mm 塑料袋： 传染性废物

3、 绿色—400×300mm 塑料袋： 损伤性废物

4、 红色—400×300mm 塑料袋： 传染性损伤性废物

二、外包装纸箱

1、 印有红色“传染性废物”字样—600×400×500mm 纸箱：用于盛装装有传染性废物的红色塑料袋。

2、 印有绿色“损伤性废物”字样—400×200×300mm 纸箱：用于盛装装有损伤性废物的绿色塑料袋。

3、 印有红色“传染性损伤性废物”字样—400×200×300mm 纸箱：用于盛装装有传染性损伤性废物的红色塑料袋。

（上述塑料袋及外包装纸箱表面均统一印有国家颁布的医疗废物警示图形标识）

2003 年 8 月 15 日

天津市环境保护局

关于医疗废物集中处置有关问题的通知

各区、县环保局：

为做好9月1日医疗废物集中处置相关准备工作，现就有关问题通知如下：

1、 市卫生局已初步确定了参加医疗废物集中处置的医疗卫生机构名单，现转发你们。

2、 8月25日至31日，市卫生局已安排各区县卫生局、防疫站对本辖区相关医疗卫生机构进行医疗废物集中处置工作的前期准备情况进行检查。请各区县环保局根据环保部门职责，主动联系区县卫生局，参加本区县的检查工作。

3、 医疗废物暂存场所标识，我局已统一制作，请你们通知有关医疗机构于8月27—29日到市环保产品营销中心（河西区闽侯路5号，电话83833551）购买。

特此通知

二〇〇三年八月二十二日

（联系电话：23051708　　联系人：吴雷）

附：医疗废物集中处置涉及医疗卫生机构名单

用再生纸印制
Recycled

天津市环境保护局
天津市卫生局 文件

津环保固[2003]214号　　签发：王亚平　张柏捷

关于对医疗废物收集数量核定办法的通知

各区县环保局、各区县卫生局、市卫生局直属各单位、各医学院校附属医院、部队企业医院、中央驻津医疗单位、各社会办医单位、收集运输单位、天津市危险废物处理处置中心：

根据市政府《批转市环保局关于集中处置医疗废物意见的通知》（津政发〔2003〕91号），现就医疗废物收集数量的核定办法通知如下：

一、医疗废物收费标准

天津市医疗废物处置收费按照收集到的医疗废物重量来计算，医疗废物的处置费用定价为3.00元/kg。医疗废物处置费纳入医疗成本。

二、医疗废物包装的装载方法

医疗废物放入塑料包装袋和装载箱中应以自然状态放入，

切勿人为地压实或挤压，以防因过度的压缩造成塑料袋的破损，以至使污染物泄漏，发生污染装载箱和外界环境的事故。

三、医疗废物收集数量的核定

1、医疗卫生机构可配置医疗废物重量计量工具，按实际重量核定医疗废物的数量，核定的数量须由收集运输单位和医疗卫生机构双方认可。称重的对象是，放置在医疗卫生机构安全暂时贮存设施内收集运输单位提供的转运容器，转运容器分两种规格：①660 升医疗废物专用塑料箱，体积：1360*780*1225，净重：42 公斤②125 升医疗废物专用塑料箱，体积：550*500*580，净重：6 公斤。③115 升医疗废物专用塑料箱，体积：665*490*380，净重：3.6 公斤（暂时代替 125 升容器）。

2、医疗卫生机构不配备称重工具的，收集数量的核定参照《医疗废物转运车技术要求》（GB19217—2003）国家标准执行。即，按照医疗废物装载的体积和比重计算重量，每立方米医疗废物核定重量为 200 公斤，660 升容器医疗废物重量核定为 132 公斤，125 升容器医疗废物重量核定为 25 公斤。装载箱中医疗废物装载达 80%以上（含 80%）时，按满箱装载重量计算医疗废物的重量。

以上两种计量方法，医疗卫生机构可任意选择其中一种核定医疗废物的数量。采用计量工具核定医疗废物数量的，要连同

医疗废物转运容器称重（外包装纸箱重量除外），不准将医疗废物从转运容器取出称重后，再放入转运容器中。

天津市环境保护局　　天津市卫生局

二OO三年八月二十二日

主题词：医疗废物　核定　通知

（共印400份）

抄报：国家环保总局，市政府

抄送：市市容委

天津市环境保护局　　2003年8月22日印发

申报登记代码：□□□□□□□□□□□□□

单位坐标　：东经：□□°□□′□□″

北纬：□□°□□′□□″

医疗废物专用调查表(2002年度)

医疗单位级别：_____级_____等

调查单位详细名称：					(盖章)
法人(或负责人)：		联系电话：			
(区、县)		乡、镇及街(道、路)			号
填表人：		单位环保负责人：		审核人：	
一、危险废物：					
(一)HW01类医院临床废物					
1.一次性医疗用品废物					
毁形情况	□已　□未　□部分		说明		
产生量	每　日　公斤		总产生量		吨/年
目前去向：[专用焚烧设备焚烧：本单位_____吨/年　外单位_____吨/年] 环卫清运_____吨/年　外卖_____吨/年					
2.手术及临床残余物					
产生量	每　日　公斤		总产生量		吨/年
目前去向：[专用焚烧设备焚烧：本单位_____吨/年　外单位_____吨/年] 环卫清运_____吨/年					
(二)HW03废药物、药品					
产生量：	每　日　公斤		总产生量		公斤/年
目前去向：[专用焚烧设备焚烧：本单位_____公斤/年　外单位_____公斤/年] 环卫清运_____公斤/年　药品管理部门回收_____公斤/年　外卖_____公斤/年					
(三)HW16类感光材料废物					
1.固态	产生量	每　日　公斤	总产生量		吨/年
处理方式		处理说明			
2.液态	产生量	每　日　公斤	总产生量		吨/年
处理方式		处理说明			
二、一般固体废物					
中药残渣					
产生量	每　日　公斤		总产生量		吨/年
目前去向：　自己焚烧_____吨/年　卖掉_____吨/年 环卫清运_____吨/年　处置_____吨/年					
三、生活垃圾					
产生量	每　日　公斤		总产生量		吨/年
目前去向：焚烧_____吨/年　环卫清运_____吨/年　其它_____吨/年					
四、废水处理污泥					
有无废水处理装置：　□有　□无					
产生量	每　日　公斤		总产生量		吨/年
目前去向：焚烧_____吨/年　环卫清运_____吨/年　其它_____吨/年					

天津市医疗废物交接记录单（试行）

医疗废物产生单位：　　处置单位：天津市危险废物处理处置中心

日　期	医疗废物数量		医疗机构交接人员签名	废物运送人员签名	交接时间
	感染性废物及其它（箱）	损伤性废物（盒）			
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					
31					

注：1.此单由医疗废物产生单位成册妥善保存至少三年。

2.填写示例："5/125"表示5个125升的通转箱，"4/660"表示4个660升的通转箱。

3.请妥善保管好此（试行）单，并每月据此单填写危险废物转移联单。

4.感染性废物是指除硬质锐器之外的医疗废物，损伤性废物为医疗过程中使用的硬质锐器（包括：一次性手术及检查器具、针头、玻璃、硬塑器具等）。

时间：　　年　　月

天津市医疗废物运送登记卡

（第一联）　　运送单位留存

运输车辆编号：　　运送人员：

医疗机构名称	医疗废物数量		医疗机构交接人员签名
	感染性废物及其它（箱）	损伤性废物（盒）	

处置单位厂区废物接收人声明：我声明，我已接受上述数量的医疗废物，状态良好。若有问题，在此注明：

接受时间：　年　月　日　时　分----　时　分

接受人员签名：

天津市医疗废物运送登记卡

（第二联）　　处置单位留存

运输车辆编号：　　运送人员：

医疗机构名称	医疗废物数量		医疗机构交接人员签名
	感染性废物及其它（箱）	损伤性废物（盒）	

处置单位厂区废物接收人声明：我声明，我已接受上述数量的医疗废物，状态良好。若有问题，在此注明：

接受时间：　年　月　日　时　分----　时　分

接受人员签名：

天津市黄河医院文件

津南黄医院字（2003）第20号

关于医院医疗废物管理的规定

各科室：

为进一步加强医疗废物的安全管理，防止疾病传播，保护环境，保护人民群众的身体健康，依照中华人民共和国国务院第３８０号令和津卫后（2003）387号文件精神，经院长办公会研究特对医院医疗废物的管理作如下规定，望各科室严格执行。

一、为加强对医疗废物的管理，医院成立了以院长为组长，分管院长、预防、护理、药剂、检验、手术室、口腔科、妇产科、总务科为成员的领导小组负责日常管理工作，并建立医疗废物回收点，设专人负责。

二、医疗废物是由医疗、预防、保健以及其他相关活动产生的具有直接和间接感染性、毒性以及其他危害性废物。（如一次性针头针管、输液输血管、输液瓶、输液袋、窥器、口腔一次性检查用刀、剪、钳、镊，过期药品、放射性物品、手术后病理切片及检验科产生的废弃物、传染病人和疑似病人产生的生活垃圾等等）。

三、各科室要严格加强医疗废物的管理，使用后的一次性医疗用品要立即毁型，消毒处置，并按规定分类存放，任何人不得将废弃物私自进行倾倒或处理变卖，不得将医用废

物混入生活垃圾，后勤部门每天将派专人进行回收并进行详细登记，双方签字。

四、医疗废物由环保部门统一回收处理，医院要进行严格交接，做好详细记录，并履行签字。对贮存地点要定期进行消毒和清洁，各科设专兼职管理人员，配备必要的防护用品，加强贮存点的管理。

五、各科室要认真落实和执行医疗废物管理的规定和各项法律法规，对不履行医疗废物管理规定的科室，要追究科室及有关责任人的责任，并纳入科室考核。

以上管理规定自公布之日起执行。

附: 医疗废物各项管理制度

天津市黄河医院

2003年8月18日

医疗废物管理组织及责任

根据天津市津卫后（２００３）３８７号文件关于转发国务院《医疗废物管理条件》的通知精神，经院办公会研究决定成立医院废物管理领导小组。

一、医疗废物管理委员会组织机构

组　长：黄松茂

副组长：徐克珍　　王英芬　　赵光政

成　员：沈　鹭　　苑凤君　　李凤玲　　张书萱

张金玲　　张秀敏　　冯红旗　　杨　静

二、管理职责

１．加强对医疗废物的监督、管理、检查，并落实好各项规章制度。

２．定期召开管理组织会议，搜集、总结在医疗废物管理方面存在的问题，制定整改措施。

３．建立严格的奖惩制度，对不符合要求的科室及人员进行必要的经济处罚或通报。

医疗废弃物管理应急预案

根据中华人民共和国和国务院第380号《医疗废弃物管理条例》第十三条规定，发生医疗废物流失、泄露、扩散时，医疗卫生机构和医疗废物集中处置单位应当采取减少危害的紧急处理措施，对致病人员提供医疗救护和现场救援，特定以下措施：

一、对医疗废物收集运送人员进行岗前应急处理培训。

二、医疗废物收集运送人员进行考核，考核合格后持证上岗。

三、双层扎紧口密闭运输，每辆运送车配备收集泄露物品的工具(0．5%过氧乙酸、0．2%过氧乙酸浸泡过的拖把、持物钳、备用包装袋)，如发现泄漏马上报告预防科。 Peroxy acid

四、如发生废弃物泄漏，立即以此为中心5m范围内划为隔离区，疏散周围人员，并做以下紧急处理：

1、包装破损废物泄漏于运送车上，用0．5%过氧乙酸喷洒200ml／m^2—350ml／m^2，然后用持物钳收集到备用包装袋，(按废物分类装袋)。

2、包装破损废物散落于地面，喷洒0．5%过氧乙酸200ml／m^2—350m l／m^2，用持物钳收集备用包装袋，然后用0．2%过氧乙酸浸泡过的拖把拖地。

3、溅到墙面和物体表面马上用0．2%过氧乙酸擦拭，高度2．5m。

五、如被废物刺破皮肤应立即报告预防科，通知外科急症医生进行处理。

六、每次收集运送医疗废物应由专人运送。

医疗废弃物交接制度

1、总务科运送人员，每次应在病区与责任人进行医疗废弃物交接登记签字。

2、认真做好分类包装，收集。

3、如发现不合格分类包装有权拒绝接收。

4、认真填好本院医疗废弃物交接记录单，并签时间姓名。

5、医院医疗废弃物集中存放处管理人员，认真与市医疗废弃物集中处置中心运输人员进行交接登记签字。

6、每天总务科回收的医疗废弃物种类、数量、科室负责人需要进行签名登记，登记存根由总务科保管。

7、如不按制度执行，责令立即整改，情节严重者立即离岗。

医疗废弃物临床管理制度

1、在科主任的领导下，护士长负责本科室的一切医疗废物的初消管理、交接等工作。

2、医疗废物需严格分类放置，黄色垃圾袋为感染性软质垃圾：绿色垃圾袋为损伤性硬质垃圾；红色垃圾袋为传染性垃圾。垃圾袋应严密结扎，不可破漏并有明显标识，放置区域应有警示标记。

3、医疗废物均需严格管理，定点存放，不可放于公共场所，严禁非专业人员接触，避免垃圾外流。

4、一次性物品需经初消后分类，分类前护士应做好个人防护(相应防护措施以预防科要求为准)。

5、每天总务科回收的医疗废物种类、数量、科室责任人需要签名、登记，登记存根由总务科保管。

6、存放的医疗废物桶应加盖，每天由：卫生员用有效氯1500—2000mg / L 消毒液擦拭，每周消毒液浸泡大消毒一次，医疗废物存放地每天二次消毒液擦拭并没专用墩布。

7、医疗废物应定时清理，不可存放积压，特殊情况时与总务科联系及时清理。

医疗废弃物收集人员个人防护

1、处理医疗废物前穿好工作服，外套隔离服。

2、戴好口罩、帽子、防护镜。

3、穿好胶鞋。

4、戴双层手套：线手套外套长袖胶皮手套。

医疗废弃物专职收集人员职责

1、 认真执行医疗废弃物管理的有关规定和操作规程消毒。

2、 按规定的医疗废物运送流程图收集、运送医疗废物。

3、 在收集过程中，发现不合格分类包装有权拒绝接收。

4、 收集过程中做好个人防护。

5、 暂时存放地用 2000mg / L 二氧化氯对废弃物及地面喷洒消毒。

6、 不按制度执行，责令立即整改，情节严重立即离岗。

7、 专职人员定期检查身体状况。

病房治疗护士个人防护

1、处理医疗废物前穿好工作服。

2、戴好口罩、帽子、防护镜。

3、戴双层手套：线手套外套长袖胶皮手套。

专用运送工具的消毒制度

1、由专人负责消毒。

2、用 500mg / L 二氧化氯喷洒作用 30 分钟后，清水冲洗。

3、每 4 小时消毒 1 次(上、下午各 1 次)。

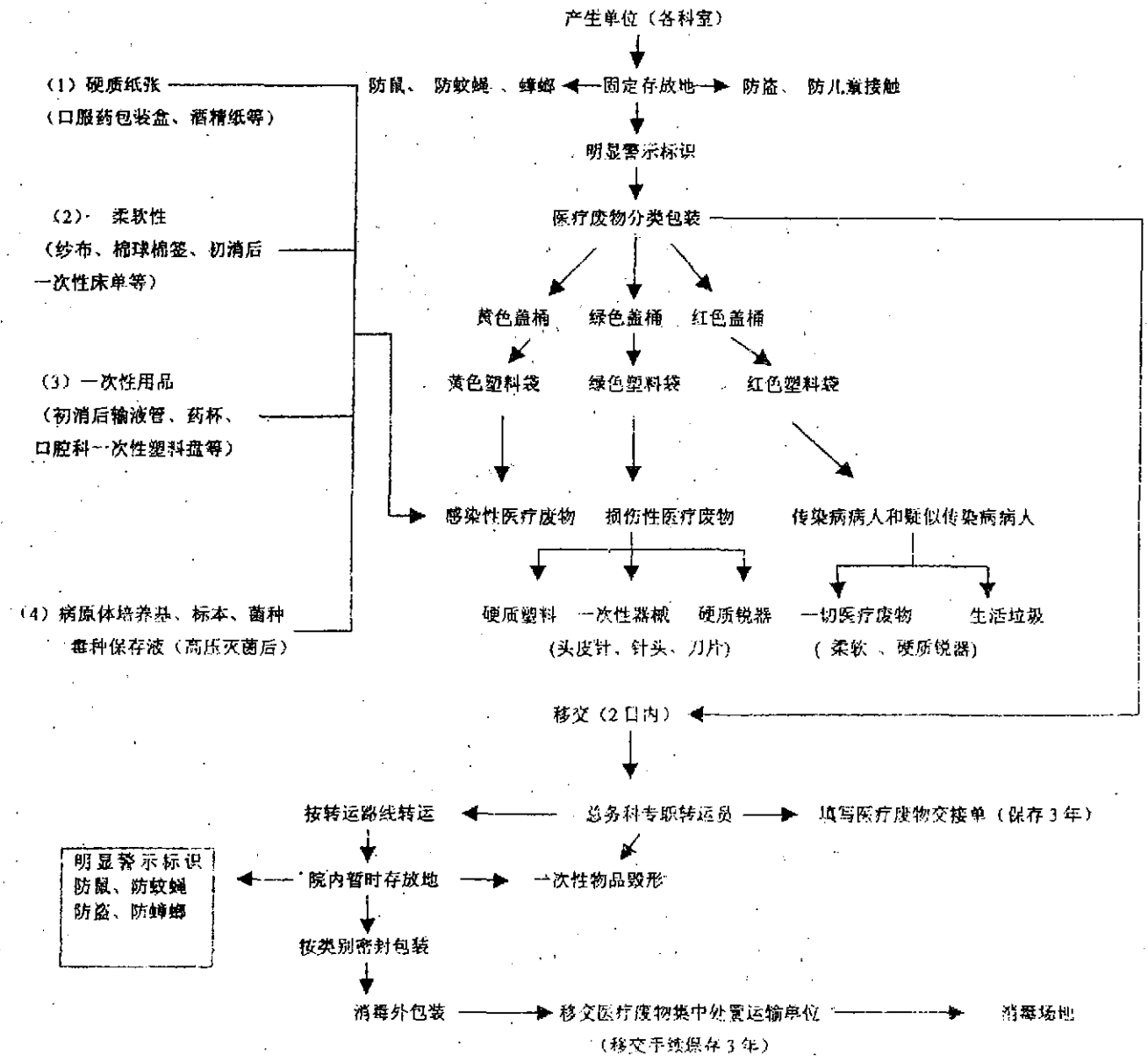
4、消毒存放地二氧化氯每 4 小时 1 次(上、下午各 1 次)。

5、认真做好各班记录并签字。

医疗废物管理人员网络

- 法人代表 黄松茂 → 主管院长 徐克珍 →
  - 护理部 沈 莹 → 科护士长 张秀敏 →
    - 内一病房 李鸿莲 → 产 房 王 静
    - 内二病房 周雅梅 → 手术室 杨 静
    - 心内病房 赵鸣冬 → 供应室 冯红旗
    - 内三病房 孙丽敏 → 眼 科 夏秀云
    - 内分泌 李桂香 → 耳鼻喉 郑云丽
    - 外一病房 林 梅 → 儿 科 梁 旭
    - 外二病房 赵美玲 → 急 症 刘淑芬
    - 妇科病房 牛鹤伟 → 肿 瘤 樊焕琴
  - 门诊办 史桂霞 →
    - 窥镜室 马淑玲 → 综合服务队 张从新
    - 五官门诊 赵玉珍 → B 超 王 虹
    - 皮肤泌尿 夏恩琴 → 门 注 周继秋
    - 血液平衡 左秀琴 → 急 注 刘惠琴
    - 计划生育 张福美 → 糖尿病 华武宗
    - 妇科门诊 王学勇 → 骨 门 许贵芝
    - 化验室 张凤荣 → 换 药 魏淑芝 康丽敏
    - 血透室 李娟娟 → 口 腔 曹金妹
    - 眼科门诊 任秀英 → 门诊药房 李 茹
    - 煎药室 巩立红 → 大药房 刘 莉
  - 预防科 王英芬 → 社 区 韩 莹
  - 后勤部 赵光政 → 卫生保洁队 李荣琴 → 田 森 桑仲斌

黄河医院医疗废物收集运送流程



APPENDIX G

SELECTED U.S. MEDICAL WASTE TREATMENT VENDORS AND SURVEY INFORMATION

List of Alternative Medical Waste Treatment Technologies and Vendor Information

Technology Name	Vendor	Name / Email Address	Vendor History and Annual Sales	Waste Treated	Process	Process Principle(s)	Waste Reduction (%)	Weight and Dimensions	Throughput	Bench-top Unit	Onsite Treatment Unit	Offsite Treatment Unit	Reusable/Beneficial End Product?	Disposal Location(s)	Collection/ Transportation Companies	Technology Maturity	Market History	Sales Locations	Sold to	Technical Support Availability
SHARP-SHIELD Disposal system	EARTH-SHIELD Inc.	Mark Rodgers 304 Yampa Street, Bakersfield, California 93307, Phone: 661-322-0300 (send information regarding the forum to 100 Quantico Avenue, Bakersfield, CA 93307-mailing address), www.earth-shield.com	Company was founded in 1997 by Argo Chemical, Inc. and Dr. Joe Dendy. Would not provide annual sales or growth numbers	Sharp waste only.-	Encasement in solid cementatious medium	Heat generated during the encasement process thermally treats the medical waste. Chemical treatment is achieved through slow release of low concentrations of gaseous chlorine by dry calcium hypochlorite present in the sharps container during use and storage	NA	64 oz. or 96 oz. puncture resistant container	600 - 900 needles per 64 oz. bottle and 900 - 1200 needles per 96 oz. Bottle	Yes; however, requires temporary storage location	NA	NA	No. Waste is encapsulated in plastic bottle and disposed of in standard waste bin	Municipal landfills	Municipal waste haulers	Yes	2 years	Bakersfield, CA	NA	Support provided by telephone
OREX ™ Sharps Management System (SMS®) Isolyser®/Sharps Management System (SMS®)	WCM Waste & Compliance Management, Inc.	2590 Pioneer Ave. Suite D, Vista, CA. 92083, Telephone 760.734.1106, Toll free 866.436.9264,Fax 760.734.1107, E-Mail service@wcminc.net866-436-9264 / fax: 760-723-1107 www.wcminc.net email: service@wcminc.net	OREX Technologies International (OTI), an operating unit of Microtek Medical Holdings, Inc, (Microtek Medical, Inc - 512 Lehmberg Road, Columbus, MS 39702 Phone (662-327-1863 and 800-824-3027).	Sharp waste only	Encasement through polymertization of a solution of monomeric acrylamide derivatives	Medical sharp waste is placed in rigid, leak-proof, puncture-resistant containers that come prefilled with Isolyser® SMS® liquid solution. When full, catalyst packets are emptied into the SMS® containers to drive the solidification/heat disinfection reaction.	NA	Large: 15 liter (4 gals), 10 liter (2.6 gals), and 5.8 liter (1.5 gals) capacity; Medium: 3.0 liter (0.75 gal) and 1.0 liter (.26 gal) capacity; Small: 0.8 liter (1 quart) capacity.	NA	Yes	NA	NA	No. Treated waste is disposed of in containers	Municipal landfills	Municipal waste haulers	Yes	5 years	Contact vendor directly	NA	Yes, from vendors
Needlyzer™	Needlyzer / MedPro	(2119 North Kenmore Ave, Chicago, IL 60614) Phone: 773-528-2652 **Clark Lloyd, International Marketing and Compliance Healthcare Products Plus, Inc. (MedPro, Inc.817 Winchester Road, Suite 200, Lexington, Kentucky 40505 U.S.A Tel: 859-225-5375), www.needlyzer.com	NA	Hypodermic needles	Metal fusion and thermal treatment	Metal hypodermic needles are fused by means of an electric circuit created when the needles make contact with the two electrodes inside the unit. The resulting high temperature oxidation (1500°C) destroys organic matter on the needle. The NeedlyzerTM utilizes heat in the destruction of non-coated stainless steel hypodermic needles, reducing them to swarf that contains chromium, nickel and ferric oxide. After a needle has been destroyed using this device, the contaminated needle has immediately been removed from the medical waste stream as a sharp. Three pieces mi 1394 Pellflex filters containing moisture, particulate and carbon filters were used in the equipment build-in filtration device to protect workers from exposing to contaminated vapor/air stream. DOP efficiency rating of 99.999% against a 0.2 micron aerosol at face velocity of 160 centimeters per second. Device passes applicable standards of the CSA (Laboratory Standard) UL544 (Medical and Laboratory Standard) and IEC 601-1	Significant, from needles to metal powder	13.5" x 5" x 4.75", 5 lbs 11 oz. or 2.32 kg	Each cartridge holds approximately 3,000 to 5,000 needles	Yes	NA	NA	The by-product of the process is a granular powder, oxidized ferrous, nickel and chromium (swarf)	Cartridge of needles can be recycled or disposed of in standard waste bin. The syringe and hub, after proper destruction, may be disposed of in a bio-hazard container	Recycler or municipal waste hauler for cartridge.	4 years	4 years	Contact vendor directly	NA	Yes, from vendor
Sharpx	Biomedical Disposal , Inc	3890 Holcomb Bridge Road, Norcross, GA 30092, Ph: 770-300-9595 or 888-393-9595 Fax: 770-300-9599) WWW.Biodisposal.com, info@biodisposal.com salesinfo@biodisposal.com	Biomedical Disposal Inc. was founded in 1995	Needles	Destroys 18- to 30-gauge hypodermic needles 1/2 to 2 inches in length. Needles are destroyed in seconds. Unique portal design guides the needle, makes destroying the needle simple	Sharpx® uses electric current from its onboard battery to destroy the syringe needle. Waste collection is addressed in two parts: needle debris is captured in a removable receptacle while vaporized gases are directed through a filtration system. Some advantages of Sharpx® are its smooth operation, portability and ease of use.	Significant, from needles to metal powder	Lightweight (2 lbs.) and only 8 1/4" long x 4" wide	One charge destroys as many as 25-100 needles	Yes	Yes	Yes	No	Municipal landfills	Municipal waste haulers	Yes	5 years	Contact vendor directly	NA	Yes, from vendor
Demolizer system	Infectious Waste Technologies	Loretta Vaz / Vaz@demolizer.com or LorettaVaz09@hotmail.com (375 South End Avenue Suite 23P, New York, NY (212) 566-1812 [new number is 203-778-1139] ****This is a distributer for the Demolizer. (Thermal Waste Technologies located at 19 Stoney Hill Road, Bethel, CT 06801 Phone: 203-778-1139).)	NA	Sharps and bio-hazardous waste (blood soaked gives, dressing, gauze, speculums, etc.)	Low-heat process that uses electro-thermal deactivation process	Medical waste is placed within a one-gallon sealed container prior to being placed in a microwave oven and heated to 350°F for 90 minutes to disinfect the content. The treated waste can be disposed of as regular MSW. A dual-stage filtration and air flow system consisting of an anti-viral and anti-bacterial HEPA filter and a charcoal-filter for odor control.	NA	19.25" D x 13" W x 12.25" H	1 gallon/ 2.5 hour	Yes, for small quantity waste generator	Yes, at the point of generation	No	No, the treated waste is typically disposed of at landfills	Municipie landfills	General trucking companies or municipal waste haulers	Yes, process technology was developed about 10 years ago	Commercial product for about 7 years	New York headquarters	Nation-wide and international (Kuwait, looking into India). Mainly working with nursing home groups and diagnostics laboratories (small quantity generators)	USA, India, and UK
PremiCide-CA with PremiGuard4 Closed Delivery System	Metrex Research Corporation – PremiCide-CA (might have merged with OBF Technologies)	1717 West Collins Ave, Orange, CA 92867, Phone No. 800-841-1428	Metrex, an affiliate of Sybron Dental Specialties, was founded in 1965. Throughout US and Canada	Liquid medical waste residue in suction canisters and calibrated containers	Encasement in solid cementatious medium	PremiCide-CA is a sanitizing encapsulant for use in suction canisters and calibrated containers. The active ingredient is glutaraldehyde. The product is not intended for liquid medical waste with greater than 20% serum	NA	Container sizes are 500cc, 1,200cc, 1,500cc, 2,000cc, 3,000cc, and 10,000 cc	Varies by container size.	Yes	NA	NA	No, container with encapsulated liquid waste must be disposed of	Municipal landfill	Municipal waste haulers	NA	Metrex purchased product line from OBF in 2003.	USA with distributor in Japan (Ondeko Corp. 011-81-359-925820)	NA	Telephone local representative of distributor
Condor Medical Waste Treatment System	Condor Healthcare Services, LLC	John Chahine / Jchahine@condortechnology.com 1532 E. Katella Ave., Anaheim, CA 92805 Phone: 714-456-0790	NA	All types of dry medical waste, except radioactive material.	Cold Treatment Process - Simultaneous shredding and chemical treatment	Medical waste is destroyed through mechanical shredding and disinfected with chlorine dioxide generated from proprietary chemical products. The disinfection solution is recycled within the system.	80%	NA	1,800 lb/hr (816 kg/hr)	No	Yes (low volume)	Yes (high volume)	No. Waste becomes confetti and chemicals break down during the process resulting in "Common Salt"	Municipal Landfill	Liberty Healthcare Services, LLC	Yes	NA	Santa Barbara, CA	Westcoast (California to Utah etc), Southeast (Florida, Georgia, etc), Northeast (NY, Boston, etc)	NA
SterlMed®	GMS Marketing Services	191 Hempstead Tpke, West Hempstead NY 11552 Phone: (800) 783-7463, Elliot Koppell, VP of Business Development (e-mail address: ekoppell@mcmtech.com) or George Aaron, President (updated infor from website - http://www.mcm-sterlmed.com/information.html. address: One Parker Plaza, Fort Lee, NJ 07024, U.S.A. Tel: 201-242-1222, Fax: 201-592-0393, e-mail: contact@mcmetech.com	MCM Environmental Technologies was founded in 1993, and restructed in 1996 and 2001. Received orders for more than 70 systems as of 10/2001	All types of dry medical waste, except radioactive material.	Cold Treatment Process - Simultaneous shredding and chemical treatment	Medical waste is destroyed through mechanical shredding and disinfected with Ster-Cide®, a USEPA-approved proprietary blend of quaternary ammonium compounds and gluteraldehyde. Ster-Cide® is 94% to 98% biodegradable	80% to 90% (volume) depending on the type of waste and the quantity	Height - 50 in (1.27 m) Width - 48 in (1.22 m) Depth - 27.5 in (.070 m) Weight - 1,444 lb. (650kg)	20 lbs (75 liters) per 12 minute cycle. 200 tons of waste per year	No	Yes, can be placed in service areas, wards, or central location	NA	No. The liquid (disinfection solution) and solid (shredded waste) portions must be separated. The liquid solution must be sewered and solid portion disposed of in standard waste bin	Municipal landfill and sewer	NA	Yes	2.5 years	Australia, Mexico., Argentina, EU, Russia, and USA	National (NY area Nasville, Tennessee, and working on approval for California) International (Europe, Mexico, Asia-Singapore)	Factory-trained and certified technicians are available. However, training for technician is also provided at factory (either Israel or USA).
SterlMed Junior®								Height - 42 in (1.05 m) Width - 33 in (0.82 m) Depth - 20 in (.050 m) Weight - NA	Up to 200 lbs per day.											

Technology Name	Vendor	Name / Email Address	Vendor History and Annual Sales	Waste Treated	Process	Process Principle(s)	Waste Reduction (%)	Weight and Dimensions	Throughput	Bench-top Unit	Onsite Treatment Unit	Offsite Treatment Unit	Reusable/Beneficial End Product?	Disposal Location(s)	Collection/ Transportation Companies	Technology Maturity	Market History	Sales Locations	Sold to	Technical Support Availability
LF612- (main system) J-Model Unit (hospital unit) and K-Model (mobile unit)	Medical Waste SafeTEC (Successor to Medicaen Technology, Inc., Medical Compliance Services, and Kysemer U.S., Inc) Located in 5387 El Paso Drive, El Paso, Texas 79905 (Telephone: 915-772-2288 and Fax: 915-771-8538) - This contact info is for the old company and the new owner is Stericycle, 847-367-5910, Shawn Sacaranes, VP of International Business Development	Mark Smolski/ mark.s@medicalwastetech.com (330 West Center Street, North Salt Lake, Utah 84054) Phone: 801-209-6582 Fax 801-936-0112 Website (http://www.medwastetec.com) Lynn Benson, Manager)	MedWaste TEC has 15 years of experience in the proper treatment of infectious waste and has placed over 120 units of various models.	Sharps, surgical waste, liquids, plastics, pathological, and any other waste allowed by state regulations/Dry and wet wastes including sharps but excluding chemotherapy waste	Cold Treatment.Process - Grinding and chemical treatment	Medical waste is destroyed through mechanical grinding and disinfected with sodium hypochlorite. The waste is dropped into a rotating multi-stage vertical shredding mill and the maceration/volume reduction and disfigurement process begins with 3-stage impact mill and shredding device. The treatment chemical is sprayed on to the waste material as it exits the macertion device. This pressurized "hot tank" is where the full treatment and decontamination	90 % (volume)	h - 15ft, 11ft w, 24 ft l; 17 ft, 13 ft, 30 ft; 20,000 lbs	SF6 - 300-600 lbs/hr, SF10 - 600-1,000 lbs/hr, SF12 - 1,000 - 1,500 lbs/hr, SF15c - 2,000+ lbs/hr	No	Yes. Can be installed in facility or within custom designed container or enclosure	No	No. Treated waste is disposed of as regular municipal waste	Municipal landfill	Municipal waste haulers	Yes. In China, probably establish local technical service ability. Train someone there. Usually can solve issues via email and telephone. Only difficulties with obscure part.	Acquired medical safetec in mid-1980. Mid-late 80s, 2nd generation for 5 years; 3rd generation for 2 years	England (commercial), has been approached by agents in China.	National (east coast, midwest, also have some older units in California), England	Depends on the location (local service contractors) however they train the product operators to trouble shoot
WR[1] Tissue Digestor	Waste Reduction, Inc	5711 West Minnesota Sreet, Indianapolis, Indiana 46241. Tel: 1-877-74-waste, Email: dlovenheime@wr2.net	Company was founded in 1993 by Dr. Gordon Kaye, Dr. Peter Weber (professors of Albany Medical College) and David Lovenheim to manufacture, market, and sale the "Tissue Digester" that was invented by Dr. Kaye and Weber for disposing of biological tissue generated by biomedical and pharmaceutical researches. Since the first Tissue Digester installation in 1993, WR[2] has been selling and installing its medical waste treatment equipment in Canada, U.K., France, Japan, Kuwait, and India	Carcasses, tissue, or contaminated liquids or solids (for example, eggs used in vaccine production).	Chemical and low-heat thermal treatment	The process consists of an insulated, steam-jacketed, stainless steel pressure vessel with a manually or automatically clamped lid. The vessel contains a retainer basket for bone remnants and refractive materials (paper, latex, sharps, etc.). The vessels are A.S.M.E. pressure-rated to operate at 100 psig but are operated routinely at less than 70 psig to achieve a processing temperature of 150° C. After loading, the entire process is automated to allow unattended operation during the processing cycle. During operation, digestion solution (stoichiometric amounts of alkalis and water) is added into the medical waste. The contents are heated while the digestion solution is continuously recirculated. Total process time is approximately 4 to 5 hours and the sterile aqueous solution of small peptides, amino acids, sugars, soaps, and electrolytes can be discharged into sanitary sewers according to local regulations. The alkali itself is consumed in the process. Mineral constituents (ash) of the bones and teeth are the only solid byproduct that can be disposed of or recycled.	90%+	Unit size varies from 16"-dia.x 8"-H to 96"-dia.x 100"-H. Min. room size required ranges from 6' x 8' x 8'-H to 16' x 20' x 18'-H. WR2 small capacity Tissue Digestors are wheeled units that will fit through a standard doorway.	Throughput rate ranges from 5 kg (11 lbs) to 4536 kg (10,000 lbs)/cycle capacity units, each treatment cycle is about 4 to 5 hours.	NA	Yes, mobile units are also available	NA	Byproducts can be used as fertilizer	Sterile treatment solution is discharged into sanitary sewer and solids are disposed of at MSW landfill	General waste haulers	Yes, technology developed in 1992 and commercial units have been in market since 1993	From 1993 till present	Sales representatives in Europe (Waste Reduction Europe, Ltd.), Japan, India, and Kuwait	US, Canada, France, U.K., and Japan	Indianapolis, Indiana and Albany, NY
PIWS' MMT 3000/Mobile Medical Waste Processor	Positive Impact Waste Solutions, Inc. ("PIWS")	P.O. Box 14692, Odessa, Texas, TX 79768 (Email: solutions@piwsinc.com) 432-550-5883 Ask for Susan Palmer Email: shpalmer@piwsinc.com	First prototype produced in 1997. After acquired by new owner in 1999, manufacturing facility was established and full-scale production of commercail units began	Cultures and stocks, pathological waste, human blood and blood products, used and unused sharps, isolation waste, animal waste from research laboratories	Chemical/low heat disinfection	After the medical waste is transferred into the twin treatment chamber of the treatment system by an automatic cart-lift mechanism, Cold-Ster (CaO) and water mist is blended into the waste to control the pH and render the organic material and microbiological organisms non-infectious by heat and alkaline pH. The waste is then cut by processing blades several times to reduce the waste viume	70% plus	This is a self-contained mobile teatment process with the treatment system and all control/monitoring equipment craftly stored in a 25 to 40-ft trailer	Max. 2,000 pounds per hour for the MMT 3000	No	Yes, the treatment system is driven to the site for onsite waste treatment (powered by generators)	Yes. Currently, the company only produces mobile treatment units, but a stationary treatment plant can also be built, in whih case the fix treatment system can be powered by electricity	No, treated waste is disposed of as MSW	Municipal landfills	General trucking companies or municipal waste haulers	Yes, the treatment system has been successfully operated at various healthcare facilities and PIWS currently has service contracts with these waste generators	Since 1999	Headquarters at Odessa, TX	PIWS currently oly offers mobile treatment services to healthcare facilities instead of being an equipment manufacturer	Yes, from headquarters in Odessa, TX
High-vacuum/high-pressure autoclaves or retorts	Bondtech	2400 N. Hwy. 2, Somerset, Ky 42503, Tel: 1-800-414-4231 or (606) 677-2616, Fax: (606) 678-9157, Email: Elsa Brown - elsabrown@bondtech.net	Autoclaves have been in use for 10+ yrs, customers included BFI, Waste Management, Medx, Applied Recovery, Sterimed, Med-Tech	Cultures and stocks, sharps, blood and fluid contaminated material, isolation/surgery waste, lab waste (excluding chemicals), soft waste	Low-heat thermal by steam	Medical waste and chemical or biological indicators (periodically) are loaded in an insulated autoclaves/retort, then the m icroprocessor controls begin the treatment cycle. A pre-vacuum cycle removes air after which saturated steam between 275-305°F is introduced. After exposure, the steam is vented through a condenser and the condensate is drained to the sewer. A post-vacuum is applied to remove residual steam for worker safety protection and simultaneous drying of the treated waste. The treated waste is unloaded for mechanical treatment or disposal	0% (volume) without a shredder/grinder	Range from 35"-dia. X 4'-long to 8'-dia. X 17'-long vessel, a commercial unit may have dimensions of 8'-dia. X 32'-long	200 Lbs. - 7,000+ Lbs./cycle and 1,500 pounds of waste per hour	NA	Commercial systems for on-site treatment in medical centers	Mobile Systems	Generally none, treated waste is disposed of at municipal landfills. Recycling of treated plastics is possible	Municipal landfills or recycling facility	Municipal waste/recycling haulers	Yes	Over 10 years	NA	Clinics, hospitals, commercial facilities	Yes
Semi-automated and totally automated robotic system; standard, high volume, and high vacuum type sterilizers	Mark-Costello Company	1145 East Dominguez Street, Carson, CA 90746 (310-637-1851 / Fax: 310-762-2330) http://www.mark-costello.com/main.shtml	The Mark-Costello Co. was established in 1956 as a sales agency/distributor, with emphasis on designing, supplying and servicing engineered systems in Centralized Lubrication Systems and Mechanical Power Transmissions. In 1971, Waste Systems Division was formed to provide systems for handling solid and medical waste. Today, the company is a large supplier of the compactors, balers, medical waste processing equipment(i.e., waste sterilizers and related waste handling), and recycling systems	All medical waste that is classified as biohazardous waste	Low-heat thermal by steam	Sterilizers use the basic principle of high temperature steam under pressure in an enclosed fully automatic steam retort. The principle involves high temperature steam under pressure for a specified period of time. Treatment cycle begins timing once the internal chamber temperature reaches 135° C. and continue for one hour	0% (volume) without a shredder/grinder	The Mark Costello Company manufactures standard type sterilizers suitable for hospitals and manufacture large commercial type sterilizers designed for commercial processing facilities. The Mark-Costello standard sterilizer ranges from 3' to 15' in length, while the commercial units vary from 15' to 35' in length. Units can be 3', 4', 5' or 6' in diameter.	High Volume Waste Treatment Systems in operation processing up to 3,000 pounds per hour, 24 hours per day	No	Commercial systems in medical facilities for on-site treatment	large systems in off-site regional treatment ceneters	Generally none, treated waste is disposed of at municipal landfills. Recycling of treated plastics is possible	Municipal landfills or recycling facility	Municipal waste/recycling haulers	Yes, medical waste steam sterilization has been in use for over 30 years	Mark-Costello Co. was founded in 1956 and has been manufacturing medical waste sterilizers since 1972, with over 425 units installations in hospitals, pharmaceutical companies, international airports, and regional processing centers across the US and overseas	California, Arizona and Mexico	Approximately 50 units in operation throughout Quebec, Canada for the past 11 years. Oversee clients included Brazil, India, United Kingdom, Australia, Guam, Mexico, New Zealand, New Guinea and Peru. Sales Agents or Distributors in some of these countries and throughout the US.	Los Angeles California.

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cGM Autoclaves,Cage & Rack Steam Sterilizers - Autoclaves	Environmental Technonics Corporation (ETC)	125 James Way, Southampton, PA 18966-3877, U.S.A., Tel: (215) 355-9100, Fax: (215) 357-4000, www.etcusa.com, Email: mailen@etcusa.com	NA	All types of medical waste except for chemo therapy drugs	Low-heat thermal by steam	Sterilizers use the basic principle of high temperature steam under pressure in an enclosed fully automatic steam retort. The principle involves high temperature steam under pressure for a specified period of time. The systems are configured for floor- or pit-mounting with single or double doors and hydraulic power lock doors.	0% (volume) without a shredder/grinder, with a shredder (70-80%)	Unit size varies from 26"-W x 42"-H x 60"-L to 102"-W x 72"-H x 120"-L. Pit containment size varies from 113"-W x 60"-L x 15"-D to 250"-W x 222"-L x 24"-D	Standard units range from 4,000 to 13,000 lbs per day	No	Commercial systems in medical facilities for on-site treatment	large systems in off-site regional treatment centers	Generally none, treated waste is disposed of at municipal landfills. Recycling of treated plastics is possible	Municipal landfills or recycling facility	Municipal waste/recycling haulers	Yes	NA	NA	NA	NA
Semi-automated and totally automated standard, high volume, and high vacuum type autoclaves/ retorts	Sterra Industries (formerly RE Baker Company)	1021 South Linwood Avenue, Santa Ana, CA 92705 (714-560-9333), www.sierraindustries.com	Manufactured insulated pressure vessels with hydraulically operated doors and safety interloks, some units have been in operation for over 10 years	All medical waste that is classified as biohazardous waste	Low-heat thermal by steam	Red bags are placed in autoclavable bags and loaded into stainless steel carts. The vessel door is opened and the hinged ramp is placed on the ground. The cart/carts are ushed up the ramp into the vessel. The door is locked and the steam (275°F, 31 Psig) is injected into the vessel for 45 minutes. At the end of the treatment cycle, the condensate is discharged and the door is opened for retriving the treated waste.	0% (volume) without a shredder/grinder, with a shredder (70-80%)	Cylindrical with outer water-tight control enclosures hydraulic pumps, , supports, and other structure. Three typical designs at 62"-height x 70"-wide x 112"-long (6,000 lbs); 96"-height x 78"-wide x 144"-long (7,200 lbs); and 96"-height x 78"-wide x 191"-long (8,500 lbs)	Varies froms size with pressure up to 100 Psig and temp. up to 400oF. Standard units range from 200, 500, to 750 lb per hr capacities	No	Commercial systems in medical facilities for on-site treatment	large systems in off-site regional treatment centers	Generally none, treated waste is disposed of at municipal landfills. Recycling of treated plastics is possible	Municipal landfills or recycling facility	Municipal waste/recycling haulers	Yes	Over 15 years	NA	NA	NA
Rotoclave	Tempico, Inc	1700 West Church Street Hammond, LA 70401 (800) 728-9008 Contact Craig Boots / cboots@tempico.com	Established 1992, $3-12 million annual sales	Medical wastes (specific types not indicated)	Low-heat thermal by mechanical fragmenting and steam treatment, followed by drying and shredding	The system contains a pursure vessel with an internal rotating drum. Medical waste bags and boxes are loaded into the drum using an optional cart dumper. Vacuum is applied to remove air as steam is introduced at 296oF/50 Psig for 30 minutes. The combined effects of the steam and the rotation force partially breaks up the waste and eliminates cold spots. An ancillary waste processing system which further shreds and processes the treated waste for volume reduction	70-80% by volume	Models 1250-G1 (4'-dia x 10'-long), 1500-D1 (5'-dia x 12'-long), 2500-D1 (5'-dia x 12'-long each, two vessels), 12000-E (8'-dia x 25'-long).	300 to 750 lbs per hour per vessel, models 1250-G1 (109 cf per 50 min. cycle), 1500-D1 (212 cf per 60 min. cycle), 2500-D1 (424 cf per 60 min. cycle), 12000-E (1,038 cf per 80 min. cycle)	No	Yes	large systems in off-site regional treatment centers	Generally none, treated waste is disposed of at municipal landfills. Recycling of treated plastics is possible	Municiple landfills	Municipal waste/recycling haulers	Yes, accepted and approved in US	1992	Louisiana, with international sales persons	Costa Rica, Puerto Rico, Spain, Ireland, England, Esdonian, Philipine, and Sri Lanka	Louisiana
Advanced autoclave, San-i-Pak	Sanipak	23535 South Bird Road, Tracy, CA 95304, Email address: sanipak@sanipak.com / info@sanipak.com, Web Site: http://www.sanipak.com/ Phone: (209) 836-2310/ Fax: (209) 836-2336	Sani-Pak has been around since 1978 and sold it first unit to a hospital in California. One of the original technologies evaluated by the USEPA in 1993	Regulated medical waste	Low-heat thermal by high vacuum and steam treatment, followed by mechanical compacion	The system first pulls a vacuum within the chamber to remove all the air. (This air is mixed with 307°F steam through the ejector). Then steam enters the sterilization chamber until the chamber reaches 38 lbs. of pressure. This procedure ensures total steam penetration into the waste. After a temperature of 270oF is achieved, a 30-minute timer is automatically activated. Within minutes, the chamber will reach its ultimate temperature of 284oF. Upon the completion of the sterilization cycle, the sterile waste is ready to be discharged and compacted into the roll off container.	40% by volume	Various in size, custom design available. Selected models: Mark II (65-3/8" H x 114" W x 31.8" D), #241 (97-3/4" H x 48" W x 73" D), #341 (7'8-3/16" H x 4'-7" W x 5'3-5/8" D), #356 (10'-3/4" H x 36'8" W x 7' D)	25 lb. to 2,500 lb. of waste per hour. For examples, Mark II (106 lbs/hr), #241 (160 lbs/hr), #341 (230 lbs/hr), and #356 (2,240 lbs/hr)	No	Yes (90% of the units are onsite)	Yes (10% of the units)	Generally none, treated waste is disposed of at municipal landfills. Recycling of treated plastics is possible	Municiple landfills	Municipal waste/recycling haulers	Yes, accepted and approved in US	1978	NA	California, Hawaii, Alaska, Canada, Europe, South America, Asia, Virgin Islands, Asia, Italy, and New Zealand	Yes, sales offices and headquarters
Chem-Clave, Series 2000, 3000, and 4000	Sterial Technology Industries (STI) - a WR² Company	2910-D Fortune Circle West, Indianapolis, IN 46241, Ph: 317-484-4200, E-mail: www.stichemclav.com or sales@stichemclav.com	STI began introducing its combined steam and chemical disinfection (bleach) treatment processes for medical waste in 1995. As technology evolved, it became primarily a steam treatment unit, using the chemical disinfectant mainly for cleaning the equipment during shutdown or maintenance. Recently, STI was acquired by WR²	Biohazardous waste including regulated medical waste, infectious waste and clinical waste	Low-heat thermal by shredding, steam treatment, drying, and chemical cleaning	Medical waste is loaded via feed conveyors or cart dumpers into the hopper under negative pressure and shredded with downward pressure applied by a ram. shredded waste then enters a rotating auger conveyor where low pressure steam is introduced through multiple ports to maintain a temperature between 205 and 230oF. Downstream of the auger conveyor is a dehydration section wherein a steam jacket increases temperatures above 212oF. The steam is discharged via a vent at the end of the conveyor and through a condenser causing the waste to dry. The treated waste is discharged into a self-contained compactor or roll-off bins for transport to a municipal landfill. A chemical subsystem injects bleach mist intermittently into the system for cleaning and odor control	Up to 90% volume reduction	NA	The 2000 Series have 300, 600, and 1,000 lbs per hour capacities for onsite hospital application; whereas the commercial units . have throughputs from 2,000 to 4,000 lbs per hour	No	Yes, for hospital applications	Yes, commercial units with larger treatment capacities than those for onsite hospital applications	Generally none, treated waste is disposed of at municipal landfills. Recycling of treated plastics is possible	Municiple landfills	Municipal waste/recycling haulers	Yes, the Chem-Clave is approved in 44 states in US	Since 1977; however, the Chem-Clave has been in market since 1995	Indianapolis, Indiana and Albany, Texas, Georgia, FL, NY, NJ, Ohio (not representative)	Just started Intl (Glasgow, 2 Japan, 2 Singpore, Beijing China, Korea, Taiwan) / National - Denver, East Coast (DC, Penn, VA, NC), South (Texas)	Indianapolis, Indiana and Albany, NY
SSM-150	Anteaus Group (aka Waste Processing Soultions)	3051 Washington Boulevard, Baltimore, MD 21230 Phone: 443-524-4245, Fax: 443-524-4250, Email: info@wasteprocessingsolutions.com. Bill Norton (President & CEO) wdnorton@redbag.com wdnorton@wasteprocessingsolutions.com	The technology derived its abbreviation from Steam Sterilization Macerator (SSM), which was developed initially in the early 1990s. The new device is sold by the Anteaus Group	Anything placed into a "red bag" can be processed in the SSM. This includes paper, cardboard, film, wovens, non-wovens, degradables, plastics, and metals as wesl as specific items such as blood, suction canisters, disposable stainless steel instruments, trocars, needles, sharps containers,and other blood contaminated materials	Low-heat thermal by shredding, steam treatment, and drying	After loading the waste into the system, steam is injected into the process tank, followed by 250°F (121°C) superheated water. After a brief soak, the pump grinder is activated and the waste is drawn through a proprietary cutter (with 7-inch macerating blades grinding at 1,800 rpm) and the impeller of the pump where it is macerated, mixed, and recicrculated. After several minutes, the formal sterilization is initiated and the temperature of the waste stream is held at 272°F for six minutes. Both a real time hard copy and a digital record are generated to verify sterilization. At the end of the sterilization cycle, cold water is injected into the vessel to cool the treated waste. Cooled and sterilized waste slurry is then discharged into a filter-separator in which solids are separated from the liquids. The solids are captured in disposable filter bags and disposed of as regular trash and the liquid is filtered again before discharging into the sanitary sewer.	Up to 80% volume reduction and 15% weight reduction	9.5' (2.89 m) in length by 7.25' (2.10 m) in height by 4' (1.22 m) in width and weighs approximately 3,500 lbs (1588 kg). An accompanying filter-separator, utilized to dewater the processed solids, measures 3' (0.9 m) by 2' (0.6 m) and weighs an additional 350 lbs (159 kg).	150-200 lbs/hour with an operating cycle of approx. 30 minutes	No	Yes	No, a commercail unit will be ready in July 2005	No, only confetti-like waste is generated for disposal in a landfill. Recycling is possible for plastics after sorting the waste streams	Process liquid is discharged into the sanitary sewer, while the waste solids captured by the filters are discarded as ordinary municipal trash in landfills	Municipal waste/recycling haulers	12 years	Sold first unit in 1997	Baltimore, Chicago, California.	California, Maryland (Baltimore), Chicago, North Carolina; International - Brazil, Japan, Guam	Tech support location are based on the facilty location, the main tech support location is in Baltimore via a 24-hour hotline system

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Ecolotec Technology	Ecolotec, LLC Sold by:Eco Concepts Inc	8 Savannah Court, Union Grove, AL 35175, also has offices in Guelph, ON, Canada, Ph (Toll): 888-470-9713, Ph: 519-826-0803, Fax: 519-826-7648, Cell: 519-831-2058, E-Mail: office@eco-concepts.com. Gordona Todorvic - office manager. Email: devries@eco-concepts.com	NA	Handles all types of medical and pathological waste	Low-heat thermal by simultaneous steam and internal shredding treatment, followed by drying	Medical waste (red bags, full sharps containers, etc) is loaded into the pressure vessel and disintegrated/pulverized by internal knife hammers that rotate up to 3500 rpm to break up and shred the waste while live steam is being injected to raise the temperature to 270oF. Once the sterilization process is completed, the vessel is vented through a condenser and filter (HEPA and activated carbons). A vacuum is then pulled t remove residual moisture while cooling the waste to 165oF through evaporative cooling. The processed waste is finally disposed of as regular trash	Up to 80% volume reduction	Footprint: 8'-8" x 3'-4", 8' height, weighted approx. 2800 lbs, minimum recommended installation space: 16 ft. x 20 ft.	Est. at 300 lbs per hour or higher, each cycle is approx. 15 minutes	No	Yes	Not currently	Generally none, treated waste is disposed of at municipal landfills. Recycling of treated plastics is possible	Municipal landfills	Municipal waste/recycling haulers	NA	NA	NA	NA	Yes, sales offices and headquarters
Hydroclave	Hydroclave	672 Norris Court, Kingston, Ontario, Canada K7P 2R9, Tel: (613) 389-8373, · Fax: (613) 389-8554, · Email: inquire@hydroclave.com, Richard Vanderval (rvanderval@hydroclave.com)	Established in 1994, the first hydroclave system was tested in 1995 by the University of Ottawa in Kingston General Hospital, Ontario, Canada	medical waste, animal/pathological waste, infectious liquid waste, and classified food waste from airplanes and ships	Low-heat thermal by simultaneous steam and mixing/fragmenting treatment, followed by drying	Hydroclave sterilizes the waste utilizing steam, similar to an autoclave, except that the high temperature steam is only applied to the outer jacket to heat the waste via the hot inner surface. A shaft and paddles in the inner vessel rotates to fragment and tumble the waste. The moisture in the waste then turns into steam and pressurizes the inner vessel (water can be added if the waste contains low moisture). The inner vessel is maintained at 132°C for 15 minutes or 121°C for 30 minutes while the mixing continues. After treatment, the steam in the inner vessel is vented through a condenser while maintaining heat input, causing the waste to dry. The steam to the outer jacket is shut off, the discharge door is opened, and the shaft and paddles reverse rotation to scoop the waste out for loading into waste disposal containers.	50% mass reduction and 75 % volume reduction	Various sizes and custom design are available. Selected models: H-25 (82" H x 79" W x 48" D, 6,500 lbs), H-65 (139" H x 110" W x 69" D, 15,500 lbs), H-100 (176" H x 102" W x 70" D, 17,800 lbs), H-150 (224" H x 102" W x 70" D, 22,000 lbs), H-200 (249" H x 102" W x 70" D, 23,200 lbs), H-250 (272" H x 102" W x 70" D, 24,400 lbs)	Vaious, for examples: H-25 (200 lbs/hr), H-65 (500 lbs/hr), H-100 (750 lbs/hr), H-150 (1,000 lbs/hr), H-200 (1,500 lbs/hr), and H-250 (2,000 lbs/hr)	No	Yes	Yes	Generally none, treated waste is disposed of at municipal landfills. Recycling of treated plastics is possible	Municipal landfills	Municipal waste/recycling haulers	Yes, the process is accepted or approved in most, if not all states in the US. It is also patented in 2000	International	Reps and sales offices in US, China, Cananda, Egypt, and Mexico	North America, South America, Asia, and Europe	Canada - mumbai
Junk Yard Dog (JYD) -1500	Aegis Bio-Systems, LLC	2500 South Broadway, Suite 250, Edmond, OK 73013, Ph: 888-993-1500 or 405-341-4667, E-mail: jrayburn@aegisco.com	System developed in 1997 and entered the market in 2000	All red bag waste including: sharps, pathological, trace cytotoxic	Low-heat thermal by a two-stage shredding and simultaneous steam and mixing treatment	A mobile treatment system that consists of the following major operational components: (1) pre-shredding with 7:1 volume reduction, (2) fully automated loading, (3) internal mechanical agitation during steam sterilization (121°C /15 psig) in a 9-cy autoclave to ensure complete waste treatment, and (4) fully automated discharge	Up o 80% volume reduction	JYD - 1500 (8' x 45'), JYD – 550 (8' x 20', an optional smaller version under construction)	JYD - 1500 (up to 2000 lbs per hour, 15 cubic yards of waste processed in 50 minutes), JYD – 550 (up to 7000 lbs per hour , 9 cubic yards of waste processed in 60 minutes)	No	Yes	Yes	Generally none, treated waste is disposed of at municipal landfills. Since material is fully shred and sterilized, plastics and metals can be removed from the waste stream for recycling. The sorting system is not currently available from Aegis	Municipal landfills	Aegis or third party transports waste to the treatment site. Treated waste is transported to the local landfills for disposal by commercial waste haulers	Research and construction phase between 1992 and 1997, Development and refinement phase between 1997 and 2000, Commercial operation started in 2000 till present. This mobile treatment system has been approved in Oklahoma, Texas, Louisiana, Arkansas, Kansas, and Missouri. The technology is additionally permitted to operate "off-site" in Louisiana	Started operating in the south central section of the U.S. and have expanded operations to Texas, Oklahoma, Arkansas, and Louisiana	China Contact: Amy Zhang - Beijing Cathay, 707A, Tower A, Fenghe Building Technology Co., Limited, 101 Jixiangli, Chaoyang District, Beijing 100020, China, Telephone: (86-10) 6553-8845, 6553-2228/9, Fax No: (86-10) 6553-8846, E-mail: mail@bibei.com.cn	The company has engaged a corporate representative in China to actively promote this system throughout the Pacific Rim. Sales are also pending in Canada and Costa Rica.	The company provides technical support from its headquarters. It is actively engaged in locating a company in China to provide post-sale tech support. This company may also be involved in local manufacturing operation
SANITEC HG-A-100, HG-A-250	Sanitec International Holdings	26 Fairfield Place West Caldwell, NJ 07006, Ph: (800) 551-9897, Mr. Joseph Deliciacovo (President), E-mail: www.sanitech-inc.com	Sanitech has been in operation since 1990. It was previously a division of ABB, but is now part of Sanitech International Holding	Medical wastes (cultures and stocks, sharps, materials contaminated with blood and body fluids, isolation and surgery waste, lab waste excluding chemical waste, and soft waste)	Low-heat thermal by shredding and microwave disinfection	Medical waste is loaded into the cart and dumped into the feed hopper under a negative pressure with high temperature steam injection. The waste is then broken down by a rotating feed arm and ground into small pieces by a shredder. The shredded waste is conveyed through a rotating conveyor screw where it is exposed to steam and heated to 95 and 100°C by 4 to 6 microwave generators for 30 minutes. The treated waste can go through an optional second shredder (typically for sharps waste) or be discharged into a roll-off bin via a second conveyor screw/auger for off-site disposal	Up to 80% volume reduction	HG-A-100 (10' W x 22' L x 17'9" H, flap open, weight 25,000 lbs) and HG-A-250 (10' W x 24' L x 17' H, flap open, weight 27,000 lbs)	HG-A-100 (220 to 400 lbs per hour) and HG-A-250 (550 to 900 lbs per hour)	No	Yes	Yes	Generally none, treated waste is disposed of at municipal landfills. Since material is fully shred and sterilized, plastics and metals can be removed from the waste stream for recycling.	Municipal landfills	Municipal waste haulers	Yes, the process has been test-proved effective for microbial inactivation and accepted/approved in 40 states in the US	Over 70 units have been installed and operated in over 20 states in the US and in sx other countries	Headquarters office	Throughout US and Internationally in South America, Europe, Asia, and Australia	NA
Electro-thermal-Deactivation (ETD)	Stericycle, Inc.	27161 N. Keith Dr. Lake Forest, IL 60045, (800) 953-9024, Shawn Sacranie, Vice President International, (847) 607-2036, www.stericycle.com, ssacranie@stericycle.com	Established in 1986, Stericycle, Inc is the largest management and treatment provider for regulated medical waste in the US	Infectious medical waste	Low-heat thermal by grinding and dielectric heating through patented ETD process	Medical waste is placed in "Sterilubs" containers and loaded on a conveyor with radiation and hydocarbon sensors. The waste contents are transferred to a size reduction equipment via a dual shaftless screw conveyor. The ground waste is then carried by high-velocity air to a cyclon where the waste is re-deposited on a sealed conveyor and the carrying air is treated by a dust collector, HEPA filter, and air wash prior to discharing into the atmosphere. The ground waste is sprayed with water, compacted, and subject to high voltage electrical field (low frequency radio waves at 50 kV/meter and 10MHz) resulting in dielectric heating to approx. 90 to 95°C for one hour. The treated waste is then loaded by conveyor system into roll-off bins for offsite disposal	Up to 70% volume reduction	NA	1,000 to 6,000 lbs per hour	No	Unlikely	Yes	Not currently, but the treated waste has demonstrated that it can be used as refuse-derived fuel. A product is currently being designed for such use in Japan	Municipal landfills	Municipal waste haulers	Yes, the process has been approved and operated at Stericycle's Sturtevant Wisconsion treatment facility for over 2 years	Since Stericycle's acquisition typically involves a treatment process other than its patented ETD, the plan is to continue using the same technology until it is ready to be replaced or under major overhaul. Stericycle only promotes ETD for its newly-built facilities domestically or Internationally. ETD is a rather new non-Incineration technology with demonstrated success for treating medical waste	Headquarters office	US and other Stericycle's or JV's international plants	Yes, via headquarters

Technology Name	Vendor	Name / Email Address	Vendor History and Annual Sales	Waste Treated	Process	Process Principle(s)	Waste Reduction (%)	Weight and Dimensions	Throughput	Bench-top Unit	Onsite Treatment Unit	Offsite Treatment Unit	Reusable/Beneficial End Product?	Disposal Location(s)	Collection/ Transportation Companies	Technology Maturity	Market History	Sales Locations	Sold to	Technical Support Availability
MedClean Series Sterilization Solutions (MedClean (MC4, MC5, MC7 series)	Aduromed	8 School Street, Suite 11-13, Bethel, Connecticut 06801 (Chris Dandatani, E-mail: cdandapani@aduromed.com, Ph: 800.360.3444)	Aduromed started as a company named Automated Process in 1992, specializing in technological enhancement of medical waste processes. It's first MedClean system was introduced in 1993. As the medical waste industry evolves and the phase-out of incineration, Automated Process changed its name to Aduromed in 2003	Regulated medical, laboratory, pathological waste and sharps	Low-heat thermal by sterilization treatment, followed by shredding	Medical waste is placed in a collection cart, weighted, and loaded into the sterilization chamber where steam is applied. After the treatment, the waste is removed from the sterilizer, cooled down, and transferred to an uncoupled dual-stage shredder to reduce the waste volume and render it unrecognizable prior to off-site disposal	Up to 80% volume reduction	NA, to provide some basis, a unit treating and destroying 2.1 million lbs medical waste is currently installed in a room with a footprint of 40'x20' (eg., MC4 - 36' x 36'; MC5 - 60' x 60' footprint)	Aduromed MedClean 4 Series can handle 300 to 1200 lbs per hour, a MedClean 5 Series can handle 450 to 1800 lbs per hour, and the largest MedClean 7 Series can process 1 to 5 tons per hour. The through-put for MC4 is between 300 and 600 lbs per cycle. MC5 are from 450, 600, 750, to 900 lbs per cycle, and MC7 from 2000 to 5000 lbs per cycle	No	Yes	Yes	Yes, the sterilized confetti-like substance is used in many ways from recycling to waste for energy, the Aduromed byproduct is completely safe	Rendered unrecognizable, treated waste accepted by all municipal landfills	None, the Aduromed solution is used on site	Autoclaves have been widely accepted as the preferred method of sterilization for over 50 years	1994-First installation	Headquarters	Numerous installations located all over the US and in Puerto Rico and Canada	We have regionalized our support offering locations where all clients can be reached within a 24 hour period.
Autoclaving (generally provided as part of a complete medical waste treatment package that consists of Pyrolytic Destructors™ and matched heat recovery and auxiliary fired boiler system)	Global Environmental Technologies	Kevin M. I. Kondo, Esq (President and Chief Executive Officer), Finance Factors Center, 1164 Bishop Street, Suite 510, Honolulu, Hawaii 96813, Ph: (808) 550-2877, Fax: (808) 550-2933, Email: Kevin Kondo, Web: http://www.globalenvironmentaltech.com	Global Environmental designs and manufactures medical waste treatment system and operates Hawaii Bio-Waste System, a medical waste treatment facility	"Red bag" waste (e.g., contaminated bandages, dressings, cotton, gauze, paper, gowns, bedding, latex gloves, masks, suction canisters and sponges) and "sharps" (e.g. contaminated needles, syringes, syringes containing fluids, scalpels, and glass test tubes, pipettes and petri dishes)	Low-heat thermal by steam sterilization	(Steam sterilization) heats soiled gauze, bandages, gowns, and used needles, scalpels and glassware, in a vacuum or without vacuum to approximately 135°C (275°F) until the waste is rendered non-infectious (about 40-60 minutes per cycle, including loading and unloading time). The treated waste can then be shredded and compacted for safe and efficient handling to a landfill site. Works in conjunction with the Pyrolytic Destructor™ and matched heat recovery and auxiliary fired boiler systems	NA, shredders and compactors are not standard autoclave package, but can be added to reduce the volume of processed medical waste by 70 to 80% prior to disposal	six (6) feet in diameter by twenty (20) feet in length (approx. 2m x 6.2m)	one metric ton of red-bag and sharps waste per hour each day	NA	Yes	Yes	No, the treated waste is typically disposed of at landfills	Municipal landfills	Municipal waste haulers	Yes, autoclave is a proven technology	NA	Honolulu Hawaii headquarters	NA	Yes, from Global Environmental's Honolulu, Woonsocket, Rhode Island, and Pottstown offices
Pyrolytic Destructor™ 550, 1200, and 2500				Pathological waste from surgery and autopsy, chemotherapy waste, lab waste, and pharmaceutical waste	Medium-heat thermal by pyrolysis	The waste is loaded into the pyrolysis chamber in four carts and the door is closed, sealed, and locked. A burner then heats the oxidation chamber to 952°C in order for the pyrolysis cycle to begin. Heat from the oxidation chamber is conducted into the pyrolysis chambers at a controlled rate until the entire chambers reach the pre-set temperature of 760°C. the heat in the pyrolysis chamber volatilizes or gasifies organic compounds in the absence of air at approx. 232°C and continues until 760°C. Since there is no combustion takes place, VOCs are transferred in the gaseous state from the pyrolysis chamber into the oxidation chamber for complete oxidation. After contributing significant energy content to the continuous heating of the pyrolysis chamber, hot gases from the oxidation chambers are discharged into the atomosphere or captured by the heat recovery system for use in heating the heat recovery boiler. The treated wastes totally inert, non-toxic caron black residue that is vertually undisturbed	Over 97% volume reduction	Varies, the largest model 2500 has dimensions of 58' L x 58' W x 23' H	Model 550 (550 kg per day), 1200 (1,000 kg per day), and 2500 (2,000 kg per day) @ two cycles per day with 8 to 10 hrs for each cycle	No	Yes	Yes	Global Environmental has developed heat recovery system to maximize the cogeneration capabilities of a treatment facility by recovering heat generated from the Pyrolytic Destructors as means to produce steam to drive other alternative treatment system such as an autoclave. The treated waste (carbon black residue) is disposed of as MSW	Municipal landfills	Municipal waste haulers	Yes, Global Environmental has operated medical waste treatment facility using the Pyrolytic Destructors™. It is in the process of developing a centralized medical waste treatment facility in Bangkok, Thailand to serve over 550 local hospitals and medical facilities using the Pyrolytic Destructors™				
Bio-Oxidizer® system	Oxidation Technologies Inc.	P.O. Box 548, Annapolis, MD 21404, Ph: (410) 990-9430, Fax: (410) 990-9431, Email: steversp@oxid-tech.com	Oxidation Technologies has assisted the health care facilities in developing, installing, and operating the Bio-Oxidizer and large-scale steam treatment units for over 10 years	All red bag medical waste, including cultures and stocks, sharps, isolation/surgical waste, lab waste, pathological waste, chemotherapeutic waste, soiled drapes/gowns/gloves, plastics, and dialysis waste	Medium-heat thermal by pyrolysis	The principle of operation is the electro-pyrolysis of organics followed by two phases of electro-oxidation. The waste is containerized in bar-coded boxes, scanned, weighted, and controlled by computer to enter the pyrolysis chamber where electric resistance heaters heat the boxes up to 590°C and causes organics and liquids to vaporize, leaving behind an inert ash (glass, metal fragments). Vapors from the pyrolysis chamber are directed into a two-stage oxidation chamber and mixed with controlled amount of oxygen at 980 and 1090°C to complete the oxidation of organics in air stream. Hot exhaust gases from the oxidation chamber are cooled in a heat exchanger to produce hot water or steam for reuse by the health care facilities, then it passes through a we scrubber and electrostatic precipitator to remova particulate and hydrogen chloride before discharging into the atmosphere via an exhaust stack. The inert ash is collected on a tray beneath the pyrolysis chamber for offsite disposal	Over 95% of volume reduction	Varies, the smallest unit Model #100 has dimensions of 42' L x 12' W x 12' H	Model #100 (100 to 125 lbs per hour) and Model #1000 (1,000 to 1,500 lbs per hour, currently under development)	No	Yes	Model #1000 is currently being designed, Oxidation Technologies also has evaluated the potentials for using the pyrolysis system to treat special medical waste (pathological, chemotherapeutic waste) and steam recovered from the pyrolysis to sterilize less sensitive medical waste	The ash-like end product has little reuse potentials and may not be cost effective for recycling. The heat generated from the pyrolysis is recovered by a heat exchanger to generate hot water or steam for use by the hospitals or health-care facilities	Ash to municipal landfills since it has consistently passed the USEPA TCLP tests and lassified as non-hazardous	Municipal waste haulers	Yes, Bio-Oxidizer is fully commercialized and approved in 7 states (US) and in Bermuda	Model #100 has been installed at various locations during the last 10 years	Oxidation Technologies headquarters in Annapolis, MD	US and Bermuda	Yes, technical support services are available from Oxidation Technologies for equipment design, installation, and operation. Oxidation Technologies also offers full service contract in which the clients pay a cost-per-pound turnkey operation fee including operation, service, and maintenance

Technology Name	Vendor	Name / Email Address	Vendor History and Annual Sales	Waste Treated	Process	Process Principle(s)	Waste Reduction (%)	Weight and Dimensions	Throughput	Bench-top Unit	Onsite Treatment Unit	Offsite Treatment Unit	Reusable/Beneficial End Product?	Disposal Location(s)	Collection/ Transportation Companies	Technology Maturity	Market History	Sales Locations	Sold to	Technical Support / Availability
MD-1000 (Emery's Reverse Polymerization Process)	Environmental Waste International (EWI)	283 Station Street, Ajax Ontario, L1S 1S3 Phone: 905 686 8689 / Fax: 905 428 8730	EWI was founded in 1992 and developed a tire pilot facility in 1994. Later the MD-1000 Medical Unit was developed and installed in Liverpool, United Kingdom (UK) in 2000	medical and infectious wastes including packaging, plastics, anatomical waste, glass, and metal sharpes	Medium Heat Thermal - Reverse Polymerization via microwave energy under nitrogen-rich environment	Reverse polymerization refers to the breakdown of organic compounds to simple carbon molecules resulting from the direct application of high-energy microwaves in a nitrogen environment. The nitrogen environment prevents oxidation and undesired and potentially hazardous by-products from forming. The process involves 3 chambers, continous batch (weighing), microwave reduction, and cooling (grinding within a 60 to 80-minute cycle. Waste is loaded into the weighing and purging chamber in plastic garbage bags/cardboard trays where the waste mass is recorded and the air is replaced with nitrogen. The waste is moved by conveyor into the reverse polymerization reduction chamber where the microwave energy is applied through 14 magnetrons with variable output of up to 3 kW each. After cooling, the treated waste is further grinded prior to placing in plastic bags for landfill disposal.	80% reduction by volume	Main unit has a dimension of 9.3' x 32.4' (2.83 m x 9.9 m), auxiliary equipment needs approx. 200-300 ft^3 (19-28 m^3) space, not required as a single area. The min. height requirement is 12 ft (3.7 m)	2700 lbs/day (1,230 kg /day), 485 tons /yr (440 tons/yr)	No	Yes	Yes	No, carbon black as the final product	Municipal landfills	General trucking companies or municipal waste haulers	Yes, the first commercial MD-1000 instllation in 2000	MD-1000 has been in market for four years. EWI also developed microturbines to process off-gases from the MD-1000 unit to co-generate electricity	Ajax, Ontario, Canada	Recycled Waste Ltd, England	Yes, EWI can provide onsite or remote trouble-shooting
Plasma Thermal Destruction and Recovery (PTDR) Unit	PEAT, Inc. (formerly Plasma Arc)	4914 Moorse Mill Road, Huntsville, AL 35811; Ph: 256-883-8997; Roy DuPree, Director of Marketing; Dan Ripes / *dripes@peat.com*	PEAT was founded in 2001. Currently, it has 50 to 100 kg/hr through-put PTDR units located in Huntsville, Alabama; Lorton, *Virginia; and Kaohsiung*, Taiwan. Two additional Taiwan facilities (currently under construction) are projected to be operational in the summer of 2003.	Organic and inorganic medical waste; additionally, PTDR can also treat waste solvents, PCBs, pesticides, military wastes, municipal solid waste, and electrical waste	High-heat thermal by plasma arc	The plasma generators (with DC torches, AC torches, and graphite electrodes) disassociate the complex molecules of the medical waste into their elemental atomic constituents (molecular dissociation). The process permanently destroysthe toxic constituency of the compounds in the waste stream, ensures that the complex pollutants such as dioxins do not reform, and makes it possible to produces non-hazardous, re-usable products such as an ultra-clean synthetic gas (syngas) and glassy, non-leacheable slag (silicate)	Over 85 to 90% depending on the waste type and operation	NA	Currently most applications are less than 10 tons per day; however, a unit with as little as 1.5 tons per day (TPD) to more than 200 TPD capacity can be designed and built	No	Yes	Yes	Yes. The process produces non-hazardous, re-usable products such as an ultra-clean syngas and glassy, non-leacheable slag (silicate). The final clean, scrubbed "syngas" (principally hydrogen and carbon monoxide) can be used directly in a boiler to produce steam, in a gas or steam turbine to produce electricity, or can be *extracted and used directly* as precursors in many important manufacturing processes (i.e. plastics and methanol production). The metals and metal alloys can be tapped and recovered for re-sale, while the non-leachable (not permeable or penetrable by liquid) slag can be used in a wide range of commercial processes, including road construction, sandblast cleaning, and concrete aggregate. It can also be formed into decorative tiles, or used in conjunction with building materials to create lightweight pre-engineered home construction materials	Syngas to boiler, gas turbine, or steam turbine to regenerate enérgy; metals and slag to recycling facilities	Recycling or municipal waste haulers	The technology has been tested since 1992 and placed in operation since 1999. PTDR is permitted in Alabama, California, Indiana, Virgina (US), and in Taiwan	PEAT has been designed, constructed, and operated PTDR since 1999.	Headquarters in Huntsville, Alabama	PEAT does not manufacture or sell PTDR systems; instead, it prefers the model of BOO (build-own- and -operate), BOT (build-operate-and-transfer), or JV. Currently, PEAT operates treatment facilities in Alabama, Virginia (US), and Taiwan	US and Taiwan
Plasma Enhanced Melter™ (PEM)	Integrated Environmental Technologies, LLC	1935 Butler Loop, Richland, WA 99352; Bill Quapp, Director of Project Development, Email: wjquapp@inentec.com, (509) 946-5700, (208) 535-9001	IET was formed in July 1995 by Dr. Daniel Cohn (MIT), Jeffrey Suma (Battelle Pacific Northwest National Lab, PNNL), and Charles Titus. The company commercialized a plasma and glass melter technology developed by MIT and PNNL under extensive research activities (over US$312 millions) sponsored by the USDoE. IET has exclusive rights to the PEM technology and holds several patent protection for the processes. Since its inception, IET has sold several commercial PEM units in the US (Washington and Hawaii), Japan, and Malaysia	All types of medical waste, including trace chemotherapy waste; the process is also capable of handling hazardous/radioactive/industrial waste, incinerator ash, municipal solid waste, and waste tires	High-heat thermal - plasma enhanced glass melter, waste recycling and energy recovery	The technology combined plasma arc (with multiple graphite electrodes), joule/resistance heating (with glass melter technology), and superheated steam to generate a stable and highly controllable treatment process. The plasma operates at temperatures from 3,000 to 10,000°C in an oxygen-depleting environment with the presence of superheated steam ensuring that pyrolysis and steam reforming reactions dominate. A high-efficiency scrubber is used to remove volatile metals and other organic pollutants from the hydrogen-rich syngas (synthetic gas, 100 BTU/scf or higher), a portion of which may be recycled to provide power for the PEM operation and the other portion used to generate electricity. Metals in the waste are recovered from the bottom of the treatment unit and the glassy waste stream recovered from the side of the treatment unit can be recycled as road base material, sandblast grit, and building construction material, or simply disposed of if no glass market exits	Over 85 to 90% depending on the waste type and operation	A 4-ton unit measures 15' L x 20' W x 14' H, minimally one to two acres of storage space required	3 sizes (4,10, and 17 ton per day) are available for commercial operation; other sizes/capacities can be designed and built	No	Yes	Yes	Multiple valuable products are generated from the treatment process, including metals, glass aggregates (sandblast grit, road base material, roof shingles), and hydrogen-rich syngas (electrical power, synthetic *natural gas or methanol*, chemical feedstock for petrochemical industry)	If there is no glass market, the end product can be disposed of at municipal landfills (geologically stable and without any concerns for leaching)	Recycling or municipal waste haulers	*Mature technology.* Since its initial conceptual development in 1995, the PEM has gone through multiple lab-scale and pilot-scale tests prior to commercialization. Over US$300 million dollars of federal grant have been spent on the R&D for the PEM. The first PEM unit (1/2 tons per day) has been operated for over 15,000 hours since 1997. A 10-ton per day unit has also been in operation since 1999.	*Since 1996*, two domestic and three international PEM designs and installations have been completed, all in operation	Idaho, western region sales office, (208) 535-9001	Japan (2, Fuji Kaihatsu and Kawasaki Heavy Industries/FIT), Malaysia (BioPure), Washington (Allied Technology Group), Hawaii (Asia Pacific Environmental Technologies)	Washington, US / Japan

Technology Name	Vendor	Name / Email Address	Vendor History and Annual Sales	Waste Treated	Process	Process Principle(s)	Waste Reduction (%)	Weight and Dimensions	Throughput	Bench-top Unit	Onsite Treatment Unit	Offsite Treatment Unit	Reusable/Beneficial End Product?	Disposal Location(s)	Collection/ Transportation Companies	Technology Maturity	Market History	Sales Locations	Sold to	Technical Support Availability
Plasma Arc Reduction (PAR)	Bio Arc	11440 66th Street N. Largo, FL 33773; Ph: (727) 546-0640; Fax: (727) 549-8097; Email: www.bioarc.com	Bio Arc, Inc. was formed in July 1999, as a subsidiary of Arc Technologies Group (established in 1990 and formerly known as the Vance IDS, Inc.). Arc Technologies Group has developed eight demonstration units for the purpose of validating Bio Arc's technology.	Culture stock, sharps, isolation waste, Lab waste, contaminated bandages, bulk blood and body fluids, pathological waste, animal waste, chemotheraphy, spent solvents and chemical waste, pharmaceutical waste.	High-heat thermal by plasma arc	PAR is a patented process by Bio Arc, which utilizes electrical energy discharged thrugh the arc torch into a waste stream. Within the process chamber, the waste is trapped in a plasma cloud (formed by the ionization of an inert gas) that breaks the molecular bonds of the waste under an oxygen-deficient environment. The energy released from the disruption of the molecular bonds is converted into heat and light, adds to the energy injected into the system and raises the temperature to over 6,000°F to completely oxidize the waste into carbon black, elemental metals, and silica residue. Gases from the process are passed through an off-gas treatment system, while the heat is recovered for the generation of steam	Over 95 to 98% of volume and mass reductions	PAR 6 model is currently marketed by Bio Arc, with a dimension of 16' W x 20' L x 20' H	PAR 6 model can process up to 400 lbs of waste per hour	No	Yes, PAR 6 model is specifically designed for onsite waste treatment by hospitals or medical centers	Currently not available	Bio Arc claims that the carbon black can be reclaimed and used as feedstock to the tire industry, as an inert filler, and other common industrial products. The PAR also has heat recovery system to capture the process heat and convert it to steam or hot water for other beneficial uses	The treated waste residue, carbon black, has been tested to pass the USEPA TCLP test and can be disposed of at municipal landfills as non-hazardous waste (if cannot be recycled)	Recyclers or municipal waste haulers	Yes, PAR has been fully commercialized and approved by the States of Alabama, Florida, Louisiana, Massachusetts, Mississippi, and Ohio	commercialization of PAR started in 1999	Bio Arc's headquarters office in Florida	Several units have been installed and operated in hospitals; most notably, Tulane University Medical Center in New Orleans and Jackson Memorial Hospital in Miami.	Yes, from Bio Arc's Florida headquarters
DC Graphite ARC Melter	Electro-Pyrolysis, Inc.	998 Old Eagle School Road, Suite 1118, Wayne, PA 19087; Ph: (610) 687-9070, Fax (610) 964-8570; Bridgett B. Wilson, Director of Marketing and Project Manager, bwilson@electropyrolysis.com	Electro-Pyrolysis, Inc. (EPI) was established in 1983 primarily to develop the use of DC arc furnace technology for the treatment of hazardous wastes. It has partnered with Svedala to market the DC Graphite ARC Melter technology internationally	All types of waste including medical and chemotherapy waste, municipal solid waste, industrial waste, chemical waste, radioactive waste, and hazardous waste	High-heat thermal by graphite arc	The proprietary DC Graphite ARC Melter consists of a refractory-lined melter with graphite hearth, sealed continuous feeding system, sealed discharged system, and emission control devices. During the waste treatment, direct current (DC) is applied between a graphite electrode graphite hearth, creating a plasma arc at 5,000°C to maintain a bath of liquid metal and slag at temperatures above 1,700°C. Waste is charged into the melter where the high temperature destroys the organic materials. The remaining inorganic materials are converted into refined metals, which can be recovered for commercial use or melted into a stable glass/ceramic material that can be buried or recycled into materials such as road aggregate, or sandblast grit.	Varies, ranging from 30 to 70% of volume reduction	Footprint 4' - W/12' - L to 100' - W/100' - L	Varies, from 50 to 3,000 lbs per hr	Possible, not offered but can be made on special request	Yes, on-site or point of origin	Yes, large commercial system can be designed and manufactured based on client's need	Yes, vitrified product (road base, sanblast grit), metal, and low to medium energy gas (supplemental boiler fuel)	Municipal landfills if slag is not to be reused or recycled	Municipal waste haulers	Yes, EPI's process is based on the modified steel-making technology that was patented by General Electric Company and acquired by EPI in 1973. The process has been evaluated extensively by DoE, PNNL, and MIT for treating hazardous and mixed waste	EPI has partnered with Svedala Pyro to market the DC Graphite Arc Melter world-wide	EPI's headquarters in Wayne, PA; Svedala Pyro Systems in Waukesha, WI	EPRI/ChemWaste Lectromelt/PEC (1.5 tons/hr), MIT/PNNL/DoE (Mark I - 50 lbs batch unit, Mark II 750lbs/hr), PNNL (Pu melter, 50 lbs/hr unit), DoE/Westinghouse SRS/Clemson Univ. (Mark I-W, 50 lbs/hr)	From EPI's headquarters in Wayne, PA. Additionally, EPI also leverages technical support from MIT's Plasma Fusion Center, Drexel University, and Clemson University's Vitrification Center through existing cooperative research programs with them
Plasma-Based Pyrolysis/Vitrification* (PBPV) System	Hawkins Industries, Inc. & HI Disposal Systems, LLC	Don Hawkins (Chairman/CEO), Thomas Damberger (President/COO), Ray Duprea, Jr. (Vice President of Marketing); 113 West Washington Street, Indianapolis, IN 46204; Ph: (800) 995-1285, (800) 973-1265, Fax: (317) 262-1265; E-mail: www.hawkinsindustries.com	HI Disposal System was formed in 1996 to build a multi-purpose solid waste processing and disposal facility in Indianapolis	Can handle all types of medical waste including cytotoxic agents, sharps, and anatomical waste, except radioactive waste. It can also be used to treat incinerator ash, toxic material, explosives, and other hazardous waste.	High-heat thermal by plasma arc torch	HI's PBPV commercial system consists of a triple feeder, plasma processing vessel, plasma heater, waste processing chamber, gas discharge treatment (quenching and scrubbing), liquid discharge treatment, solid discharge/handling treatment, gas analyzer, regenerative thermal oxidizer/energy recovery system, and supervisory control and data acquisition (SCADA) sub-systems. PBPV uses a 2-MW plasma arc torch to heat a waste processing chamber to about 3,000°F in the absence of air (pyrolysis). The waste material is dissociated and reformulated into a non-leachable, stable glassy slag and a low-BTU gas (mostly hydrogen, carbon monoxide, nitrogen, carbon dioxide, methane, and water vapor) with a heating value of approx. 300 BTU/scf	Volume of the waste can be reduced by 95 to 98% and the weight by 80 to 90%	Dimensions: 50' - L x 30' - W x 30' - H (Weight: 60 tons)	1,000 (system-A) to 3,000 (system-B) pounds per hour	No	No	This is a regional waste treatment and resource recovery facility to treat medical and other waste in Indianapis area	Gases which have a heating value of about 300 BTUs/scf and can be used to generate steam, electricity, or methanol. Solid residue (non-leachable, vitrified or glassy slag) can be used as concrete aggregate and roadbed material, or for manufacturing decorative tiles, composite roofing, or even decorative water fountains	Municipal landfills if the slag is not to be recycled	Municipal waste haulers	Yes, the PBPV system was developed by PEAT. HI has already acquired all necessary permits to construct and operate the regional treatment facility	This is the first plasma based waste treatment facility operated by HI. Commercialization of the PBPV system may be feasible through HI/PEAT licensing	NA	NA	NA, PEAT is likely to provide all technical support for the HI facility
Plasma Converter™	Startech Environmental Corp.	15 Old Danbury Road, Wilton, CT06897-2525; Ph: (203) 762-2499, Toll Free: (888) 807-9443, Fax: (203) 761-0839; Email: starmail@startech.net; Joseph Longo, Chairman, jlongo@startech.net	Startech has been promoting the plasma technology since 1985. In 2000, Startech developed Starcell™, a hydrogen separation technology working in conjunction with the Plasma Coverter to provide green and renewable surce of hydrogen	All types of waste including regulated medical waste, outdated pharmaceuticals, PCBs, chemical agents, hazardous waste including incinerator ash, municipal sluges, paints and solvents, and contaminated soils	High-heat thermal by plasma arc torch	The proprietary Plasma Converter consists of an in-feed system, plasma vessel, gas polisher, computer control station, and power supply. All wastes fed into the vessel via the feed system are irreversibly destroyed in the plasma vessel (a cylindrical two-part stainless steel container lined with insulation and refractory material) heated by a plasma torch to tempertures between 3,315°C and 8,870°C. Metals, glass, and silica are heated into a molton mass while organic compounds are gasified to form a clean "Plasma Converted Gas™ (PCG, or syngas) that can be used as fuel, chemical feedstock, or for other purposes. The gas is cleaned by a high temperature cyclone separator to remove particulate, a spray dryer to quench the gas to about 150°C, and then a packed bed adsorber prior to being collected	A 300-to-1 volume reduction	Varies, a 5 tons per day (TPD) Plasma Converter has a skid dimension of 7.5' - W x 15' - L x 15' - H, a 10 TPD converter has a skid dimension of 7.5' - W x 16'2" - L x 16'4" - H, a 20 TPD converter has a skid dimension of 7.5' - W x 17' - L x 18.5' - H, and a 50 TPD converter has a dimension of 8.5' -W x 18'4" - L x 18.5' - H, larger systems up to hundreds of tons per day are also available	5, 10, 20, 50 tons per day (TPD) Plasma Converters are available; large systems can also be designed and constructed	No	Yes	Truck-mounted mobile or stationay Plasma Converter systems are also available	Synthesis fuel gas called PCG ™ (that can be used to fuel for electric generation, plant heating and cooling, plastic/chemical manufacturing, and cell electricity) and obsidian-like stone, which is non-toxic and non-leachable (that can be tued as road bed and concrete aggregate, industrial sandblast grit, material for decorative water fountain/roofing tile)	Municipal landfills unless there is recycling market for the slag	General trucking companies or municipal waste haulers	Yes, technology has gone through R&D, prototype testing, and scale-up phases. It is fully commercialized	Startech has ben actively promoting its technology since 1996 in US, Japan, Taiwan, Poland, Philippine, Italy, and South Africa	Startech's headquarters in Bristol, CT	Island Energy System, Puerto Rico Municipalities, Envepac (Japan), Mihama (Japan), Polus Montana, Bytom, Chempol	Yes, by Startech. A demonstration and training center has been established in 2001 in Bristol, Connecticut to provide training for company representatives, distributors, and clients. It also provides testing and analysis, third party validation, and application engineering services

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Fixed and mobile plasma treatment systems	MSE Technology Applications, Inc.	200 Technology Way, P.O. Box 4078, Butte, MT Ph: 406-494-7277 Fax: 406-494-7230) emailed jruffner@mse-ta.com (Jeff Ruffner) for Plasma Waste Treatment	The company was incorporated in 1974 with over 200 employees, received State of Montana Governor's Excellence in Exporting 2002 export marketing Program Award and evaluated over 300 technologies and completed 21 technology demonstrations. In 1996, MSE purchased a 53-acre DOE test and administrative facility that was built in 1978 with $46M worth of equipment. Currently, it continues providing technology testing, evaluation, and demonstartion for federal agencies; creating strategic alliances/partnerships/JVs, commercializing and deploying technologies of interest; creating co-located technology based companies, and providing technical support to federal agencies. MSE has been involved in the development of plasma technology since 1989	All types of waste-	High-heat thermal by plasma arc torch	Uses plasma temperatures between 7,000 and 10,000°C to treat any types of hazardous, infectious, radioactive wastes. The treatment products are inert and stable glass slags, clean off-gas emission and clean secondary water	NA, similar to other plasma technology	NA	NA	No	Yes, the fixed treatment system uses 1 MW dual mode non-transferred arc and transferred arc torch, with state-of-the-art wet or dry offgas system and fully integrated control system. Mobile system with a 500 KW dual mode nontransferred/transferred arc torch and semi-dry offgas system is also available for deployment on the skid	Yes, the fixed treatment system uses 1 MW dual mode non-transferred arc and transferred arc torch, with state-of-the-art wet or dry offgas system and fully integrated control system	NA, presumably the offgas and glass slag generated will have similar re-use/recycling benefits	Municipal landfills unless there is recycling market for the slag	General trucking companies or municipal waste haulers	Yes, MSE has assessed the technology for over 15 years	NA	Butte Montana headquarters	NA	Yes, from MSE headquarters

Note:

NA - Not Available

Information presented in this spreadsheet and report is based on (1) telephone interviews from the vendors, (2) responses from survey questionnaires, and (3) website data; USTDA and Tetra Tech do not warrant the accuracy and truth of the claims, facts, and data provided by the vendors

Neither USTDA nor Tetra Tech offers any endorsement for technology vendors presented in this spreadsheet or report

Technology Name	Process Monitoring System	Noise / Odor	Initial Capital Cost	Cost of Routine Operation & Maintenance	Freq. of Routine Maintenance	Freq. of Sched. Parts Maintenance	Cost of Sched. Parts Maintenance	Installation Utility Req'ts	Ease of Trouble-shooting	Product Life	Product Warranty	Training Req't and Cost	Shipping /Installation Time	Build Time (if applicable)	Future Modification / Enhancement	Product References	Special Note(s)	Pros	Cons
SHARP-SHIELD disposal system	NA	NA	$34.95 to $44.95 plus shipping and handling	US$0.55 or $0.81 per oz. of medical sharps disposed depending on Sharp-Shield container size	NA	NA	NA	NA	NA	24 months	No	10 minutes of training	NA	NA	NA	Gavin, Rick T DDS 3600 De Souza Pl # B, Bakersfield, CA 93309 Phone: (661) 831-4533	Primarily intended for clinics and small medical facilities	Treated sharps can be disposed of directly to municipal landfills	Only treats sharps. High cost. Requires 24 hour temporary storage prior to disposal. Multiple steps increases worker exposure to injury
OREX ™ Sharps Management System (SMS®) Isolyser®/Sharps Management System (SMS®)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Instruction that comes with the product is self-explainatory	NA	NA	NA	NA	Primarily intended for clinics and small medical facilities	Treated sharps can be disposed of directly to municipal landfills	NA
Needlyzer™	Unit contains a time shut-off safety feature. Sensor to prohibit operation when cartridge has been removed. Self-covering cartridge cover to prevent accidental spillage when removed. Operation of the NeedlyzerTM is accomplished with the use of one hand. Utilizing electric-eye technology, the unit will automatically start as the operator's hand approaches the unit and will automatically shut off after the needle has been completely destroyed and the operator has removed the syringe from the unit. The syringe and hub, after proper destruction, may be disposed of in a biohazard container. Multiple safeties make certain that the unit will not function under specific operating conditions	All vapors produced are drawn down through a triple filtration system by a high-performance fan. The filtration system, containing a moisture, carbon and particulate filter, is rated at 99.999% efficient	NA	NA	NA	Filtration - 3 piece ml 1394 Pallflex filter containing moisture, particulate and carbon filters	NA	110VAC, 60HZ; two-stage, Class 2 charger; rechargeable battery (hospital grade)	NA	NA	One-year manufacturer's warranty	NA	NA	NA	NA	Online testimonial from Dr. Joel W. Swanson	During operation, the Needlyzer™ generates a temperature of 1,500°C, completing oxidizing the needle, reducing it to swarf. A 20-gauge 1.5" needle will be completely oxidized in less than one second; larger gauge or longer needles may take slightly longer. The swarf is collected in a replaceable cartridge that can hold approximately 3,000 to 5,000 oxidized needles (depending upon the size of the needles)	The unit provides single-handed operation at the point of destruction. Proper use of this device reduces the risk of needlestick injury, and serves as an acceptable substitute for conventional sharps containers. The device is intended for use in hospitals and other healthcare facilities	NA
Sharpx	NA	NA	US$995, accessory pack is US$14.95	NA	Easy, Low Maintenance – Built-in drawer opens easily and uses convenient liners for fast debris removal	NA	NA	7.2 VDC high capacity rechargeable NiCad battery	Yes	NA	NA	No training required, follow equipment manual instructions	NA	NA	NA	NA	Sharp x reduces the risk of injury in the "hot zone" – the distance from the patient procedure to the sharps container. Sharpx® and its compact charger cradle fit conveniently on any flat surface near a 110v wall outlet. This convenience, along with its inherent low cost of operation, make it a practical and effective solution for patient care sites in your facility. 60-minute fast charge. Peak voltage detection for optimum charge level. Automatic switching from fast to trickle charge	Sharpx is versatile, dependable, portable, and requires little maintenace work. Proper use of this device reduces the risk of needlestick injury, and serves as an acceptable substitute for conventional sharps containers. The device is intended for use in hospitals and other healthcare facilities	Using this device near flammable materials may cause an explosion or fire that could result in significant injuries. This device cannot be used wit syringes containing flammable materials or tha have been used to inject radioactive substances or cannot be used to destroy suture needles, biopsy needles, or any objects other than stainless steel
Demolizer system	The processing unit incorporates a state-of-the-art microprocessor to assure that operating parameters have been successfully completed in accordance to the sterilization parameters of 350°F for 90 minutes	very quiet and with no odors	$5,000	1KWH/ cycle	Weekly cleaning	Yearly replacement of filters	$45	Electrical - 115V AC/10A/50/60 Hz or 220V AC/6.3A/50/60 Hz, energy consumption - 1 KWH/cycle	Very easy	10+ years	1 year	Technical assistance via e-mail or telephone with vendors and equipment distributors. A 13-minute training video is included in purchase	Varies depending on shipping locations	Depending on quanitity, generally in one month	NA	Gloria Gertzman (Dental Director, Bridgeport Community Health Center), Gwendolyn Testa (Cental Director, Hill Health Center), Tim Kenefick (The Pediatric Center), Joan Siebold (R.N., Staff Education Coordinator, Greenwich), Margaret Shannon (R.N., Supervisor, GTE Stamford)	Bacterial efficacy test results indicated zero growth (up to 8 log 10 reduction) of B. subtilus, S. aureus, C. albicans, M. fortuitum, M. bovis, and G. sp. after treatment; while inativation of duck hepatitis B virus (DHBV) was at least 1.1E05. It provides an onsite treatment alternative to small quantity waste generator by saving cost and space required for waste storage and offsite treatment. The waste container is designed to replace red bags and sharp containers	Demolizer combines storage and treatment of small quantity medical waste into one countertop unit that (1) contains and treats used hypodermic needles to prevent needlestick injuries, (2) caps and reduces waste disposal cost, (3) reduces administrative overhead and storage space required for offsite treatment/disposal	Process throughput rate is to small for large medical waste treatment operations
PremiCide-CA with PremiGuard® Closed Delivery System	NA	NA	NA	0.5K - $87.45, 1.2K - $136.45, 1.5K - $177.30, 2K - $179.25, 3K - $206.45, 10K - NA	NA	NA	NA	NA	NA	1.5 years	NA	Several hours.	Varies depending on the location (national/international)	depending on quanitity	NA	Metrex sells only to distributors	Completely closed delivery system which prevents spills and limits exposure. 10 minutes to solidify.	NA	NA
Condor Medical Waste Treatment System	The complete process is monitored for time, temperature, and chemical concentration by state-of-the-art computer-controlled electronics. Should any operating parameters deviate from normal, treatment is automatically halted and the control panel alerts an operator	Yes/Mild	Five-year fixed pricing with no upfront capital costs (lease service option).	NA	NA	Typical ware-and tear of the shredder blades	NA	NA	Easy	NA	NA	NA	From signing of the contract-90 days (includes shipping/installation/ build time)	see shipping/installation	Always looking into	Centennial Medical Center and Walter Reed Medical Center	Reduces waste to 20% of initial volume.	No need for water inlet or to discharge solution to sanitary sewer system. Chemical solution is recycled.	Waste is only reduced to 20% of original volume.
SterMed®	Sytem is designed and built with an integrated monitoring system. In the event, that one of the parameters is not met, the relevant error message will appear on the display panel and the system will shut down. Information concerning treatment parameters are printed after each treatment cycle and may be electronically transferred to any PC within the facility and/or, at the option of the facility, to MCM's maintenance center	Yes/Mild	US$55,000 - 66,000	$0.26 - 0.33 per kg waste treated ($0.12-0.15 per lb), O&M cost approx. $3,000 to $4,000 per year	Throughout year	Blade replacement once every eight (8) mos. to one (1) year and pump replacement once every three (3) years. The filter sack needs to be changed every 3-5 treatment cycles.	Included in cost of routine maintenance.	Three (3) phase electrical outlet with a 20-amp breaker. A standard 115V outlet is also required for the printer	Very easy	NA	Parts and labor for one (1) year. Cost of labor warranty is refunded in a technician is sent for training.	Staff can be trained in less that one day by MGM personnel or internally trained technician. Free training for internal technician. However, travel to factory in either Israel or US and lodging must be paid for by hospital/facility	NA	NA	NA	NA	Best suitable for clinics and small medical facilities	Waste is reduced to 10% of original volume.	Requires water inlet and waste discharge to sanitary sewer
SterMed Junior®			US$24,000 - 30,000					Single phase electrical outlet. A standard 115V outlet is also required for the printer									Reduces waste to 10% of initial volume. An ½" (one half inch) inlet pipe for water and at least 4" (2 inches) sewerage drain are required.		

Technology Name	Process Monitoring System	Noise / Odor	Initial Capital Cost	Cost of Routine Operation & Maintenance	Freq. of Routine Maintenance	Freq. of Sched. Parts Maintenance	Cost of Sched. Parts Maintenance	Installation Utility Req'ts	Ease of Trouble-shooting	Product Life	Product Warranty	Training Req't and Cost	Shipping /Installation Time	Build Time (if applicable)	Future Modification / Enhancement	Product References	Special Note(s)	Pros	Cons
LF812- (main system) J-Model Unit (hospital unit) and K-Model (mobile unit)	Electronic Control System insures proper chemical to waste ratio, and maintains total system integrity. Any interruption of service by any of the subsystems will halt the process and alert the operator of the specific problem.	Yes (80 dB)/mild	Domestic US$200,000 to over 500,000	US$0.006 per lb of waste processed. Includes maintenance and parts	Lube and oil based on running hours	Facility site-plan, manage installation, couple of days training operators and maintenance. Included in a quote.	Some parts replacement, cutter blades, and sometimes bearings	460V 3-phase, 60 Hz. Can be modified for foreign installation	Fairly easy.	Approx. 10 years	1 year parts and labor and possibly be extended	held and mixed in large tank in bleach mixture, high % of paper plastic. Machine mixes right concentration based on weight. Discharge is damp shredded waste that has absorbed fluid. Not flushing liquid down drain. 500 lb load may take 1/2 gallon bleach. 3,000 lb use a gallon.	Shipping -Depends on the location (installation could take about few days)	2 months	Always looking into	NA	Approved in 47 states, and in 10 European Union countries. The pressurization stage of the system can also be upgraded to utilize steam as the medium, and incorporate autoclave treatment into the system. Can change drum into autoclave (must know upfront).	Waste is reduced to 10% of original volume. Accepts dry and wet wastes. Can be upgraded with autoclave. Material can also be processed as it becomes available with the "on-line mode" feature, which eliminates the need for pre-treatment storage.	NA
WR² Tissue Digestor	The unit has fully automated UMC (Universal Multiloop Controller) control system and automated lid closure system	Very low noise and minor odor	$80, 000 to $1 million depending on the unit/size and also on the mass and volume reduction needed	US$3/cycle or $0.30/pound	Little maintenance is required	NA	NA	Electrical: 460V/3 Phase, Power consuption: 8.35 KWH /cycle, 30 to 125 psi (100 psi) steam, water, and drains	Easy, technical support hotline is available, can also be conducted remotely with a dedicated phone line.	20-30 yrs	12 months extended warrenty is available	training program with installation are included in price. Remote monitoring is included as part of the system - need a phone connection to plug into diagnose. Training time is one week (includes operaoons/diagnose) for U.S. domestic clients and two to three weeks (one week on-site/one to two weeks in indianapolis for factory training) for international clients	shipping (few weeks depending on location) and installation takes two week	6 months	They are currently working on modification for the existing equipment for reduce/reuse of the byproducts	State University of New York (SUNY) Incubator Park	Process can dispose of animal carcasses, including radioactively labeled ones, at $0.07 to $0.13 per kg. Provides facility design consultation, engineering services, and custom-designed and manufactured waste handling apparatus to meet specific customer requirements.	The Tissue Digestor has the following distinctive advantages: it (1) eliminates radioactivity contaminated tissues and neutralizes toxic fixing agents, cytotoxic agents, and many other toxic compounds; (2) equals or superior to incineration in volume and weight reduction, but at a much lower operating cost ($0.40/lb); (3) does not cause air pollution or produces harmful byproducts; (4) achieves zero growth in efficacy tests with A. fumigatus, B. subtilus, P. aeruginosa, Giardia cysts, M. bovis, G. muris, S. aureus, M. fortuitum, C. albicans, M. terrae, and B. stearothermophilus, and (5) has been approved by many states as an alternative to incineration.	NA
PIWS' MMT 3000/Mobile Medical Waste Processor	Treatment system has weight scale and automated computer monitoring/control system for pH, weight, and processing time.	Relatively minor	NA	lower cost-per-pound	NA	NA	NA	Mobile treatment unit uses self-contained generator, while a fix site facility needs electricity	Yes	NA	NA	PIWS uses its own operators	NA	NA	Yes. PIWS continues looking for process modifications and improvement to reduce treatment cost and increase efficiency	The John Hopkins Hospital – Maryland (Project Only); Midland Memorial Hospital, Medical Center Hospital, Odessa Regional Hospital, Baptist St. Anthony's, Covenant Health System, Presbyterian Hospital of Dallas, Harris Methodist HealthCare System – Texas; Via Christi Regional Medical Center, Wesley Medical Center – Kansas	PIWS's first International Unit has been delivered for operation in the United Kingdom, it is in the process of forming JVs with United Engineers (a Singapore Company), Beijing AIR-SYS Energy Technology Ltd. (China), and IEM, Inc. (a US Corporation) and to file International Patents for marketing services in China, European Community, Japan, South Korea, Russia, India, Mexico, and Canada	the treatment process combines chemical and heat treatment to disinfect infectious medical waste. It is effective, with high throughput rates, and preferred by many clients since they can have all the advantages of onsite treatment process without having to construct and maintain one. Mobile treatment can be a good option for China either as a supporting process to the centralized treatment facility or as a primary treatment mechanism for rural areas	NA
High-vacuum/high-pressure autoclaves or retorts	The process cycles for this Bondtech installation are controlled by programmable controllers that continously monitor and record the temperature and pressure within each sterilizer while controlling the complete sterilization cycle.	Negligible/minor	US$90,000 for 100 lbs/cycle, $110,000 for 250 lbs/cycle, $123,000 for 750 lbs/cycle, to $175,000 for 1,500 lbs/cycle; two-stage shredders from $79,000 to $135,000; self-contained compactor from $18,000 to $22,000 each; hydraulic bin dumper from $14,000 to $16,500; and autoclave bags from $18 to $163 per 100	NA	NA	NA	NA	Steam - 305oF/55 Psig, sewer drain, electrical	Easy	10+ years	NA	One to two days at most at client's facility, travel and lodge costs bear by the clients	NA	3 to 6 months	NA	Over 75 units sold in U.S. and overseas	Capable of custom-designing the system, ranging from 250 lbs (115 kg) to 6,000 lbs (2,727 kg) per cycle and higher; can provide optional equipment such as shredders, bins, carts, cart washers, balers, autoclave bags, bin dumpers, lifters, self-contained compactors, and conveyor systems; offers complete turnkey installation and maintenance services	(1) proven and easily acceptable technology by hospitals and communities, (2) approved and accepted in the U.S. as an alternative technology, (3) treatment and performance standards well established, (4) various optional sizes, (5) relatively low capital and O&M cost	(1) does not render the treated waste unrecognizable or offer volume reduction without a shredder or grinder, (2) offensive odors may be generated without proper air handling equipment, (3) sewer discharge of condensate is required, (4) volatile chemicals or mercury can generate toxic fumes if treated together with the waste, (5) potential waste weight increase due to absorption of steam condensate if a drying device is not provided, and (6) treatment performance may be compromised by barriers to direct steam exposure or heat transfer
Semi-automated and totally automated robotic system; standard, high volume, and high vacuum type sterilizers	Standard units are equipped with a MRC 5000 Partow one or two pen circular chart recorder/controller that can be programmed to operate from a 24-hour up to 7-day period. It has remote monitoring capabilities; and a PLC digital Controller that can perform additional functions and records for time, temperature and pressure on tape	Minor	Capital equipment costs range from US$34,000 to $55,335 for standard hospital sized sterilizers. Large commercial type autoclaves (not including ancillary equipment) range in prices from $80,000 to $150,000. Prices for the totally automated system start at an estimated $275,000	Average cost is approximately $0.15 per kg in the USA. Small to medium units use approx. 100 lbs of steam per cycle, large standrad units use approx. 150-200 lbs steam per cycle	Varies	Scheduled maintenance typically performed biannually, unless otherwised suggested by the manufacturers	Maintenance cost for a standard sterilizer is approx. US$60/mo and basically involves a lubrication and occassional door change	Steam - 60 Psig regulated supply, electrical - 115-V single phase 5 amps unless shredding or grinding is used, floor drains, vent and blowdown lines	Easy, follow instruction manual, instant tech support via e-mail or telephone are 24/7	Average 15 years. Many are still in operation after 20 years of hard use.	Manufacturer's warranty program	Standard sterilizers are manufactured according to customer utility requirements and are ready for simple power and steam hook-up once they arrive. Many hospitals choose to install the units themselves. For an additional cost, Mark-Costello will provide a technician to supervise the hook-up, start-up and will in-service train the employees who will be responsible for operating and maintaining the system	Installation time is estimated to be 1 to 2 weeks / Packaging and shipping time is estimated at about 4 weeks from portal to portal	Production time is approximately 10 to 12 weeks from receipt of Purchase Order	NA	NA	The Mark-Costello Co. has the one of the largest selection of sterilization systems. It also offers cart-to-cart dumpers, cart-to-compactor dumpers, scissor lifts, compactors, conveyor, grinders (suitable for sterilized sharps, documents and other biohazardous waste), steam boilers, cardboard balers, and other waste handling equipment	(1) proven and easily acceptable technology by hospitals and communities, (2) approved and accepted in the U.S. as an alternative technology, (3) treatment and performance standards well established, (4) various optional sizes, (5) relatively low capital and O&M cost	(1) does not render the treated waste unrecognizable or offer volume reduction without a shredder or grinder, (2) offensive odors may be generated without proper air handling equipment, (3) sewer discharge of condensate is required, (4) volatile chemicals or mercury can generate toxic fumes if treated together with the waste, (5) potential waste weight increase due to absorption of steam condensate if a drying device is not provided, and (6) treatment performance may be compromised by barriers to direct steam exposure or heat transfer

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CSM Autoclaves,Cage & Rack Steam Sterilizers - Autoclaves	NA	NA	NA	NA	NA	NA	NA	Steam - 100 to 2,000 lb/hr, water - 8 to 50 gpm, air - 3 to 5 scfm, electrical - control (120V/10A) and power (230V/480V/30A/15A), and 4 to 8-in drains	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Semi-automated and totally automated standard, high volume, and high vacuum type autoclaves/ retorts	The systems are equipped with built-in ramp, automatic controls, and record/documentation	NA	NA	NA. Typical natural gas consumption rates for the three models are 1.71, 2.71, and 2.46 therms per 60-minute cycle	NA	NA	NA	Steam - 3/4" NPT 60 Psig, water - 1/2" NPT 40 Psig, drain (2"-S/S, two), electrical - 120V 60 Hz 1-phase for control and 208-230/480V 60Hz 3-phase for the motor	Yes	Over 10 years	Manufacturer's warranty program	Minimum	NA	NA	NA	NA	Offers a shredding/grinding unit designed for medical waste, with fully automatic controls, a semi-automatic car tipper, and an auger that conveys the shredded waste directly to a compactor. They also offer stationary compactors in a variety of styles and capacities.	NA	NA
Rotoclave	The system uses programmable microprocessors to control and adjust temperature and pressure	Very quiet / the systems has less odor than other similar systems	US$250,000 - $1 million	$0.025 per lb utility costs	very little, quarterly for rotoclave, every few weeks for grinder teeth	quarterly	30,000, 80% on grinder	Steam - 450lbs/hr at 60 Psig, water - 75 gpm, electrical - 30 kWh 250 A, Air - 5 cfm @ 100 psig	Yes	25-30 years	1 yr	included in price	1 month and 1 1/2 week for operation start up	4-6 months	NA	Over 25 units sold and in operation	The system offers parameteric print out. Tempico also offers integrated scale and automatic loading systems, as well as single-stage (D1 models) or dual-stage (D2 models) grinders. Hitachi is Tempico's Asian dealer.	The unit comes in different configurations so that it can be adapted to a variety of individual needs and situations. Besides, it has gone through three separate microbial inactivation efficacy tests conducted by third parties and showed no post-treatment microbial growth of B. megaterium/B. stearothermophilus and high disinfection efficiency (6.7 to 8 Log_{10} kills for B. stearothermophilus, 7.4 to 9.1 Log_{10} kills for B. subtilis, and 8 to 10 Log_{10} kills for others). The water soluble extract from the medical waste treated and the wastewater outflow from the Rotoclave were also tested for mutagenic potential using the Ames test ; none showed any detectable mutagenic potential. The system design also effectively eliminates cold spots that are generally a major concern for the traditional autoclave	More costly in capital investment than others
Advanced autoclave, San-I-Pak	No Touch Automation"-the system is manufactured and designed to eliminate as many potential hazards to operator's as possible. The equipment records the operator code, date, time, temperature, pressure, vacuum level and weight (optional) of every sterilization cycle and records this information using a fail-safe, dot-matrix printer. Information printed is controlled by the PLC for accurate, tamper proof documentation. A digital display is utilized to keep the equipment operators completely informed as to the machine's functions, clearly explaining the current cycles status and history at all points of the sterilization process and provides detailed instructions for the correction of any cycle interruption and equipment procedural operation.	The machine odors are practically non-existent since the blowdown steam is vented into the condensate tank where it recondenses to water; additionally, the San-I-Pak Sterilizer & Compactor systems are equipped with a deodorant system. The roll-off container door is sealed against liquid seepage and air flow.	From US$26,000 (25 lbs/hr unit) to over $500,000	Including materials, labor utilities, hauling, maintenance, disposal costs and the capital equipment amortization, system will cost between US$0.02 and $0.04 per lb. with hauling costs between US$0.02 and $0.05 per lb. for a total cost of US$0.04 to $0.09 per lb.	Dependent on the type of systems-preventative maintenance	quarterly	NA	Steam - 1" insulated line with min. 65 Psig steam and max. 125 psig; water - 30 to 100 psi; floor drain; electrical - 120V 10A, 208/240/480V 3 phase, and 220V single phase; phone line for remote control	All San-I-Pak systems include a telemetry package, which allows the system to be monitored via modem from the factory. With this package and the assistance of our factory based service department, 99% of all service issues can be handled over the telephone.	NA	Equipment for defects in materials and workmanship (1 yr) from date of deliver, (14) months from date of shipment whichever occurs first.	Labor requirements are 1 to 10 minutes per person per hour per chamber. No special skills for the operation are required. The system is designed to facilitate non-technical operation and maintenance. San-I-Pak offers Factory Training and on-site In-Service Training for all facility personnel on the simple operation and maintenance of the equipment. The equipment requires regular tools that normally found in a Maintenance Department: 3/8-1¼ wrenches, hammers, screw drivers, pipe wrenches, grease gun, allen wrenches and crescent wrenches	Five days-installation however most units are installed and are operational within four hours	90-120 days from receipt of purchase order and deposit	NA	Over 700 units sold	Sanipak offers a wide range of integrated custom designs based on dozens of models. Multiple units can be lined up along a common load platform and waste can be loaded from ground or dock level. It can also offer cart dumpers, conveyors, single and two-stage shredders, compactors with 4-to-1 and 6-to-1 ratios, bailers, and auto-weighing systems	The Sanipak systems have demonstrated past tracks of success with the USEPA. In the 1993 study conducted by USEPA, all levels of B. stearothermalphilus (up to 6 Log_{10} kills) an B. subtilis (up to 8 Log_{10} kills), both steam and non-steam exposed spore containers, were inactivated in very treatment cycle tested. Its treatment systems have go through several modifications to improve the efficacy of steam sterilization. Additionally, Sanipack offers waste audit programs, in-service training, full service contracts, in house monitoring, and remote messaging systems, among others.	NA
Chem-Clave, Series 2000, 3000, and 4000	PLC system to control the feed mechanisms and system performance, as well as record data on a treatment card. Remote monitoring is capable via modem. The units ave touch-screen and self-diagnostic technology. Aluminum enclosure can be provided if needed. No liquid or contaminated air discharge	Minor and can be controlled by chemical spray;relatively quiet with minimum moving parts (72 db)	Prices range from approx. US$370,000 for the 600 lbs/hr unit to $430,000 for the 1,000 lbs/hr unit	US$0.07 per lb (inclusive to depreciation), otherwise $0.03 per lb	Normal oiling and greasing per 3 million lbs of waste processing	same as routine maintenance shedder cutting system	US$0.015 cent per lb (shredder/seals/lubricants/gear) depending on operating conditions. There is also cost associated with preventative maintenance	Minimum of 45 kwh	Very easy, simple touch screen diagnostics - STI technical personnel can also dial into the unit	10+ years	1 year	training program with installation, included in price (more extensive for international & the operators are brought to Indianapolis for factory training). Remote monitoring is included as part of the domestic system - need a phone line connection).	NA	6 months	Always looking into	Hershey Medical Center, Steve Hiesler, Penn State University, Methodist Hospital of Indiana, Mr. Ron Bourne 317-962-2835	A series microbial inactivation tests have been cnoducted for the STI Chem-Clave by three independent laboratories between 1995 and 1997. The test results indicated over 6 Log^{10} kills for B. stearothermophilus, over 8.5 Log^{10} kills for B. subtilis, and over 6 Log^{10} kills for five other microorganisms. TCLP tests in 1996 also showed that the treated waste may be classified as non-hazardous	Several notable advantages of the STI Chem-Clave systems are: (1) inclusion of negative air and HEPA filter system enables pre-shredding of the waste, (2) shredding increases surface area of the waste for steam exposure and improves treatment efficiency, (3) the rotating auger enhances mixing and steam contact with the shredded waste and eliminates cold spots, (4) the unique and patented dehydration chamber improves drying of the treated waste, and (5) disinfectant chemical spray subsystem reduces human exposure risks to pathogens and acts as a deodorant for the waste stream	NA
SSM-150	24-hour remote monitoring system in Baltimore. Unless the hatch is closed and locked, the system will not operate. Once the treatment cycle i initiated, the operator will not have additional interface with the equipment until the treatment process is completed	No unpleasant odor	Less than $200,000 . There are three options available: (1) purchase, (2) lease, and (3) turnkey	Depends on the usage	Depends on the usage, the cutter needs to be serviced after every 400 cycles of treatment	Depends on the usage	See manufacturer warranty	Electrical - 480 V, 60 Hz, 3-phases; sewer drains; hot and cold water, phone line	Easy to troubleshoot (part of the process monitoring system)	10 years	1 year on major parts and a service aggreement - could vary	8 hours - no cost involved. Its part of the intial cost	Varies by locations, 2 to 3 days domestically	15 weeks	Working on modifications currently	http://www.redbag.com/wpshtml/wps_customers.htm	The system has the following advantages: (1) cost-effective, (2) low maintenance, (3) destruction of waste at the point of generation, (4) proven and accepted technology, (5) no hazardous chemicals or other materials used in the process, (6) no harmful emissions, (7) no associated social stigma, (8) reasonable capacity, and (9) requires small footprint	The SSM is very cost effective, relatively small, simple to operate, reduces liability, and is environmentally friendly. One unit is capable of servicing a 300 to 325 bed hospital. If more capacity is needed, additional units can be added and placed close to major areas of infectious waste generation or it can be centralized. One employee can operate up to six units	n/a

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Ecolotec Technology	The computer also has a safety program which will automatically lengthen the sterilization time in the event of a rotary tool failure. This guarantees that operators are never exposed to blood borne disease organisms and therefore assures full compliance with OSHA regulations. The system operation is computer controlled with hard copy printout.	No objectionable effluents, odors or residues	Approx. US$325,000	Operating cost below US$0.04 per lb of waste	Low maintenance requirements	NA	NA, most costly maintenance item is replacement of knife hammer	Electrical: 230V/200A disconnect, 115W 80 A breaker; steam: < 80 lbs/hr @ 60 PSI; water: 10 gpm cold water, 1" connection; drain: 4"; HVAC: standard computer environment, 10 air exchanges/hour in room, machine connection to outside vent; additional electrical: main motor: 40 hp, mixing baffle motor: 1.5 hp, vacuum pump: 1 hp, controls: < 60 Amps	NA	NA	Stand. manufacturing warranties	Provided by Ecolotec based on time and material	NA	NA	NA	NA	NA	Full sterilization of regulated medical waste (RMW) to over 6 Log10 kills is easily achieved due to the elimination of cold spots by pulverizing the waste, thus significantly increase the exposure surface of the waste to steam	NA
Hydroclave	The system uses programmable microprocessors to control and adjust treatment parameters and environment. It is also equipped with a strip chart recorder that document the process parameters.	Low noise and very low emmisions	US$50, 000 to over $500,000 (models cited here from US$200,000 to $500,000)	Generally with an energy cost of approx. US$0.01per lb of waste processed, other operating costs (labor, building, etc.) vary depending on countries and regions operated. Approx. energy consumptions (kWh/h electricity and lbs/batch steam): H-25 (1.85, 200), H-65 (4. 700), H-100 (5, 1,000), H-150 (6, 1,800), H-200 (8, 2,200), H-250 (8, 2,500)	Quarterly inspection	Varies for each unit	Varies for each unit depending on the model size. For examples, costs for oil gas and gasket replacement may vary from US$500 to $2000	Depending on the models. Electrical - 460 V 3-phase, 60Hz for drive motor; steam 40 to 60 psi minimum; water - 100 to 1,000 gallons per batch; condenser water flow - 10 to 40 gpm	Easy to troubleshoot (part of the system monitoring)	15 years	3 years for main components and 1 year for small parts	Provide training - 2 days as part of packagare	Depends on the locations, 3 to 6 weeks for international orders	10 to 12 weeks on any products	NA	will send out a datasheet	There is no need for "pre-and post-vacuum", that is, pull infectious air and liquids of the vessel, as is the case with most autoclaves. Very low energy consumption, low water consumption, very low emissions.	The process has been tested to how inactivation of microbial load greater than one-in-a-million equivalent of B. stearothermophilus within 30 minutes at 121°C or 15 minutes at 132°C. The process takes the advantage of high moisture content of the medical waste for self steam generation and mixing that helps eliminating cold spots to ensure treatment efficacy. Hydroclave guarantees sterility of all waste particles, no pre-shredding of infectious waste necessary and no special waste bags or chemicals are required. It also offers a shredding system, conveyor, three-day commissioning, and one-day operator training	NA
Junk Yard Dog (JYD) -1500	Yes, the system is monitored digitally with full report capability. Reports are prepared daily showing time and temperature of each treatment cycle with data points being captured every 20 seconds. The system automatically re-sets if treatment conditions fall below required temperature. Temperature readouts are captured at both top and bottom of the autoclave. This assures temperature consistency through the entire load.	Low noise and low emmisions	The cost for constructing JYD – 1500 in the US is approximately US$1,000,000 (equipment manufactured in China should be considerably less). Retail pricing for JYD – 550 is not yet available; but should be considerably less than the JYD – 1500	Est. at US$0.08 per lb of waste treated, including labor for operations and maintenance, as well as replacement parts.	Grease and oil as consumables	The company has a schedule of daily, weekly, monthly and quarterly maintenance activities. The shredders require maintenance after 300,000 lbs of waste treatment two crews, 8 hours to remove and replace)	Cost is US$4,500	Electrical - 480 V 200A, 3-phase; water - 1/2" connection; natural gas or propane - 860,000 btu/hr at maximum firing rate	The system is very easy to operate with a broad range of indicator controls. It is fully automated with "one button" start/stop feature.	All components are modular and replaceable. Effective life of the product will be years if properly maintained.	Standard – 6 months, extended – 1 year	Extensive training will be provided by the manufacturer at locations in the US at no additional cost to buyer. Additional training is available after delivery, on-site, at an additional cost.	Varies depending on locations	90 days from receipt of order if no other equipment is in production queue.	NA	Yes	Efficacy. Some technologies achieve a certain level of disinfection and other technologies can achieve sterilization. The JYD treatment systems achieve complete sterilization with assurance of full penetration of the waste load. The JYD treatment units are part of an overall process that embraces the concept of pathogenic protection after initial deposit. The waste is never touched after initial deposit in the waste receptacle. This is especially important in a SARS environment where disease can be easily transmitted from surface contamination. Aegis Bio-Systems can provide extensive training in the infection control area, as well as process and training material for waste handlers.	In general, this is a pre-approved technology, requiring only efficacy test results by the local governmental agency (in US) for issuing a permit to operate "on-site". The system is mobile, transportable, and can process large loads in a very compact pressure vessel. It allows fully automated transfer of material through the process train from loading to discharge and the shredded waste is treated in a tumbling and mixing environment toensure complete penetration of the steam. A complete treatment cycle time, from loading to full discharge, is 50 minutes, nearly one half of the time requred by a standard autoclave	Costly, besides, if shredders are weak or jammed, workers may be required to work with contaminated material. Th JYD-1500 uses proprietary and patented shredders specifically designed for this purpose. They can process material as hard a titanium and large stainless steel instruments.
SANITEC HG-A-100, HG-A-250	Automatic lift/load system eliminates double and triple waste handling, standard electrical and water hook-up, interlocking and automated controls eliminate worker exposure, on-board digital control/self-diagnostics	Minor odor in the microwave unit area and the secondary shredder used for sharps is noisy	HG-A-100 (approximately US$500,000), HG-A-250 (approximately $600,000)	NA, energy consumption is approx. 0.1 kWh per lb of waste treated, peak demand at approx. 70kW	NA	NA, the shredder generally requires the most inspection and maintenance efforts - it is also the most expensive item for O&M costs	NA	Electric - 460/480 V, 150 to 200A, 60 Hz, 3-phase; water - 3/4" NPT hookup	Relatively easy	NA	Standard manufacturer warranty for 1 year	Extensive training will be required for workers t understand the principals of microwave/steam-based treatment process and routine preventive maintenance tasks specified in the Sanitech's manuals. Training oversea is typically based on time-and-material	Varies depending on locations	NA	NA	NA	The systems can be used as mobile units. Tests conducted by independent third parties on waste emission, residual toxicity, and microbial inactivation showed that (1) the level of VOC and aerosol emissions were low and below the OSHA PELs (permissible exposure limits); (2) the treated waste residues passed the federal Toxicity Characteristics Leaching Potential (TCLP) tests and could be considered a non-hazardous waste; and (3) over 7 Log_{10} kills for B. subtilis, Pseudomonas aeruginosa, Staphlococcus aureus, Enterococcus faecalis, Nocardia asteroides, Candida albicans, Aspergillus fumigatus, Mycobacterium bovis, Mycobacterium fortuitum, and duck hepatitis as well as over 3 Log_{10} kills for Giardia muira	Several notable advantages of the Sanitec microwave system are that (1) it is a proven technology for treating medical waste and easily accepted by the health care and public communities; (2) it is approved as an alternative treatment technology to incineration by most of the states in US; (3) the system produces minimum or negligible harmful air emissions; (4) there are no liquid discharge; (5) up to 80% volume reduction can be achieved by the system; (6) pre-treatment shredding incrgases the contact surface area of the waste, improving steam penetration and treatment effectiveness; and (7) the technology is automated and easy to operate, requiring only one operator	Disadvantages of the system include (1) the potential presence of offensive odors around the microwave unit, (2) higher capital cost than other disinfection processes, (3) noise created by the secon shredder used for the sharps, and (4) maintenance and replacement of shredder could be costly and time consuming
Electro-thermal-Deactivation (ETD)	Fully automated digital and LCD monitoring capabilities for air flow and system operation conditions	Minor odor in the ETD treatment unit area and moderate noise level in the size reduction equipment area	By quote only	NA	NA	NA	NA	NA	By trained specialists	NA	NA	Pending negotiation with Stericycle	NA	NA	NA	Contact Stericycle		Stericycle is currently the largest medical waste management and treatment company in the US. In addition to ETD, it also offers autoclave and incineration (although with decreasing demands) treatment processes as well as a full lines of waste containers, container cleaning system, RAD/HW sensors, compactors, shredders, conveyors, and other treatment associated equipment. Stericycle is not just a equipment vendor, it is more of a full-service medical waste treatment company. As such, its interest is in developing wholelly-owned or JV-type full service waste treatment facility from waste management, collection, transportation, treatment, to refuse-derived fuel from the treated waste. This provides different opportunities beyond manufacturing and selling a particular treatment process	NA

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MedClean Series Sterilization Solutions (MedClean (MC4, MC5, MC7 series)	All MedClean systems include the AutoTouch® Control System which monitors over 40 safety items at all times and manages all regulatory compliance aspects. The AutoTouch can also be configured to be remotely managed	Minor	NA	MedClean system operates at under US$0.03 per lbs of waste treated	Routine maintenance on the shredding device depends on the volume of waste being treated. For 500,000 lbs or less, a bi-weekly one hour schedule is preferable. If treating 2.1 million lbs, a daily check should be performed. These estimates are for shredding, the autoclave requires only twice a year checks for seal wear and safety items.	An on-demand 24-hr response system provides available maintenance contacts, factory certified technicians, and quick turnaround for parts	These costs are included in an operational cost analysis provided to every client	Electrical - 115 V 5A, steam, drain	Extremely easy with the AutoTouch touchscreen display.	Averaging 8 to 10 years depending on environment.	1 year product workmanship on the shredder and hydraulic components, 5 years on the autoclave vessel	Training is recommended and there is no additional cost.	varies on location	6-8 weeks	NA	Available upon request	The Aduromed process uses autoclave capable transportation carts. This allows users to directly fill the carts and not touch the waste ever again. These carts are then autoclaved during the sterilization process and are safe to be reintroduced into the healthcare setting	Advantages are: 100% compliance worldwide, 80% reduction of volume, exceeds EPA sterilization standards for bacillus stearothermophilus by 1000 times, completely OSHA compliant safety features, reliable components, ISO 9001:2000 and 140001 compliant, meets ENERGY STAR guidelines, treats sharps, and has a 10 year record of 99% uptime	NA
Autoclaving (generally provided as part of a complete medical waste treatment package that consists of Pyrolytic Destructors™ and matched heat recovery and auxiliary fired boiler system)	Complete automated control system for unattended operation. After pushing the "Cycle Start" pushbutton, the sterilizer will proceed through a purge cycle, that is, both the steam inlet and vent valves will be opened, allowing the steam to completely fill the chamber and force all air out. This ensures better penetration and sterilization effectiveness. An adjustable timer controls the purge cycle. At the completion of the purge time, the exhaust valve will close and allow pressurization of the unit. A safety relief valve is provided to prevent over-pressurization of the sterilizer vessel. The controls include an "Emergency Stop" button should there be requirements for an emergency shutdown.	Minor odor in the treatment equipment area as all autoclave does	varies, from US$80,000 to $250,000	NA	Autoclaves are constructed to meet the exact ASTM Boiler and Pressure Vessel Code Section VIII, Div. 1 and 2 std. and reg. They are customed built as part of the "total medical waste treatment package" in conjunction with the Pyrolytic Destructors™ and matched heat recovery and auxiliary fired boiler systems, requiring little maintenance effort	NA	NA	Electrical - 480 V, 60 Hz, 3-phases; sewer drains; hot and cold water, phone line	Relatively simple via modem for technical assistance from the vendor	10 years	NA	One day	3 to 4 weeks in shipping, one day for installation with all utility ready for hookup	3 - 6 months	Always looking into	NA	Global Environmental considers Pyrolytic Destructors™ the heart and autoclave the muscle of its medical waste treatment system. The concept is to use Pyrolytic Destructors™ to treat a portion of the waste stream and generate the heat to be recovered by the heat recovery boiler, which in turn, provides the steam required for autoclave(s) to treat the remaining portion of the waste stream - this provides a smart and cost effective alternative for large regional treatment facility that requires multiple or one large but cost prohibitive Pyrolytic Destructors™. Several heat recovery variations are also developed to meet client's specific needs for this combination treatment system, including (1) heat recovery only boilers and stand-alone fuel-fired boiler, (2) heat recovery boiler with an integral fuel-fired boiler, and (3) heat recovery boiler with auxiliary fuel firing	Autoclvae is a proven treatment technology for medical waste and the treatment cost is among the lowest of all. Using heat recovery technogy to provide alternative steam from Pyrolytic Destructors™ reduces energy consumption and significantly increase the treatment capacity. the inexpensive modular autoclave units can also be added if the waste stream capacity increases.	NA
Pyrolytic Destructor™ 550, 1200, and 2500	The treatment unit is controlled by a microprocessor-based control panel that adjusts treatment parameters and initiates emergency procedures (which can be initiated manually as well) when necessary. Once the detruction cycle begins, there is no requirement for the prence of operator. the PLC can be programmed to alert personnel or locations if a problem is encountered. The control system can only be adjusted by designated management personnel. A modem incorporated into the control system allows Global Environmental to acess and modify the program as well as diagonose and maintain the treatment system remotely from its US offices	The system generates no offensive noise (since there are no moving parts) or odors during and after treatment	Varies, Model 1200 (US$900,000) and 2500 (US$1,400,000)	US$0.07 to 0.1 per lb of waste treated; however itmay vary depending on country location, waste content, and propane/natural gas cost	The Pyrolytic Destructors™ are constructed of quality materials all meeting strict performance specifications, and designed for long life and ease of maintenance. Maintenance and replacement for high temperature refractory fiber modules, temperature probes, thermocouples, switches, electric motors, and industrial burner can be performed easily since they are standard off-the-shelf products	NA, depending on he operation conditions	NA	NA		10 to 15 years or longer	NA	Provided by Global Environmental at client's location based on time and material	3 to 4 weeks in shipping, ne week for installation and test with all utility ready for hookup					Bio-Oxidizer has the following advantages: (1) system performacne is comparable to incineration but produces much less air emissions (an independent study showed that the air emissions were one to three orders of magnitude lower than the new USEPA emission std. for a new incinerator with similar size) and an inert nonhazardous end product of carbon ash (studies showed that the ash passed the USEPA TCLP tests and could be classified as non-hazardous); (2) it is capable of treating a wide range of medical waste except for radiological waste and mercury; (3) high mass and volume reductions of waste by over 95%, (4) it recovers over 80% of heat in the form of hot water or steam, (5) no odors and low noise, (6) no liquid generation, and (7) complete microbial inactivation.	Relative high initial capital cost, large footprint/space requirement, and skilled operating personnel
Bio-Oxidizer® system	The system is fully automated, rquiring only a few minutes of operator time per hour, the loader automatically loads boxes as needed and a bar code system provides documentation of time, weight, and waste designation that can be stored electronically or printed out by the computer	Essentially free of odors and noise	Approx. US$1.6 million for Model #100 and an est. US$3.5 million for Model #1000; cost for a full service contract depends on location, model, volume and type of waste	NA, Model #100 uses approx. 0.6 to 1.2 kWh of energy and Model #1000 uses approx. 0.1 kWh of energy per lb of waste treated, almost 80% of the heat is recovered as hot water or steam	Follows daily preventive maintenance schedule recommended by the manufacturer	Major scheduled maintenance may include conveyor belts, heating elements, fans, scrubber, and electrostatic precipitator	NA	Electrical - 480 V, 60 Hz, 3-phases; water - 5 - 10 gpm; compressed air - 100 psig; 6" to 12" vent duct; phone line	Yes, with technical service support from Oxidation Technologies	Over 10 years	NA	Oxidation technologies will provide onsite training (basic understanding of the pyrolysis, std. operating procedures, occupational safety, record keeping, problem identification, and contingency); cost and duration depend on the type of contract (procurement versus service contract)	NA	NA	Yes	NA	Safe for the environment due to low emission and production of inert ash solid, enhanced employee safety with fully automated operation and safety interlocks, automated loading and record keeping, integral heat exchanger for energy recovery, and innovative control technology and interface	Pyrolysis is a proven thermal technology similar but superior to incineration/crematory because it does not involve an open flame or violent turbulence caused by the combustion in waste treatment process. This significantly reduces air and particulate emissions. As a result, the USEPA has excluded pyrolysis from the incinerator regulations. other advantages include: (1) capable of treating a wide range of medical waste except for radiological waste and mercury, (2) high volume reduction of waste by over 95%, (3) inert carbon black residue as the final waste treatment product, (4) heat recovery allows energy re-use, (5) no odors and low noise, (6) no liquid generation, and (7) complete microbial inactivation.	Relative high initial capital cost, large footprint/space requirement, and skilled operating personnel

List of Alternative Medical Waste Treatment Technologies and Vendor Information

Technology Name	Process Monitoring System	Noise / Odor	Initial Capital Cost	Cost of Routine Operation & Maintenance	Freq. of Routine Maintenance	Freq. of Sched. Parts Maintenance	Cost of Sched. Parts Maintenance	Installation Utility Req'ts	Ease of Trouble-shooting	Product Life	Product Warranty	Training Req't and Cost	Shipping /Installation Time	Build Time (if applicable)	Future Modification / Enhancement	Product References	Special Note(s)	Pros	Cons
MD-1000 Emery's (reverse Polymerization Process)	State-of-the-art computer control system to monitors entire process simultaneously, minimizes operator intervention, and controlled shutdown procedure to ensure safe unattended operation. It is also controlled by solid state PLC and components with low maintenance and easily accessible spare parts to increase process reliability	Minor	To be quoted separately	NA	NA	NA	NA	120 kW peak load, 85 kW average (assuming 24-hour continuous operation, the MD-1000 will use 2,040 kWh of electricity, 18 cardboard trays and a maximum of 120 litres of NaOH solution daily, assuming the waste loads are 30% PVC plastic) (Assuming continuous operation and optimal waste loading, in the order of 400 m3 per day (14,300 SCF/day) of natural gas will be used	Relatively simple with complete computerized problem diagnostic capabilities and instrumentation	10 years plus	One year parts and labor	Training to be provided at installation location. Cost for oversea training can be negotiated either as a purchase price or based on time and material	NA	NA	Future upgrades to the turbine system include the installation of an energy recovery unit that will provide energy for heating and cooling of the entire facility.	Liverpool installation features two 30 kW microturbines which process off-gases from the MD-1000 unit to co-generate electricity. The production of electricity helps to reduce operating costs and improves the energy efficiency of the overall process / The microturbine feature also precludes the need for a stack or chimney as normal venting will suffice and meet all environmental standards	Reverse Polymerization of medical and biomedical waste should not be confused with microwave disinfection or autoclaving processes, which use microwaves to generate steam to inactivate pathogens. Reverse Polymerization should also not be confused with pyrolysis. With the Reverse Polymerization Process, the amount of energy and the rate of energy input is highly controllable through the system magnetrons, while pyrolysis cannot be controlled to the same degree.	The process has the following advantages: (1) proven technology of direct microwave energy, (2) low vessel temperature of 150 - 250°C and nitrogen environment prevent formation of toxic byproducts, (3) heavy duty stainless steel construction, (4) grinder in the third chamber only process disinfected waste, (5) solid state PLC and advanced computer control system, (6) user friendly interface, (7) remote monitoring capability, (8) available air conveying system to handle the treatment product, (9) low energy cost, (10) short cycle time and over 485 tons per year of treatment capacity, (11) over 30% of volume reduction, and (12) proven effective sterilization with STTATT Level 4 pathogen inactivation and 8 log10 spore inactivation	NA
Plasma Thermal Destruction and Recovery (PTDR) Unit	PLC system -self protecting and self monitoring	Essentially free of odors and noise	Large, PEAT estimated that the retail prices for units in the 3 TPD range are typically between US$2 to 3 million (not installed and exclusive of site infrastructure and utility). As such PEAT prefers to use the model of BOO, BOT, or JV	Project-specific (waste type, capacity) and location dependent	NA	NA	NA	NA		10 - 15 years	1 year, extended warranty plan available	PEAT will provide all necessary training for facility personnel who involve in the operation and maintenance of the treatment facility. Training cost may be born by PEAT depending on the operation model	NA	NA	Always looking into	PTDR has been validated through extensive, certified tests as well as construction and operation permits. PEAT's R&D facility in Huntsville has performed pilot treatments/studies for a wide range of waste stream and maintained one of the largest database on independently validated gas composition and slag leachability tests	PEAT is one of the most aggressive vendors to promote plasma treatment technology via a non-traditional equipment procurement approach. It emphasizes on BOO, BOT, and JV business models and have successfully done so in Taiwan	PTDR has the following advantages: (1) it produces hydrogen-rich syngas that may be used to produce electricity to sustain the PTDR operation and be sold to power generators or energy brokers; (2) it produces salable commercial products such as metals, road base, sandblast grit, insulation panels, construction blocks, and roof shingle material; (3) it has low emissions compared to incineration due to pyrolysis rather than combustion; (4) it produces very stable glassy product that can withstand weathering and aging process without leaching out any contaminants; (5) it achieves sterilization from extremely high plasma temperature; (6) PEAT offers different operation packages in the form of BOO, BOT, or JV to ensure proper technology transfer, minimize investment risks, and maximize resources conservation and recovery	NA
Plasma Enhanced Melter™ (PEM)	PLC system -self protecting and self monitoring	Essentially free of odors and noise	Project-specific (waste type, capacity) and location dependent, approximately US$800,000 (for a small unit with generator) and up	Project-specific (waste type, capacity) and location dependent	NA, varies depending on parts. The AC and DC electrodes will be consumed during the treatment and need to be replaced at the following frequencies: one section of graphite electrode every 3-4 weeks for each of the three AC electrodes, one section of graphite electrode every 2-3 days (for processing organic waste) or every week (for processing inorganic waste) for each of the three DC electrodes	NA	NA	NA, energy consumption at approx. 0.6 kWh per pound of waste during plasma arc operations, power demand during idling is 10 kW	PLC-based system for self protection, IET also provides technical assistance using expert personnel from MIT and PNNL	20 years	1 year	8 week of classroom / on the job	Shipping could take up to 2-3 weeks (e.g. Japan) and installation	6 to 8 months	Always looking into	Allied Technology Group, Asia Pacific Environmental Technologies, Kawasaki Heavy Industries/FIT and Ryukyus Univ. (Okinawa, Japan), Fuji Kaihatsu (Lizuka, Japan), BioPure System (Kuala Lumpur, Malaysia)e	PEM provides a revolutionary method to deal with two pressing and emergent issues: waste treatment and disposal, clean energy sources. The technology was developed by the joint venture of two best R&D entities MIT and PNNL under the direction of DoE. The process successfully converted waste into recyclable by-product and alternative clean energy source in hydrogen-rich syngas. USEPA certifies that the PEM has met the equivalency of the BDAT (Best Demonstrated Available Technology) standard unders RCRA for incineration and combustion	The PEM has the following notable advantages over other waste treatment/disposal technologies; (1) it produces hydrogen-rich syngas that may be used to produce electricity to sustain the PEM operation and be sold to power generators or energy brokers; (2) it produces salable commercial products such as metals, road base, sandblast grit, insulation panels, construction blocks, and roof shingle material; (3) it has low emissions compared to incineration due to pyrolysis rather than combustion; (4) it produces very stable glassy product that can withstand weathering and aging process without leaching out any contaminants; (5) it achieves sterilization from extremely high plasma temperature; (6) the reduction of air pollution, elimination of undesirable waste production, and recovery of energy and material makes PEM cost competitive; (7) the PEM has been modified to significantly improve the conventional glass melter technology; and (8) IET's know-how can assist in designing and manufacturing various sizes of treatment units based on the required through-put rates	Relative high initial capital cost, large footprint/space requirement, and skilled operating personnel

Technology Name	Process Monitoring System	Noise / Odor	Initial Capital Cost	Cost of Routine Operation & Maintenance	Freq. of Routine Maintenance	Freq. of Sched. Parts Maintenance	Cost of Sched. Parts Maintenance	Installation Utility Req'ts	Ease of Trouble-shooting	Product Life	Product Warranty	Training Req't and Cost	Shipping /Installation Time	Build Time (if applicable)	Future Modification / Enhancement	Product References	Special Note(s)	Pros	Cons
Plasma Arc Reduction (PAR)	PAR is fully automated with PLC controls	Essentially odorless and very quiet	Quotes to be provided to clients directly	NA, energy consumption for PAR 6 model is approx. 180 kWh per 400 lbs of waste treated. 50 gallons of NaOH solution is used for pH adjustment per week	NA	NA	NA	Electrical - 480 V 3-phase, 600 A; water connection - min. 125 gallon per hour	Relatively easy with the PLC control and real time monitoring screen	15 to 20 years	1 year parts and labor, extended warranty is available	Training will be provided by Bio Arc during and after the system installation on a time-and-material basis for foreign operations	NA	NA	Always looking into. PAR has gone through several design changes to improve stability, energy efficiency, gas handling and emission reduction, and engineering performance in the past. This system optimization process will continue to ensure that the PAR is among the best waste treatment technologies	Tulane University Medical Center in New Orleans and Jackson memorial Hospital in Miami	Over US$10 million has been invested in developing and optimizing the PAR system for the past 10 years	The PAR system shares the same advantages as other plasma technologies have	Similar disadvantages as other plasma technologies
DC Graphite ARC Melter	The system is fully automated, requiring very little attention from the operator	Essentially free of odors and with little noise	US$500,000 to several millions	Est. at $100 per ton of waste processed	Yearly usage. electrode replacement as used	Yearly or as needed	NA	Electrical - 112 to 2250 kWh, water for cooling	Yes, with technical service support from EPI and research institutes	Years	NA	Yes, to be provided by EPI on a time and material basis. The duration of training my be from few days to one week	NA	One year	Always looking into. With technical support from MIT and Clemson University, EPI continues to modify system configurations, material, and controls to improve process reliability and efficiency	MIT's Plama Fusion Center, Drexel University, Clemson University's Vitrification Center, PNNL, Westinghouse SRS	A unique feature of this technology is the use of concentric electrodes: during start-up, an arc strikes between an inner and outer electrode heating the waste until it is melted to produce enough molten metal; then the inner electrode is raised out of operation and the arc forms between the outer electrode and the metal bath. The length of the arc can be changed by raising or lowering the remaining electrode. Additionally, the furnace can be operated in an oxidizing (combustion) or reducing (pyrolysis) atmosphere. In an oxidizing atmosphere, combustion gases are formed. A reducing atmosphere allows greater control of the temperature and produces a low to medium-energy gas that can be used as supplemental boiler fuel	The following lists advantages of the DC Graphite Arc Melter: single electrode, no water cooling is required, clean utility load, low electrode consumption, ease of power control, lower refractory wear than an AC system, higher energy transfer efficiency than plasma torch or induction, reduced noise level, utility friendly, low gas flow, can be integrated with existing system, recover metals, stable and non-leachable (non-hazardous by passing the TCP tests) vitrified product, controlled environment, lower maintenance cost than a plasma torch, hot/cold top operation, and complete destruction of hazardous constituents	Relatively high capital cost. space requirements, and low through-put rates
Plasma-Based Pyrolysis/Vitrification" (PBPV) System	The Supervisory Control and Data Acquisition (SCADA) system will control the PBPV process and record selected data on computer disks for later analysis	Expected to be less than other treatment technologies	System-A processing 1,000 lbs per hour (up to 12 tons per day) is about US$3.0 million including permitting, installation, and one year of selected spares and consumables. Costs for System-B (3,000 lbs per hour, up to 36 tons per day) are considerably higher; System-B is designed for a regional commercial processing facility	Operating costs (including labor, power, consumables, operations, maintenance, and amortized capital cost) for system-A is between US$0.17 to $0.19 per lbs of waste processed; operating cost for System-B is est. at $0.12 to 0.14 per lb of waste	Follows daily preventive maintenance schedule recommended by the manufacturer	Follow the schedule recommended by the manufacturer	NA	Electrical - 1150 KVA, 480V, 3-ph; water - 3 gpm; steam - 315 lbs per hour; natural gas - 45 scf per hour. Estimated energy consumption at 1.22 kWh per lb of waste, the power demand for the plasma arc torch is about 3,000 kW.	Yes, trouble-shooting can be easily provided by HI/PEAT technical team via a modem or 24-hr hotline	Over 10 to 15 years depending on operating conditions	NA	Training (similar to the incinerator) will be provided by the quarified technical team from HI/PEAT on a time-and-material basis for foreign operations	NA	NA	Yes, the R&D and testing for the prototypes have been completed, additional effort will be on the improvement of material handling, equipment hardware, and overall performance	NA	Once the first working facility is fuly functional, HI will market the concept globally to communities and/or other businesses in the waste industry	The advantages of the PBPV are: conversion of waste into a combustible gas (which may be used to provide 1/3 of the electricity required to run the system) and an inert glassy slag (which is a recyclable commercial commodity); significant volume and weight reduction of the waste; and ability to handle all types of medical an hazardous waste, except for radioactive waste	Large capital investment and the high throughput rates required for economic operation. Hence, using plasma technology to treat medical waste is appropriate only for large hospitals or regional treatment facilities.
Plasma Converter™	The system is omputer controlled, ease to use and operates at normal atmospheric pressure, safe and quiet	Essentially free of noise and odors	To be quoted separately	NA	Follows daily preventive maintenance schedule recommended by the manufacturer	Follow the schedule recommended by the manufacturer. The most maintenance-intensive aspect of the PCS is the need to periodically replace electrodes at every 300 to 500 hours of operation (typical). This can be accomplished in approx. 30 minutes to ensure minimum downtime of the system	NA	NA	Yes, both on-line and 24-hr hotline services are provided by Startech	NA	NA	At both the Startech training center in Bristol, CT (at no charge) and client's facility (time-an-material if oversea)	NA	NA	Always looking into	NA	Startech has installation in Taiwan, Japan, Pilippine, Poland, Italy, and other countries. It offers several purchase plans including BOT,BOO, co-development/JV, or equipment procurement w/ long-term service agreement from Startech.	Notable advantages of the PCS include: both hazardous and non-hazardous waste can be safely treated without generating harmful/toxic byproducts or residues; significant volume reduction of waste (300-to-1); meets and exceeds current USEPA discharge standards for waste and emissions; generation of commodity products such as metals, specialty inorganics and a clean syngas for sale or reuse; various treatment capacities and mobile/stationary configurations are available; it can be operated either as a continuous feed or batch system; it can achieved total and irriversible destruction of hazardous/toxic constituents, lethal virus, bacteria, and prions; the goal of zero discharge can be achieved with all treatment products recycled/reused; the PCS can be directly coupled to co-generation and power system	Relatively high capital cost. space requirements, process reliability and maintenability

Technology Name	Process Monitoring System	Noise / Odor	Initial Capital Cost	Cost of Routine Operation & Maintenance	Freq. of Routine Maintenance	Freq. of Sched. Parts Maintenance	Cost of Sched. Parts Maintenance	Installation Utility Req'ts	Ease of Trouble-shooting	Product Life	Product Warranty	Training Req't and Cost	Shipping /Installation Time	Build Time (if applicable)	Future Modification / Enhancement	Product References	Special Note(s)	Pros	Cons
Fixed and mobile plasma treatment systems	Fully automated process monitoring control and equipment	NA	To be quoted separately	NA	NA	NA	NA	Electricity, cooling water, off-gas cleanup system, nitrogen, oxygen	NA	NA	NA	NA	NA	NA	NA	NA	NA	The plasma technology offers a single process that can handle a wide variety of waste from hazardous, mixed, industrial, to infectious.	High capital cost, low throughput rates, relatively high energy consumption, and lack of actual performance data (particularly $ per lb treatment unit price)

List of Selected U.S. Incinerator Vendors

Vendors	Address/Phone	Website	Summary of Incineration Products
Boiler Erection and Repair	200 S. main St., Ambler, PA 19002: 800-220-1481	www.boilererection.com	Customized incinerators manufacturer
Buffalo Metal Fabricating Corp.	50 Wecker St., Buffalo, NY 14215; 716-892-7800	www.uffalometalfab.com	Customized incinerators manufacturer
Combustion Systems Co., Inc.	5701 W. Minnesota st., Indianapolis, IN 46241; 317-390-1100	www.combustionsysteminc .com	Incinerator manufacturer and service provider
Cutter Northern Refractories Inc.	10 Hancock St., Woburn, MA 01801-3712; 800-582-8204, 781-938-8998	www.cutternorthern.com	Incinerator and refractory manufacturer and service provider
Elastec/American Marine Inc.	121 Council St., Carmi, IL 62821; 618-382-2525	www.americanmarine.org	Small dual-chamber incinerator for treating medical waste; specifications: 900 kg weight, 6'-9" (H) x 3.5' (W) x 5'-8" (L), 8 ft^3 per load, up to 150 kg per 8 hr day, 110v/220v, diesel fuel, 0.35 KW/hr electricity consumption and 9.8 gal diesel fuel per 2 hr cycle
Enviro-Mechanical	8230 W. 30 Court Hialeah, FL 33018; 305-827-4120	www.enviro-mech.com	Representative of Anderson 2000 model and National Incinerator's pathological medical waste incineration units
NCE Corporation	15 E. Uwchlan Ave., Suite 404, Exton, PA 19341	www.nce-turboclean.com	Patented TurboClean Thermal oxidizer uses innovative FlashBurn technology and HYDROP (wet scrubbing) gas cleaning technology to treat medical and infectious waste. The process operated at 1000 to 1230°C in an oxygen-rich environment and designed to burn medical waste and meet USEPA MACT emission requirements. It can be set-up as a single or multiple units. The unit specifications are: 34' (L) x 10' (W) x 12' (H); processes up to 500 lbs/hr; total system weighs 45,000lbs; utilities require electrical (480V, 150A, and 3 phase), water (min. 50 psi), Fuel (natural gas, propane, #2 diesel fuel), and sewer hookup; power consumption is approx. 65 KW/hr, fuel consumption between 500 to 1 MBTU/hr, water consumption at 150 gal, and exhaust is between 21 and 71°C
Pennram Diversified Manufacturing Corp.	P.O. Box 695, Williamsport, PA 17703; 570-327-2802	www.pennram.com	One of the largest vertical and horizontal controlled air-waste incinerator manufacturers in the U.S.; several models are available for treating medical/pathological waste with capacities ranging from 55 to 550 lbs/hr; utilities require natural gas (2.0 psig), electricity (208/230/380/480/3 phase/50-60, and water (30-60 psig); Pennram's controlled air incinerators destroy the waste in two chambers – the primary chamber is operated under oxygen-deficient environment at approx. 816°C to oxidize the waste, the secondary chamber is operated under a turbulent condition at approx. 760 to 1093°C to oxidize the volatile component of the waste; low oxygen content and exhaust temperature are carefully controlled in the secondary chamber to reduce emissions and achieve optimal fuel economy; heat from the incinerator is typically directed to a heat recovery boiler, hot water heater, or air-to-air heat exchanger
P.D.I. Inc.	8155 Whispering Palm Dr., Boca Raton, FL 33496; 561-883-9208, 570-378-3245	www. Pdimirjv.com	PDI developed and manufactured portable mobile incinerators under the US patent #5727481 and #6352040 to treat medical waste, hazardous chemicals, ammunition waste, pyrotechnics, narcotics/drugs, tires, and animal carcasses
Resource Environmental Systems	1 Westinghouse Plaza, Boston, MA 02136; 800-853-1045, (617) 329-3900	www.resourcegroup.net	Resources Environmental System designs, sell, install, and service pyrolytic and controlled air incinerators; system components included programmable control, incinerator, waste heat boiler, filter with ceramic elements, and scrubber
Crawford Industrial Group, LLC	9101 Parkers Landing, Orlando, FL 32824; 407-851-0993	www.crawfordequipment.c om	Crawford engineered, designed, and manufactured a wide variety of batch-loaded, multi-chamber, controlled air, fixed hearth incineration and crematory systems; the incinerators vary in their capacities from 70 to 650 lbs/hr; combustion takes place in the primary combustion chamber and the waste air stream is further oxidized in the baffled secondary combustion chamber to achieve first level pollution control
Burney The Burner	P.O. Box 4744, Palm Spring, CA 92263-4744; 800-272-1243	www.burneytheburner.com	Manufactures stationary incinerators with capacities ranging from 50 to 1000 lbs/hr

Vendors	Address/Phone	Website	Summary of Incineration Products
Incinerator Specialists inc.	734 N. Progress Dr., Medina, OH 44256; 888-883-BURN, 330-723-6339	www.incineratorspecialists.com	Designs and manufactures various crematories as well as medical waste and trash incinerators. Incinerators are typically controlled air, vertical dual chamber units with emission control devices; the throughput rate range from 100 to 1000 lbs/hr
Texas Incinerator	2401 Neill Ave., Midland, TX 79701	www.texasincinerator.com	Designs and manufactures fixed hearth, moving hearth, and rotary kiln incinerators with capacities from 100 to 10,000 lbs/hr for treating MSW, medical waste, and sludge; scrubber and other air emission control systems can be incorporated to meet the latest USEPA requirements
Advanced Environmental Systems Inc.	2440 Oldfield Point Rd., Elkton, MD 21921-6712; 410-620-1800	www.aesinc.com	AES designs, manufactures, and installs direct-fired and indirect-fired rotary kilns, controlled-air incinerators, fluidized bed incinerators, solid/sludge/liquid incinerators, and their associated emission control systems (wet or combination scrubbers, bag-house)
Advanced Combustion Systems	1999 Alpine Way, Bellingham, WA 98266; 800-445-0243	www.acs-acs.com	ACS provides design and construction of standard or custom stationary/modular or mobile incineration systems that are either horizontal or vertical configuration; mass burn, controlled air, or rotary kiln type; in batch feed or continuous operation mode with a 5-yr total component warranty. ACS's incinerators have been used to treat MSW, medical/infectious waste, pathological waste, industrial and hazardous waste, and sludge. ACS also provide planning, consulting, feasibility studies, planning, emission testing, site evaluation, certified operator training, retrofit/modification and equipment update, and repair and maintenance services
International Waste Industries	P.O. Box 9829, McLean, Virginia 22102; 703-442-5303	www.iwi-systems.com	IWI is a full service designer and manufacturer of waste incinerators, including complete waste handling equipment, ash removal equipment, waste heat recovery equipment, air pollution control system, and continuous emission monitoring and recording instrument. System throughput rates range from 75 lbs/hr to over 100 tons/day. IWI's dual reactor (horizontal or vertical configuration, controlled air type) incinerators have been successfully used in treating medical/infectious waste, industrial waste, MSW, hazardous waste, confidential waste, and pathological waste.
National Incinerator	305 N. 7th St., P.O. box 1978, Corsicana, TX 75110; 800-544-0661, 903-672-4651	www.national-incinerator.com	National Incinerators builds complete and quality incinerators for a wide variety of commercial and industrial wastes, including medical and pathological waste. Medical waste/pathological waste incinerators range in capacities from 50 to 1000 lbs/hr and are designed to burn 24 hours per day with a min 3-second retention time. System specifications are: 5'x5'x6" to 10'x10'x6" for slab construction, 29' to 38.5' overall height, and three to seven burners.
Sterling Boiler & Mechanical, Inc.	1420 Kimber Lane, Evansville, IN 47715; 800-326-5447, 812-479-5447	www.sterlingboiler.com	Sterling Boiler has all in-house capabilities (Boilermaker, Fabrication, Shop, and Refractory Departments) to design and manufacture custom or generic industrial incinerators
Bestech Environmental resources, Inc.	1016 Ronda Lane, Birmingham, Al 35214; 205-791-3656	www.bestechinc.com/thermtec.com	Bestech is a distributor of Therm-Tech's horizontal configurated dual-combustion chamber incinerators, with capacities range from 300 (batch load) to 3500 (continuous feed) lbs/hr. Large unit also features hydraulic ram feed injection, multiple step hearths for material movement through unit, automatic stainless steel ash wet removal system, extended secondary chamber for flue gas retention, latest version of computer software and hardware
Consutech Systems, LLC.	P.O. box 15119, Richmond, Virginia 23227; 804-746-4120	www.consutech.com	Manufacturer of modular controlled-air incinerators that uses a vertical configuration of dual combustion chambers, with capacities range from 75 lbs/hr to 125 tons/day (modular design for multiple systems up to 500 tons/day). Consutech also provides flue gas control system for emission compliance, which consists of dry scrubber, wet scrubber (if necessary), quench chamber, mixing chamber, fabric filter bag-house, reagent feed system, and optional carbon injection system

APPENDIX H

DRAFT UL2334 – STANDARDS FOR ALTERNATIVE TREATMENT TECHNOLOGIES FOR THE DISPOSAL OF MEDICAL WASTE[1]

[1] UL shall not be responsible to anyone for the use of or reliance upon a UL Standard by anyone. UL shall not incur any obligation or liability for damages, including consequential damages, arising out of or in connection with the use, interpretation of, or reliance upon a UL Standard.

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Underwriters Laboratories Inc.®

October 24, 2003

To: **UL 2334 Technical Committee for the Standard for Alternative Treatment Technologies for the Disposal of Medical Waste; Public Review Participants**

Subject: **Ballot for Adoption of the *Standard for Alternative Treatment Technologies for the Disposal of Medical Waste* (UL 2334) as an American National Standard**

The Technical Committee for the *Standard for Alternative Treatment Technologies for the Disposal of Medical Waste* has completed its development of a draft standard. Draft UL 2334 is the product of four years of research, meetings and vigorous discussion. The Technical Committee must now indicate by ballot whether there is consensus to adopt UL 2334 as an American National Standard.

Concurrent with the Technical Committee balloting is a public review and comment period. This is an opportunity for other interested parties to express their thoughts on whether the standard should be adopted.

If the Technical Committee indicates that consensus exists for adoption and any public comments received are satisfactorily resolved, UL 2334 would then be submitted to UL's *Environmental and Public Health (EPH) Council* for ballot. EPH Council consensus for adoption would result in UL designating UL 2334 as an American National Standard (ANSI/UL 2334). However, if consensus for adoption is not obtained for either the first or second ballot, the Technical Committee will cease its standards development activities. In that case, UL 2334 would not be designated as an American National Standard.

INSTRUCTIONS

Technical Committee Members:

If you are a voting member of the Technical Committee, complete the attached ballot with your vote on adoption of the standard. Please note that negative ballots must be accompanied in writing by supporting reasons for the vote and, where possible, proposed solutions to the issue raised.

Other Interested Parties:

If you are an interested party participating as a public reviewer, you are requested to send comments to the TC Secretary. The Technical Committee member ballot shall not be used to submit your comments.

Comments shall be made in writing and may be sent via E-mail to jonathan.brania@us.ul.com, by fax to (919) 547-6262 or by mail to the attention of Jonathan Brania (TC Secretary) at

Underwriters Laboratories Inc.
12 Laboratory Drive
RTP, NC 27709-3995.

Please reference all correspondence to Subject 2334. Note that all comments received are public and may be circulated to others. Please include your full name, company or organization name and address in your correspondence.

Technical Committee BALLOTS and all COMMENTS DUE: DECEMBER 8, 2003

APPENDICES

Appendix A is the proposed draft standard. This is the latest text produced by the Technical Committee. It supersedes all previous drafts. For those comparing it to the draft accompanying the September 8, 2003 Technical Committee meeting report, all proposed additions / deletions cited in that document have been incorporated. Several editorial changes ("that" for "which") were made in Section 6. Finally, a sentence was added to Section 2 clarifying the edition date in effect for referenced documents.

Appendix B is the Technical Committee membership roster.

Appendix C is the Technical Committee ballot.

PRODUCTS AND INDUSTRIES AFFECTED BY THE PROPOSAL

UL requests your assistance in identifying other products or industries that might be affected by the requirements in the draft standard. UL suggests that all suppliers or customers for these products and industries be made aware of these requirements prior to their proposed effective date.

Please also note that proposed requirements are of a tentative and early nature and are for review and comment only. Current requirements are to be used to judge a product until these requirements are published in final form. Any questions regarding interpretation of requirements should be directed to UL Technical Representative for the UL 2334 Technical Committee (Tom Blewitt).

PROPOSED EFFECTIVE DATE

If adopted, UL anticipates that the requirements of UL 2334 will be effective upon publication.

* * *

Unless specifically requested to do so, UL will not acknowledge comments indicating concurrence with these proposals.

JONATHAN BRANIA
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REVIEWED BY:
JACK McGURK
Chair of UL 2334 TC
Chief, CA Department of Health

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SR: SB

APPENDIX A

PROPOSED FIRST EDITION OF THE STANDARD FOR ALTERNATIVE TREATMENT TECHNOLOGIES FOR THE DISPOSAL OF MEDICAL WASTE, UL 2334

OCTOBER 2003

Please note that proposed requirements are of a tentative and early nature and are for review and comment only. Current requirements are to be used to judge a product until these requirements are published in final form.

A Foreword, Table of Contents and assorted non-technical standards and publication information will be added to the Standard if adopted and published.

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1 Scope

1.1 These requirements cover efficacy of manufacturer-specified medical waste treatment claims and methods for technologies employed as an alternate to incineration[1] and landfill.

1.2 Alternative medical waste treatment technology, as covered by these requirements, consists of all methods of microbial inactivation through the use of heat generated by assorted media, the use of chemicals, and irradiation.

1.3 These requirements do not supercede applicable federal, state or local laws and regulations pertaining to medical waste management, treatment, transportation or disposal. In addition, the requirements do not cover:

- Hazardous waste identified or listed in 40 CFR Part 261;
- Radioactive waste defined and regulated by the Nuclear Regulatory Commission; or
- Domestic sewage materials identified in 40 CFR 261.4(a)(1).

1.4 Emerging Research

1.4.1 Additional efficacy requirements may be added, as science deems necessary.

2 Reference Publications

US Code of Federal Regulations

40 CFR 156.10 "Labeling Requirements for Pesticides and Devices"

40 CFR 62.14490 "Approval and Promulgation of State Plans for Designated Facilities and Pollutants – Definitions."

40 CFR 261 "Identification and Listing of Hazardous Waste."

American Type Culture Collection (ATCC)

World Federation of Culture Collections Bylaws (http://www.wfcc.info/bylaws.html.)

American Society for Microbiology's Manual of Clinical Microbiology

The foregoing references to documents shall be considered to refer to the latest edition and all amendments published to that edition.

3 Definitions

For the purpose of this Standard the following definitions apply.

Dust: Small loose particle agglomerates, ranging in size from several tens of nanometers to millimeters.

Equipment: Technology that employs kinetic energy for treatment or control purposes.

Quantitative Reduction: A numerical decrease in organism colony forming units (e.g. 4 Log_{10} or 0.0001 or 99.99%).

Normal: Operation, including stand-by, according to the manufacturer's intended purpose and subject to the manufacturer's limits and conditions of use.

[1] *40CFR 62.14490: Hospital/medical/infectious waste incinerator or HMIWI* or *HMIWI unit* means any device that combusts any amount of hospital waste and/or medical/infectious waste.

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Scaling: Proportional reduction in physical size or quantity intended to represent full-size / -quantity performance.

Single Fault Condition: Condition of operation, including single component failure, that may result in incomplete treatment. If a SINGLE FAULT CONDITION results unavoidably in another SINGLE FAULT CONDITION, the two failures are considered as one SINGLE FAULT CONDITION.

Technology(ies): Any method, process, system or device intended for the treatment of medical waste prior to disposal.

Thermal Degradation: The altering of physical properties on a molecular level through the non-flame application of heat.

Type Tests: A test of one or more technology samples made to a particular design, to show that the sample meet one or more requirements of this standard.

Vitrified Solid: Non-porous glass-like substance formed by fusion under high heat conditions.

4 Markings and the manufacturer's operating manual or instructions for use

4.1 *Markings*

4.1.1 General

Technology shall bear markings in accordance with 4.1.2 to 4.2. These markings shall be visible from the exterior, or be visible after removing a cover or opening a door without the aid of a tool. if the cover or door is intended to be removed or opened by an operator. Markings applying to the technology as a whole shall not be put on parts that are removed by an operator without the use of a tool.

Compliance is determined by physical inspection.

4.1.2 *Identification*

The technology shall, as a minimum, be identified by:

a) Manufacturer's name or registered trade mark;

b) Model number, name or other means to identify the technology.

c) Place of manufacture

d) Type of treatment technology (microwave, plasma arc, grinding, radiation, chemical, steam, pyrolysis, or any other type or combination of technologies)

e) The date or other dating period of manufacture not exceeding any three consecutive months.

Exception: The date of manufacture may be abbreviated; or may be in a nationally accepted conventional code or in a code affirmed by the manufacturer, provided that the code:

a. Does not repeat in less than 10 years for a household product and less than 20 years for a commercial product, and
b. Does not require reference to the production records of the manufacturer to determine when the product was manufactured.

If technology bearing the same distinctive designation (model number) is manufactured at more than one location, technology from each manufacturing location shall bear an identification of such location.

Compliance is determined by physical inspection.

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4.2 *Warning markings*

Warning markings shall have lettering[2] in which:

a) The precautionary signal word shall be at least 2.75 mm high;

b) The text shall be at least 1.5 mm high and contrasting in color to the background; or

c) If molded or stamped in a material, the text shall be at least 2.0 mm high and, if not contrasting in color, a depth or raised height of at least 0.5 mm.

Warning markings shall be visible when the technology is ready for NORMAL use.

If it is necessary for the operator to refer to the manufacturer's operating manual or instructions for use to preserve the protection afforded by the technology, the technology shall be marked with the ⚠ symbol. If a warning applies to a particular part of the technology, the marking shall be placed on or near to this part.

A warning shall alert the operator of precautions to be taken to avoid contact with treatment chemicals, burn hazards, hazardous energy, moving and/or uninsulated live electrical parts that are accessible after installation and resulting from operation under the conditions for tests described in Section 6.

A warning shall alert the operator of prohibited control settings (see 6.3.9).

Compliance is determined by physical inspection.

4.3 *Durability of markings*

Markings in accordance with 4.1.2 to 4.2 shall be suitable for the purpose, remain clear and legible under conditions of NORMAL use and, for external markings, resist the effects of cleaning agents specified by the manufacturer.

Compliance is checked by inspection and by performing the following test for durability of external markings.

The markings are rubbed by hand, without undue pressure, first for 15 s with a cloth soaked with the specified cleaning agent (or, if not specified, with water) and then for 15 s with a cloth soaked with isopropyl alcohol (2-propanol).

The markings shall be clearly legible after the above test, and adhesive labels shall not have worked loose or become curled at the edges.

4.4 *Manufacturer's Operating Manual or Instructions for Use*

4.4.1 *General*

The technology shall be accompanied by the following:

a) Operating instructions for use.

b) Guidance on training required to appropriately operate and maintain technology as intended. A means to evaluate recommended training "readiness" shall be included. A checklist coordinated with the training information is considered an acceptable means.

Exception: Not required for single-use technology.

[2] *Conforms to US Code of Federal Regulations 40CFR 156.10 "Labeling Requirements for Pesticides and Devices" applicable to suction canisters.*

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c) Technical specification.

d) Name and address of manufacturer or supplier from whom technical assistance may be obtained;

e) The information specified in 4.4.2 to 4.4.5.

f) A statement that the technology shall only be used in accordance with the manufacturer's instructions.

g) Any limitations of use (e.g. not intended for the treatment of sharps, pathology or anatomical body parts)

Exception: Technology whose markings and label content are regulated as part of a government registration program.

An illustration may be used with a required instruction to clarify the intent but shall not replace the written instruction.

Warning statements and a clear explanation of warning symbols marked on the technology shall be provided in the manufacturer's operating manual or instructions for use.

Where NORMAL use involves the risk of exposure to ionizing or non-ionizing radiation, or handling of treatment chemicals, instruction shall be given on correct use and safety provisions. If any treatment chemical is specified or supplied by the technology manufacturer, the necessary information on its constituents and the correct disposal procedure shall also be given.

Compliance is determined by physical inspection.

4.4.2 *Technology ratings*

The manufacturer's operating manual or instructions for use shall include the following:

a) The types of waste, manufacturer's specified throughput per hour or capacity per cycle, specific heat criteria (if applicable), required non-integral pre- post-treatment (if any), and holding time of the waste intended to be treated by the technology;

b) The equipment supply voltage or voltage range, frequency or frequency range, and power or current rating;

c) The equipment fuel supply (if applicable), including fuel type (e.g. natural gas, propane, No. 2 heating oil), manifold pressure (gas fired equipment), and gallons per hour (fuel oil equipment);

d) Manufacturer's specified rate, quality and pressure of inlet steam (if applicable);

e) A description of all electrical input, fuel gas, fuel oil, steam and chemical feed connections;

f) A statement of the range of environmental conditions for which the technology is designed.

g) Manufacturer's specified rate and quality of treatment media

Compliance is determined by physical inspection.

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4.4.3 *Equipment installation*

The manufacturer's operating manual or instructions for use shall include the following installation instructions, as appropriate:

a) Assembly, location, leveling and mounting requirements;

b) Instruction for grounding;

c) Connections to the power supply;

d) Connections to the fuel supply;

e) Ventilation requirements;

f) Requirements for special services, for example air, cooling liquid;

g) Instruction on verifying operation of safety features and controls, for example, interlocks, guards; pressure relief valves;

h) Instructions on integration with other equipment.

The installer shall be made aware that equipment may be the source of electromagnetic energy and that it should not be installed in the vicinity of equipment susceptible to such energy.

Exception: Equipment that does not contain an electrical component operating at a frequency of greater than 10kHz.

Compliance is determined by physical inspection.

4.4.4 *Technology operation*

Instructions for use shall include:

a) Identification of operating controls and their use in all operating modes;

b) Selection / rejection criteria for loading and/or feeding technology;

c) Instructions for interrupting and restarting equipment operation, for example, when a load needs to be cleared;

d) Identification of manufacturer's recommended personal protective equipment (PPE)[3].

e) Identification of the point in the process where the load is considered treated waste;

Exception: Not required if instruction is provided to reprocess entire waste load if the treatment is interrupted for any reason.

f) Instructions for interconnection to accessories, monitoring devices and other equipment, including indication of suitable accessories, detachable parts and any special materials, where applicable;

[3] *This requirement shall not be interpreted to mean that the manufacturer is responsible for identifying all possible types of PPE.*

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g) Specification of limits for intermittent operation, where applicable;

h) An explanation of symbols used on the technology;

i) Instructions for replacement of consumable materials, if applicable;

j) Instructions for cleaning, if applicable,

k) The following statement or equivalent: *It is recommended that the user operating instructions shall be incorporated, as appropriate, in the facility's waste management plan.*

l) The manufacturer's recommended method and frequency of field-testing to verify continued operation as intended.

Exception: Where parametric monitoring is provided in accordance with 5.1.5, the instructions shall include:

1. Depiction, purpose and use of monitoring devices including the critical operating parameter recording capability.
2. The range of normal operation and information on how to identify operation outside of that range.
3. Information on action to be taken when operation is observed outside normal range or in the event of a parametric control initiated shut-down.
4. Adjustment or calibration information and frequency, if appropriate.
5. The following or equivalent statement: ***CAUTION***. *Parametric controls are provided on this technology to ensure intended waste treatment. Do not tamper with controls or proper waste treatment may not occur.*

The instructions shall state that the technology shall not be used in a manner not specified by the manufacturer.

Compliance is determined by physical inspection.

4.4.5 *Technology maintenance*

The manufacturer shall provide instructions for the user concerning technology inspection and preventive maintenance. Such instructions shall specify that if the equipment is not equipped with devices to monitor the parameters of the treatment of medical waste, then the performance in routine operation shall be monitored at intervals recommended by the manufacturer, through tests utilizing bacterial spores indicated in Table 5.1 and conducted in accordance with 5.1.4.

Exception: Not required for single-use technology.

Compliance is determined by physical inspection.

5 Efficacy

5.1.1 General

Technologies shall comply with the following treatment criteria under the conditions described in Section 6 for three successive test loads as demonstrated through the use of the surrogate biological indicators described in 5.1.2:

a) Inactivation of a 6 Log_{10} or greater concentration of vegetative bacteria, fungi, lipophilic/hydrophilic viruses, parasites, and mycobacteria; and

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b) Inactivation of a 4 Log_{10} or greater concentration of *Geobacillus stearothermophilus* or *Bacillus atrophaeus* spores.

Exception: Suction canisters shall demonstrate inactivation of a 2 Log_{10} or greater concentration of the indicated spores.

Exception: Demonstration of compliance using biological indicators (5.1.2) is not required for technology that employs thermal degradation treatment of the entire waste load.

Inactivation is indicated by no visible growth of recovered cultured biological indicators, or QUANTITIATIVE REDUCTION in concentration of biological indicator organisms or, for THERMAL DEGRADATION technology, complete reduction of the test load (5.1.3) to DUST, VITRIFIED SOLID or a dust / vitrified solid combination.

NOTE: In addition to inactivation, some jurisdictions require additional steps (e.g. grinding of waste until unrecognizable) before waste is considered to be completely treated.

Compliance is determined by test (5.1.4) using a test load (5.1.3) and, except for thermal degradation technology, biological indicators (5.1.2).

5.1.2 Biological Indicators

Mycobacterial species and spores prepared from species in Table 5.1 shall serve as biological indicators to determine compliance with 5.1.1. Organisms shall be obtained from the American Type Culture Collection (ATCC) or a culture collection from a member of the World Federation of Culture Collections.[4]

The biological indicators shall be capable of being introduced directly into the test load or in a manner (e.g. via spore strips or vials containing cell or spore suspensions) that will not affect the indicator's viability or the evaluation of the efficacy of the treatment process. The concentration shall be sufficient to ensure a quantifiable indicator recovery and determination of inactivation when tested in accordance with 5.1.4.

Biological indicators shall be capable of being recovered from the test load via methodology that yields data that are statistically correct (e.g. sample collection, number of samples/test, number of colony forming units / plate). Microbial culturing methods as described in the most recent edition of the American Society for Microbiology's *Manual of Clinical Microbiology* shall be used.

Biological indicators shall be used in accordance with their manufacturer's instructions.

Table 5.1
Surrogate Biological Indicators

Microbial Group	Surrogate Biological Indicators
Bacteria	*Mycobacterium terrae* (ATCC 15755) *Mycobacterium bovis* (BCG, ATCC 35743)
Fungi	
Parasites	
Lipophilic/Hydrophilic Viruses	
Mycobacteria	
Bacterial Spores	*Spores of:* *Geobacillus stearothermophilus* (ATCC 7953) *Bacillus atrophaeus (ATCC 9372)*

NOTE: The ATCC numbers provided in this table are current as of publication. The most current ATCC numbers shall be used. The mycobacterial species are surrogates for vegetative bacteria, fungi, parasites, and lipophilic/hydrophilic viruses. Inactivation of the specified concentrations of the mycobacterial species is equivalent to the inactivation of a similar concentration of vegetative

[4] *WFCC-MIRCEN World Data Centre for Microorganisms c/o National Institute of Genetics 1111 Yata, Mishima, Shizuoka 411-8540 JAPAN.*

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cells of the other microorganisms. However, while efficacy tests with mycobacteria and Bacillus spores are specified, vegetative cells of microorganisms from one or more of the other microbial groups may be employed as biological indicators.

5.1.3 Test Load

The test load shall be composed of actual or simulated medical waste, predetermined in weight, volume or other suitable measure to conform to the requirements of 5.1.3.1.

Exception: The test load for suction canisters shall be as indicated in section 5.1.3.2.

5.1.3.1 Test *Load - Characteristics*

Depending on the treatment process and biological inactivation mechanisms utilized, protocols for loading technology shall be devised by the manufacturer and shall specifically delineate or incorporate, as applicable:

a) Waste compositions that typify actual waste to be processed by the system as described in terms relating both to the throughput (weight or volume per unit of time or per timed cycle), as well as other applicable physical properties, such as specific heat, thermal conductivity distributions of organic and non-organic, liquid and solid matter.

b) Waste types that typify the rated treatment capacity conditions as indicated in the manufacturer's operating manual or instructions for use;

c) Physical and/or chemical conditions comparable to actual use (e.g., process time, temperature, chemical concentration, pH, humidity, load density, and load volume);

d) Dilution and neutralization methods that do not affect organism viability;

NOTE: Care should be taken when handling a test load inoculated with biological indicators. Proliferation of some of these microorganisms can cause adverse health effects and adverse environmental emissions if dealt with improperly, and should be handled only by trained laboratory personnel.

5.1.3.2 Test Load – Suction Canisters

Suction canisters shall be tested utilizing concentrations of 100% whole blood, 100% serum, or any combination thereof (calf, sheep or goat which has been pre-tested to ensure that it does not harbor zoonotic agents).

Protocols for loading suction canisters shall be devised by the manufacturer and shall specifically delineate or incorporate:

a) Sufficient volume to conform with 6.3.13;

b) The inoculated load shall not be treated in any manner that would preclude its clotting nor should the test blood suspensions be agitated during the treatment period;

Exception: The anti-clotting agent heparin may be used if it can be demonstrated by laboratory test that it neither increases nor decreases efficacy performance or that its effects may be quantified and accommodated such that compliance with 5.1.1 can be readily determined.

c) Demonstration that dilution and neutralization methods do not affect the viability of the biological indicators.

5.1.4 Efficacy Testing - General

The technology shall be completely assembled, installed and operated under NORMAL conditions. Scaling is permissible if all parties agree that a full-scale load or operation site is not available, the adjustment in

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scale doesn't increase or decrease efficacy performance, yields reproducible results and does not render the results of this test inconclusive. The technology shall be tested in accordance with 5.1.4.1, 5.1.4.2 or 5.1.4.3 as appropriate.

When applicable, biological indicators shall be introduced directly or via carriers throughout the test load as specified in 5.1.3. Where used, a minimum of three carriers is required to assure a representative assessment of the treatment process efficacy.

Tests that are interrupted shall be considered as void and discontinued. Additional tests shall be conducted to achieve the required minimum repetition of test loads. In such cases, new sample(s) shall be used if the manufacturer's instructions indicate that the technology is for single-use only.

5.1.4.1 Efficacy Testing – All Technology Except Suction Canisters and Thermal Degradation Technology

The technology shall be operated under the most adverse NORMAL load condition(s) for a total of three separate test loads.

For technology that maintains the integrity of the carriers of the biological indicators (e.g., ampules, plastic strips) inactivation shall be determined in accordance with 5.1.1 and 5.1.2.

For technology that does not ensure or provide for the integrity of the carriers of the biological indicator (e.g., chemical inactivation or grinding) or where the test load is directly inoculated, inactivation shall be determined via quantitative reduction as specified in Steps 1 and 2 below:

Step 1 - Control

a) Introduce test load (5.1.3.1) with $Log_{10}IC$ concentration to the technology.

b) Operate technology under NORMAL operating conditions without the addition of the treatment agent (e.g., heat, chemicals) until entire test load is completed.

c) Collect test load to recover the biological indicator organisms from the test load.

d) Plate recovered organisms and quantify $Log_{10}RC$

e) Measured $Log_{10}RC$ shall be at least the concentration specified in 5.1.1. Minimum $Log_{10}I$ concentration for Step 2 shall be calculated by the equation in Table 5.2:

Step 2 - Test

a) Inoculate the test load with the minimum $Log_{10}I$ concentration confirmed as sufficient in Step 1.

b) Operate technology under NORMAL operating conditions.

c) Collect and wash a representative sample of the test load to recover the biological indicator organisms from the test load.

d) Plate recovered organisms and quantify $Log_{10}RT$

e) From data collected from Step 1 and Step 2, the QUANTITATIVE REDUCTION is calculated by employing the equation in Table 5.2:

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Table 5.2
Quantitative Reduction Calculations [a]

Control	Test
$Log_{10}RC = Log_{10}I - Log_{10}NR$	$QR = Log_{10}RC - Log_{10}RT$
QR is the quantitative reduction $Log_{10}RC$ is the number of viable organisms recovered in the non-treated processed test load . $Log_{10}I$ is the number of viable organisms introduced into the test load . $Log_{10}NR$ is the number of unrecovered organisms remaining in the non-treated processed test load. *$Log_{10}NR$ represents an accountability factor for microbial loss.* $Log_{10}RT$ is the number of viable organisms recovered in the non-treated processed test load.	
[a]. *All quantities are in cfu/g of test load or in cfu/ml if load is a liquid.*	

5.1.4. 2 Efficacy Testing – Suction Canisters

QUANTITATIVE REDUCTION shall be demonstrated in three suction canister samples when tested as outlined below in Steps 1 and 2:

Step 1 - Control

a) Introduce test load (5.1.3.2) with $Log_{10}IC$ concentration to the suction canister.

b) Agitate to ensure the even distribution of the biological indicator;

c) Collect and plate recovered organism suspensions. Samples shall be withdrawn from the center and periphery (one sample from each of the two sites) of the inoculated test load at the following time intervals; 0 hr, 4 hr, 8 hr, 24 hr, 48 hr, and 72 hr or to such time that the criteria in section 5.1.1 are achieved; and

d) Measured $Log_{10}RC$ shall be at least the concentration specified in 5.1.1. Minimum $Log_{10}I$ concentration shall be calculated by the equation in Table 5.2.

Step 2 - Test

a) Inoculate the test load with the minimum $Log_{10}I$ concentration confirmed as sufficient in Step 1;

b) Operate suction canister under NORMAL operating conditions.

c) Collect and plate recovered organisms at the time intervals described in Step 1 c) and quantify $Log_{10}RT$;

e) From data collected from Step 1 and Step 2, the QUANTITATIVE REDUCTION is calculated by employing the equation in Table 5.2:

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5.1.4.3 *Efficacy Testing – Thermal Degradation Technology*

The technology shall be operated under the most adverse NORMAL load conditions for a total of three test loads.

The remains of the test load shall be collected and visually examined

5.1.5 Parametric Monitoring

Devices may be provided to monitor the parameters of the treatment process, supplementing or replacing field monitoring by use of biological indicators. Such parameters shall be demonstrated to correlate with the criteria in section 5.1.1 and the monitoring devices shall accurately indicate the parameters. To demonstrate that this correlation has been established, parametric monitoring devices shall:

a) Correlate with biological indicator inactivation through documented efficacy studies that quantitatively link microbial inactivation with the parameter(s) being monitored by the monitoring devices;

b) Accurately monitor the treatment agent and/or treatment conditions, as applicable (i.e.. provide the limiting conditions that influence accurate monitoring); and

c) Be appropriate for the conditions that exist under operational circumstances.

Demonstration of the above components may allow the use of parametric monitoring for auditing treatment conditions or alerting the equipment operator of equipment malfunction or abnormal behavior. For the use of parametric monitoring to substitute or replace biological indicator inactivation tests. the parametric monitoring devices are required to additionally:

a) Have tamper-proof (i.e., cannot be altered by the operator) controls or automatic factory-set controllers;

b) Be integrated with the equipment to automatically shut-down or no longer accept or expel waste if treatment conditions are not maintained at specified parameters;

c) Be integrated with the equipment to automatically shut-down or no longer accept or expel waste unless calibrated periodically as specified by the manufacturer's instructions (see 4.4.4 m) and

d) Provide the means for a tamper-proof (i.e., cannot be altered by the operator) recording of all critical operating parameters (see 4.4.4 m)

Compliance is determined by physical inspection.

5.1.6 Efficacy Controls and Monitoring

Equipment shall be provided with the means to monitor operation and to provide audible or visual indication to the operator that:

a) Required treatment media is low or needs to be replaced; and

b) The treatment process was not completed.

Compliance is determined by physical inspection.

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6 Conditions for Tests

6.1 *General*

All tests are TYPE TESTS to be carried out on samples of technology or representative sub-assemblies

Compliance is checked by carrying out all applicable tests. Tests are carried out under:

a) Reference test conditions (see 6.3);

b) Fault conditions (see 6.4).

6.2 *Sequence of tests*

The sequence of tests is optional unless otherwise specified. The technology under test shall be carefully inspected after each test. If the result of a test causes doubt whether any earlier tests would have been passed if the sequence had been reversed, these earlier tests shall be repeated. Where tests under fault conditions may be destructive, these tests may follow those under reference test conditions.

6.3 *Reference test conditions*

6.3.1 *Environmental conditions*

The test location shall be within the following environmental conditions:

a) A temperature of 15°C to 35°C;

b) A relative humidity of not more than 75%;

c) An air pressure of 75 kPa to 106 kPa;

Exception: Where the manufacturer's instructions (see 4.4.2 f) specify NORMAL operating conditions outside the ranges cited above.

The environmental conditions shall be stable during tests. The presence of hoarfrost, dew, percolating water, rain, and solar irradiation are not considered to represent stable conditions.

Unless otherwise specified, references to water are to refer to sterile buffered dilution water, or water of equal purity.

6.3.2 *State of technology*

Unless otherwise specified, tests shall be carried out on the technology assembled for NORMAL use and under the least favorable combination of the conditions given in 6.3.3 to 6.3.13.

When dimensions or mass make it unsuitable to carry out particular tests on a complete technology sample, tests on sub-assemblies are allowed, provided it is verified that the assembled equipment will be in accordance with this standard.

6.3.3 *Position of technology*

The technology shall be in any position of NORMAL use and with any ventilation unimpeded.

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6.3.4 *Accessories*

Accessories and operator interchangeable parts available from or recommended by the manufacturer for use with the technology under test shall be either connected or not connected.

6.3.5 *Covers and removable parts*

Covers or parts that are removable without the use of a tool shall be removed or not removed. Covers that do not require the use of a tool for removal need not be removed if they have interlock systems meeting the requirements of 6.21.7.

6.3.6 *Equipment Power supply*

The following requirements apply:

a) The supply voltage shall be between 90% and 110% of any rated supply voltage for which the equipment is set or, if the equipment is rated for a greater fluctuation, then any supply voltage within the fluctuation range;

b) The frequency shall be any rated frequency;

c) Equipment rated for both a.c. and d.c. shall be connected to an a.c. or d.c. supply;

d) Equipment rated for d.c. or single-phase a.c. supply shall be connected both with normal and reverse polarity;

e) Where the means of connection permits reversal, battery operated equipment shall be connected with both reverse and normal polarity.

6.3.7 *Equipment Input voltage*

Input voltage shall be set to any voltage within the rated voltage range.

6.3.8 *Equipment Grounding terminals*

Equipment grounding terminals, if any, shall be connected to ground.

6.3.9 *Controls*

Controls that the operator adjusts by hand shall be set to any position except that:

a) Mains selection devices shall be set to the correct value;

b) Combinations of settings shall not be made if they are prohibited by the manufacturer by marking on the equipment (see 4.2).

6.3.10 *Integration*

The technology shall be integrated with associated equipment for its intended purpose, or stand-alone.

6.3.11 *Load on motors*

Load conditions of motor-driven parts of equipment shall be in accordance with the intended purpose.

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6.3.12 *Duty cycle*

Technology for short-term or intermittent operation shall be operated for the longest period and have the shortest recovery period consistent with the manufacturer's instructions.

6.3.13 *Loading and filling*

Technology shall be loaded (filled) with the manufacturer specified maximum quantity of waste (4.4.2 a.) and / or lesser quantity, including not loaded (empty) to create the most adverse NORMAL operating condition.

NOTE — if the specified material would cause a hazard during test, another material may be used provided that it can be shown that the result of the test is not affected.

6.4 *Testing in SINGLE FAULT CONDITION*

6.4.1 *General*

The following requirements apply:

a) Examination of the technology will generally show the fault conditions which are liable to result in incomplete treatment and which, therefore, shall be applied;

b) Fault tests shall be made except where it is demonstrated that incomplete treatment will not arise from a particular fault condition;

c) The technology shall be operated under the least favorable combination of reference test conditions (see 6.3). These combinations may be different for different faults and they should be recorded for each test;

6.4.2 *Application of fault conditions*

Fault conditions shall be applied only one at a time and shall be applied in turn in the most convenient order. Multiple simultaneous faults shall not be applied unless they are a consequence of an applied fault.

After each application of a fault condition, the technology or representative sub-assembly shall pass the applicable tests of Section 5.

6.4.3 *Duration of tests*

6.4.3.1 The technology shall be operated until further change as a result of the applied fault is determined irrelevant. Each test is normally limited to 1 h since any secondary fault arising from a SINGLE FAULT CONDITION will usually manifest itself within that time.

6 4.4 *Compliance*

6.4.4.1 *Compliance is checked as specified in Sections 5.*

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APPENDIX I

ECONOMIC ANALYSIS FOR CENTRAL MEDICAL WASTE TREATMENT FACILITY

Tianjin Medical Waste Treatment Facility
Facility Construction/Installation Capital and Annualized Costs

Cost Item	(PRC-made)		**Buildings/Treatment Units**
Direct Cost	(in $US, US $1.00 = RMB **8.00**		)
Facility Construction		**Unit Price**	$2,250,000
Wastewater Treatment Plant		**Unit Price**	$288,750
Shredding/Disinfection Unit		**Unit Price**	$1,283,000
		Total Facility Cost	**$3,821,750**
		Annualized Costs at 5% of Total Cost	**$191,088**

Wastewater Treatment Plant Installation		
Purchased Equipment (PE)	**Unit Price**	$288,750
	Installation Cost	$0
	Total Plant Cost	**$288,750**
	Annualized Costs at 10% of Total Cost	**$28,875**

(Source: Data provided by DL)

Tianjin Medical Waste Treatment Facility

Capital and Annual Costs for Transport Vehicles, Collection Containers, and Consumables

PRC-made Equipment				
Cost Item			Vehicles	Containers
Direct Cost				
	Purchased Equipment (PE)	Unit Price	$14,000.00	$250.00
		Units Required	20	300
		Unit Price	$18,750.00	$12.50
		Units Required	6	5,250
		Purchased Equipment	$392,500	$140,625
		Total Purchased Equipment	$533,125	
	Annual Costs	Disinfectant	$1,425	
		Fuels	$3,750	
		Maintenance	$414,000	Vehicle/Container and Facility I
		Labor	$112,500	Administrative and Technical S
		Electricty	$140,910	
		Deodorizer	$21,840	US made
		Steam	$79,279	
		Landfill charges	$100,185	
		Overhead, Insurance, Tax	$87,389	
		Total annualized Costs	$961,278	

(Source: Data provided by DL)

Tianjin Medical Waste Treatment Facility
Annual Costs for Waste Handling and Disposal

Cost Item			
Direct Cost	(in $US, US $1 = RMB $8.27)		
	Waste Handling and Disposal	**Unit Price (ton)**	$8.75
		Tons	10,920
	Landfill Pull charge	**Unit Price (pull)**	$50.00
		# Pulls	927
	Annualized Costs		**$141,900**

[(26300 ton-yr/ density or 200kg/m3) * (1-0.975) or 97.5% volume reduction]

(Data source: Shanghai DL)

Tianjin Medical Waste Treatment Facility
Investment Summary

(All Cost Value x US $1,000)

Item	Value
Facility	$2,250.00
Vehicle	$392.50
Container	$140.63
Waste Water Plant	$288.75
Shredding/Disinfection Unit	$1,283.00
Capitalized Interest	$188.71
Total Investment	**$4,543.59**

Item	Value	Interest Allocation	Total
Facility	$2,250.00	$97.50	$2,347.50
Equipment			
Vehicle	$392.50	$17.01	$409.51
Container	$140.63	$6.09	$146.72
Waste Water Plant	$288.75	$12.51	$301.26
Shredding/Disinfection Unit	$1,283.00	$55.60	$1,338.60
Capitalized Interest	$188.71		
Total Investment	**$4,543.59**		**$4,543.59**

Tianjin Medical Waste Treatment Facility
Depreciation Schedule (Value x US $1,000)

	Item	Life Span	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
	Year		2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
1	Facility																					
	Acquisition Cost	10	2,250.00	2,250.00	2,250.00	2,250.00	2,250.00	2,250.00	2,250.00	2,250.00	2,250.00	2,250.00		-	-	-	-	-	-	-	-	-
	Capitalized Interest		97.50	97.50	97.50	97.50	97.50	97.50	97.50	97.50	97.50	97.50		-	-	-	-	-	-	-	-	-
	Replacement & Improvement												3,023.82	3,023.82	3,023.82	3,023.82	3,023.82	3,023.82	3,023.82	3,023.82	3,023.82	3,023.82
	Facility Subtotal		2,347.50	2,347.50	2,347.50	2,347.50	2,347.50	2,347.50	2,347.50	2,347.50	2,347.50	2,347.50	3,023.82	3,023.82	3,023.82	3,023.82	3,023.82	3,023.82	3,023.82	3,023.82	3,023.82	3,023.82
	Straight Line Depreciation																					
	Depreciation - Acquisition Cost		202.50	202.50	202.50	202.50	202.50	202.50	202.50	202.50	202.50	202.50	225.00	-	-	-	-	-	-	-	-	-
	Depreciation - Capitalized Interest		8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	9.75	-	-	-	-	-	-	-	-	-
	Depreciation - Replacement & Improvement												272.14	272.14	272.14	272.14	272.14	272.14	272.14	272.14	272.14	272.14
	Depreciation Subtotal		211.28	211.28	211.28	211.28	211.28	211.28	211.28	211.28	211.28	211.28	506.89	272.14	272.14	272.14	272.14	272.14	272.14	272.14	272.14	272.14
	Net Book Value - Facility		2,136.23	1,924.95	1,713.68	1,502.40	1,291.13	1,079.85	868.57	657.30	446.03	234.75	2,751.58	2,479.53	2,207.39	1,935.24	1,663.10	1,390.96	1,118.81	846.67	574.53	302.3828
2	Transportation Vehicle																					
	Acquisition Cost	10	382.50	382.50	382.50	382.50	382.50	382.50	382.50	382.50	382.50	382.50										
	Capitalized Interest		17.01	17.01	17.01	17.01	17.01	17.01	17.01	17.01	17.01	17.01										
	Replacement & Improvement												527.49	527.49	527.49	527.49	527.49	527.49	527.49	527.49	527.49	527.49
	Vehicle Subtotal		409.51	409.51	409.51	409.51	409.51	409.51	409.51	409.51	409.51	409.51	527.49	527.49	527.49	527.49	527.49	527.49	527.49	527.49	527.49	527.49
	Straight Line Depreciation																					
	Depreciation - Acquisition Cost		35.33	35.33	35.33	35.33	35.33	35.33	35.33	35.33	35.33	35.33	39.25									
	Depreciation - Capitalized Interest		1.53	1.53	1.53	1.53	1.53	1.53	1.53	1.53	1.53	1.53	1.70									
	Depreciation - Replacement & Improvement												47.47	47.47	47.47	47.47	47.47	47.47	47.47	47.47	47.47	47.47
	Depreciation Subtotal		36.86	36.86	36.86	36.86	36.86	36.86	36.86	36.86	36.86	36.86	86.42	47.47	47.47	47.47	47.47	47.47	47.47	47.47	47.47	47.47
	Net Book Value - Vehicle		372.65	335.80	298.94	262.08	225.23	188.37	151.52	114.66	77.81	40.95	439.06	391.59	344.12	296.64	249.17	201.69	154.22	106.75	59.27	11.80
3	Waste Collection Container	10																				
	Acquisition Cost		140.63	140.63	140.63	140.63	140.63	140.63	140.63	140.63	140.63	140.63										
	Capitalized Interest		6.09	6.09	6.09	6.09	6.09	6.09	6.09	6.09	6.09	6.09										
	Replacement & Improvement												188.99	188.99	188.99	188.99	188.99	188.99	188.99	188.99	188.99	188.99
	Container Subtotal		146.72	146.72	146.72	146.72	146.72	146.72	146.72	146.72	146.72	146.72	188.99	188.99	188.99	188.99	188.99	188.99	188.99	188.99	188.99	188.99
	Straight Line Depreciation																					
	Depreciation - Acquisition Cost		12.66	12.66	12.66	12.66	12.66	12.66	12.66	12.66	12.66	12.66	14.06									
	Depreciation - Capitalized Interest		0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.61									
	Depreciation - Replacement & Improvement												17.01	17.01	17.01	17.01	17.01	17.01	17.01	17.01	17.01	17.01
	Depreciation Subtotal		13.20	13.20	13.20	13.20	13.20	13.20	13.20	13.20	13.20	13.20	31.68	17.01	17.01	17.01	17.01	17.01	17.01	17.01	17.01	17.01
	Net Book Value - Container		133.51	120.31	107.10	93.90	80.70	67.49	54.29	41.08	27.88	14.67	157.31	140.30	123.29	106.28	89.27	72.26	55.25	38.24	21.24	4.23
4	Waster Water Plant																					
	Acquisition Cost	10	288.75	288.75	288.75	288.75	288.75	288.75	288.75	288.75	288.75	288.75										
	Capitalized Interest		12.51	12.51	12.51	12.51	12.51	12.51	12.51	12.51	12.51	12.51										
	Replacement & Improvement												388.06	388.06	388.06	388.06	388.06	388.06	388.06	388.06	388.06	388.06
	Plant Subtotal		301.26	301.26	301.26	301.26	301.26	301.26	301.26	301.26	301.26	301.26	388.06	388.06	388.06	388.06	388.06	388.06	388.06	388.06	388.06	388.06
	Straight Line Depreciation																					
	Depreciation - Acquisition Cost		25.99	25.99	25.99	25.99	25.99	25.99	25.99	25.99	25.99	25.99	28.88									
	Depreciation - Capitalized Interest		1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.25									
	Depreciation - Replacement & Improvement												34.93	34.93	34.93	34.93	34.93	34.93	34.93	34.93	34.93	34.93
	Depreciation Subtotal		27.11	27.11	27.11	27.11	27.11	27.11	27.11	27.11	27.11	27.11	35.05	34.93	34.93	34.93	34.93	34.93	34.93	34.93	34.93	34.93
	Net Book Value - Plant		274.15	247.04	219.92	192.81	165.69	138.58	111.47	84.35	57.24	30.13	323.01	288.08	253.15	218.23	183.31	148.38	113.45	78.53	43.60	8.68
5	Shredder/Disinfection Unit																					
	Acquisition Cost	10	1,283.00	1,283.00	1,283.00	1,283.00	1,283.00	1,283.00	1,283.00	1,283.00	1,283.00	1,283.00										
	Capitalized Interest		55.60	55.60	55.60	55.60	55.60	55.60	55.60	55.60	55.60	55.60										
	Replacement & Improvement												1,724.25	1,724.25	1,724.25	1,724.25	1,724.25	1,724.25	1,724.25	1,724.25	1,724.25	1,724.25
	Shredder/Disinfection Unit Subtotal		1,338.60	1,338.60	1,338.60	1,338.60	1,338.60	1,338.60	1,338.60	1,338.60	1,338.60	1,338.60	1,724.25	1,724.25	1,724.25	1,724.25	1,724.25	1,724.25	1,724.25	1,724.25	1,724.25	1,724.25
	Straight Line Depreciation																					
	Depreciation - Acquisition Cost		115.47	115.47	115.47	115.47	115.47	115.47	115.47	115.47	115.47	115.47	128.30									
	Depreciation - Capitalized Interest		5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.56									
	Depreciation - Replacement & Improvement												155.18	155.18	155.18	155.18	155.18	155.18	155.18	155.18	155.18	155.18
	Depreciation Subtotal		120.47	120.47	120.47	120.47	120.47	120.47	120.47	120.47	120.47	120.47	289.04	155.18	155.18	155.18	155.18	155.18	155.18	155.18	155.18	155.18
	Net Book Value - Shredder/Disinfection Unit		1,218.13	1,097.66	977.19	856.70	736.23	615.75	495.28	374.81	254.33	133.86	1,880.07	1,413.89	1,258.70	1,103.52	948.34	793.16	637.97	482.79	327.61	172.42
	Total Cost		4,543.59	4,543.59	4,543.59	4,543.59	4,543.59	4,543.59	4,543.59	4,543.59	4,543.59	4,543.59	5,852.60	5,852.60	5,852.60	5,852.60	5,852.60	5,852.60	5,852.60	5,852.60	5,852.60	5,852.60
	Total Depreciation		408.92	408.92	408.92	408.92	408.92	408.92	408.92	408.92	408.92	408.92	981.09	526.73	526.73	526.73	526.73	526.73	526.73	526.73	526.73	526.73
	Total Net Book Value		4,134.66	3,725.74	3,316.82	2,907.90	2,498.97	2,090.05	1,681.13	1,272.20	863.28	454.36	5,325.87	4,799.13	4,272.40	3,745.67	3,218.93	2,692.20	2,165.46	1,638.73	1,111.99	585.26

Note

1 Residual value for fixed assets: 10%

2 Depreciation formula: Capital investment * 90% / Life Span. Straight-line Depreciation

3 Life span: An asset's service life

4 For assets with 10-year life span, new set of equipment is required at 11th year, and new cost includes a 3% annual inflate rate based on original cost of equipment value

5 Capitalized Interest is charge on bank loan at 6.5% annual interest rate during 8-month construction period

6 Bank loan: $3,237 13 (70% of initial investment $4,354 68+Capitalized Interest $188 71)

7 Capitalized Interest=Principal*Interest Rate*Number of Periods $188.71

Tianjin Medical Waste Treatment Facility
Annual Cost Analysis (Value x US $1,000)

	Item	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Total	Per Year
	Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020		
1	Annual Waste processed (tons)	9,125	9,125	9,125	9,125	9,125	9,125	9,125	9,125	9,125	9,125	9,125	9,125	9,125	9,125	9,125	136,875.00	9,125.00
	Annual Waste processed (Kgs)	9,125,000	9,125,000	9,125,000	9,125,000	9,125,000	9,125,000	9,125,000	9,125,000	9,125,000	9,125,000	9,125,000	9,125,000	9,125,000	9,125,000	9,125,000	136,875,000.00	9,125,000.00
	Annual Inflation escalation		3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%		
	Processing fee / Kg $RMB	$ 2.40																
	Processing fee / Kg $US	$ 0.3000	$ 0.3000	$ 0.3000	$ 0.3000	$ 0.3000	$ 0.3000	$ 0.3000	$ 0.3000	$ 0.3000	$ 0.3000	$ 0.3000	$ 0.3000	$ 0.3000	$ 0.3000	$ 0.3000		
	Transportation fee / Kg $RMB	$ 0.75																
	Transportation fee / Kg $US	$ 0.0938	$ 0.0938	$ 0.0938	$ 0.0938	$ 0.0938	$ 0.0938	$ 0.0938	$ 0.0938	$ 0.0938	$ 0.0938	$ 0.0938	$ 0.0938	$ 0.0938	$ 0.0938	$ 0.0938		
2	Income																	
	Processing Income	2,737.50	2,737.50	2,737.50	2,737.50	2,737.50	2,737.50	2,737.50	2,737.50	2,737.50	2,737.50	2,737.50	2,737.50	2,737.50	2,737.50	2,737.50	41,062.50	2,737.50
	Transporation Income	855.93	855.93	855.93	855.93	855.93	855.93	855.93	855.93	855.93	855.93	855.93	855.93	855.93	855.93	855.93	12,838.95	855.93
	Other Income	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Total Income	**3,593.43**	**3,593.43**	**3,593.43**	**3,593.43**	**3,593.43**	**3,593.43**	**3,593.43**	**3,593.43**	**3,593.43**	**3,593.43**	**3,593.43**	**3,593.43**	**3,593.43**	**3,593.43**	**3,593.43**	**53,901.45**	**3,593.43**
3	Cost Analysis																	
	Waste Collection & Transportation Exp																	
	Labor	47.81	49.24	50.72	52.24	53.81	55.42	57.09	58.80	60.56	62.38	64.25	66.18	68.17	70.21	72.32	889.21	59.28
	Vehicle Fuels	11.25	11.59	11.94	12.29	12.66	13.04	13.43	13.84	14.25	14.68	15.12	15.57	16.04	16.52	17.02	209.24	13.95
	Container/Vehicle Disinfectant/Deodorizer	27.77	28.60	29.46	30.34	31.25	32.19	33.15	34.15	35.17	36.23	37.31	38.43	39.59	40.77	42.00	516.40	34.43
	Waste Collection & Transportation Exp Subtotal:	**86.83**	**89.43**	**92.11**	**94.88**	**97.72**	**100.65**	**103.67**	**106.78**	**109.99**	**113.29**	**116.69**	**120.19**	**123.79**	**127.51**	**131.33**	**1,614.85**	**107.66**
	Waste Processing Exp																	
	Labor	38.25	39.40	40.58	41.80	43.05	44.34	45.67	47.04	48.45	49.91	51.40	52.95	54.54	56.17	57.86	711.41	47.43
	Material	83.75	86.26	88.85	91.52	94.26	97.09	100.00	103.00	106.09	109.27	112.55	115.93	119.41	122.99	126.68	1,557.66	103.84
	Utility/Steam	220.19	226.79	233.60	240.61	247.82	255.26	262.92	270.80	278.93	287.30	295.92	304.79	313.94	323.36	333.06	4,095.28	273.02
	Waste Processing Exp Subtotal:	**342.19**	**352.45**	**363.03**	**373.92**	**385.14**	**396.69**	**408.59**	**420.85**	**433.47**	**446.48**	**459.87**	**473.67**	**487.88**	**502.52**	**517.59**	**6,364.34**	**424.29**
	Waste Disposal:	**141.90**	**146.16**	**150.54**	**155.06**	**159.71**	**164.50**	**169.44**	**174.52**	**179.75**	**185.15**	**190.70**	**196.42**	**202.32**	**208.39**	**214.64**	**2,639.19**	**175.95**
	Operating & Maint. Expense																	
	Equipment Maint. Labor	9.56	9.85	10.14	10.45	10.76	11.08	11.42	11.76	12.11	12.47	12.85	13.23	13.63	14.04	14.46	177.81	11.85
	Equipment Maint.Material	272.63	280.80	289.23	297.90	306.84	316.05	325.53	335.29	345.35	355.71	366.39	377.38	388.70	400.36	412.37	5,070.53	338.04
	Facility Maint.	112.50	115.88	119.35	122.93	126.62	130.42	134.33	138.36	142.51	146.79	151.19	155.73	160.40	165.21	170.17	2,092.38	139.49
	Vehicle Maintenance (2% of OC)	7.85	8.09	8.33	8.58	8.84	9.10	9.37	9.65	9.94	10.24	10.55	10.87	11.19	11.53	11.87	146.00	9.73
	Vehicle Insurance & Registration Fee (15% of OC	58.88	60.65	62.47	64.34	66.27	68.26	70.31	72.42	74.59	76.83	79.13	81.50	83.95	86.47	89.06	1,095.10	73.01
	Wastewater Plant Maint.	28.88	29.74	30.63	31.55	32.50	33.47	34.48	35.51	36.58	37.68	38.81	39.97	41.17	42.40	43.68	537.04	35.80
	Insurance	178.25	183.59	189.10	194.77	200.62	206.63	212.83	219.22	225.80	232.57	239.55	246.73	254.13	261.76	269.61	3,315.16	221.01
	Property Tax	178.25	183.59	189.10	194.77	200.62	206.63	212.83	219.22	225.80	232.57	239.55	246.73	254.13	261.76	269.61	3,315.16	221.01
	Other Overhead - Contingency	87.39	90.01	92.71	95.49	98.36	101.31	104.35	107.48	110.70	114.02	117.44	120.97	124.60	128.33	132.18	1,625.34	108.36
	Depreciation Expense	408.92	408.92	408.92	408.92	408.92	408.92	408.92	408.92	408.92	408.92	981.09	526.73	526.73	526.73	526.73	7,177.26	478.48
	Tax and Licenses	113.59	117.00	120.51	124.12	127.85	131.68	135.63	139.70	143.89	148.21	152.66	157.24	161.95	166.81	171.82	2,112.65	140.84
	(Gain)/Loss on disposal of Fixed Assets.																	
	Operating & Maint. Expense Subtotal:	**1,456.68**	**1,488.11**	**1,520.49**	**1,553.84**	**1,588.18**	**1,623.56**	**1,660.00**	**1,697.53**	**1,736.19**	**1,776.01**	**2,389.19**	**1,977.08**	**2,020.59**	**2,065.40**	**2,111.56**	**26,664.44**	**1,777.63**
	General Administrative Expense																-	-
	Management Labor	16.88	17.39	17.91	18.45	19.00	19.57	20.16	20.76	21.38	22.02	22.69	23.37	24.07	24.79	25.53		
	Other Overhead	67.50	69.52	71.61	73.75	75.97	78.25	80.59	83.01	85.50	88.07	90.71	93.43	96.23	99.12	102.09		
	General Administrative Expense Subtotal:	**84.38**	**86.91**	**89.51**	**92.20**	**94.96**	**97.81**	**100.75**	**103.77**	**106.88**	**110.09**	**113.39**	**116.80**	**120.30**	**123.91**	**127.63**	**1,569.29**	**104.62**
	Other Expense																	
	Interest Expense	**210.41**	**196.39**	**182.36**	**168.33**	**154.30**	**140.28**	**126.25**	**112.22**	**98.19**	**84.16**	**70.14**	**56.11**	**42.08**	**28.05**	**14.03**	**1,683.30**	**112.22**
4	Total Annual Expense	2,322.38	2,359.45	2,398.05	2,438.22	2,480.02	2,523.50	2,568.70	2,615.68	2,664.48	2,715.17	3,339.99	2,940.26	2,996.95	3,055.77	3,116.78	40,535.41	2,702.36
	Income Before Tax	1,271.05	1,233.98	1,195.38	1,155.21	1,113.41	1,069.93	1,024.73	977.75	928.95	878.26	253.44	653.17	596.48	537.66	476.65	13,366.04	891.07
	Income Tax	419.45	407.21	394.48	381.22	367.43	353.08	338.16	322.66	306.55	289.82	83.64	215.55	196.84	177.43	157.29	4,410.81	294.05
5	Net Income	851.60	826.77	800.90	773.99	745.98	716.85	686.57	655.09	622.40	588.44	169.80	437.62	399.64	360.23	319.36	8,955.23	597.02
	Profitability	24%	23%	22%	22%	21%	20%	19%	18%	17%	16%	5%	12%	11%	10%	9%	17%	
6	Principal Repayment	215.81	215.81	215.81	215.81	215.81	215.81	215.81	215.81	215.81	215.81	215.81	215.81	215.81	215.81	215.79	3,237.13	215.81
	Principal	3,237.13	3,021.32	2,805.51	2,589.70	2,373.89	2,158.08	1,942.27	1,726.46	1,510.65	1,294.84	1,079.03	863.22	647.41	431.60	215.79		
	Int	6.50%	6.50%	6.50%	6.50%	6.50%	6.50%	6.50%	6.50%	6.50%	6.50%	6.50%	6.50%	6.50%	6.50%	6.50%		
7	Interest Payment	210.41	196.39	182.36	168.33	154.30	140.28	126.25	112.22	98.19	84.16	70.14	56.11	42.08	28.05	14.03	1,683.30	112.22
8	Principal Balance at beginning of the year	3,237.13	3,021.32	2,805.51	2,589.70	2,373.89	2,158.08	1,942.27	1,726.46	1,510.65	1,294.84	1,079.03	863.22	647.41	431.60	215.79		
9	Principal Balance at the end of the year	3,021.32	2,805.51	2,589.70	2,373.89	2,158.08	1,942.27	1,726.46	1,510.65	1,294.84	1,079.03	863.22	647.41	431.60	215.79	0.00		
10	Fixed Expense	965.67	982.37	999.57	1,017.29	1,035.54	1,054.34	1,073.71	1,093.65	1,114.19	1,135.35	1,729.31	1,297.40	1,320.52	1,344.33	1,368.86		
11	Variable Expense	1,356.71	1,377.08	1,398.47	1,420.93	1,444.47	1,469.16	1,495.00	1,522.03	1,550.29	1,579.83	1,610.68	1,642.86	1,676.43	1,711.44	1,747.92		
12	Unit Expense/Ton	0.25	0.26	0.26	0.27	0.27	0.28	0.28	0.29	0.29	0.30	0.37	0.32	0.33	0.33	0.34		
13	Annual Medical Waste (Ton)	9,125	9,125	9,125	9,125	9,125	9,125	9,125	9,125	9,125	9,125	9,125	9,125	9,125	9,125	9,125		
14	Collection & Transportation Expense/Ton	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01		
15	Waste Processing Expense/Ton	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.05	0.05	0.05	0.05	0.05	0.05	0.06	0.06		
16	Waste Disposal/Ton	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02		

Note

1 All costs,except non cash items, are adjusted for average annual inflation rate 3%.
2 Annual waste estimated as 10,500,000 Kgs per year
3 Sales tax is calculated at 5% of annual income and other value-added tax is estimated at 11.55% of sale tax.
4 Income Tax is estimated at 33% and could be adjusted according to actual.
5 Charge Price per Kg = $3.76 RMB/Kg
6 Operational income: income from medical waste processing is calculated as Unit Price*Annual Kgs
7 Other income: none assumed
8 Labor cost includes fringe benefits.
9 Fixed Expense = Facility Maint.+ Vehicle Insurance & Registration Fee+Waste Water Plant Maint.+Insurance+Property Tax+Depreciation
10 Variable Expense = Total Annual Expense - Fixed Expense

ianjin Medical Waste Treatment Project
ncome Statement (Value x US $1,000)

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15
icome	3,593.43	3,593.43	3,593.43	3,593.43	3,593.43	3,593.43	3,593.43	3,593.43	3,593.43	3,593.43	3,593.43	3,593.43	3,593.43	3,593.43	3,593.43
ther Income	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Less Discount and Return															
Total Income	**3,593.43**	**3,593.43**	**3,593.43**	**3,593.43**	**3,593.43**	**3,593.43**	**3,593.43**	**3,593.43**	**3,593.43**	**3,593.43**	**3,593.43**	**3,593.43**	**3,593.43**	**3,593.43**	**3,593.43**
ost Of Sales															
Waste Collection & Transportation Exp															
Labor	47.81	49.24	50.72	52.24	53.81	55.42	57.09	58.80	60.56	62.38	64.25	66.18	68.17	70.21	72.32
Vehicle Fuels	11.25	11.59	11.94	12.29	12.66	13.04	13.43	13.84	14.25	14.68	15.12	15.57	16.04	16.52	17.02
Disinfectant	27.77	28.60	29.46	30.34	31.25	32.19	33.15	34.15	35.17	36.23	37.31	38.43	39.59	40.77	42.00
Waste Collection & Transportation Exp Subtotal:	**86.83**	**89.43**	**92.11**	**94.88**	**97.72**	**100.65**	**103.67**	**106.78**	**109.99**	**113.29**	**116.69**	**120.19**	**123.79**	**127.51**	**131.33**
/aste Treatment Exp															
Labor	38.25	39.40	40.58	41.80	43.05	44.34	45.67	47.04	48.45	49.91	51.40	52.95	54.54	56.17	57.86
Material	83.75	86.26	88.85	91.52	94.26	97.09	100.00	103.00	106.09	109.27	112.55	115.93	119.41	122.99	126.68
Utility	220.19	226.79	233.60	240.61	247.82	255.26	262.92	270.80	278.93	287.30	295.92	304.79	313.94	323.36	333.06
Waste Treatment Exp Subtotal:	**342.19**	**352.45**	**363.03**	**373.92**	**385.14**	**396.69**	**408.59**	**420.85**	**433.47**	**446.48**	**459.87**	**473.67**	**487.88**	**502.52**	**517.59**
/aste Disposal	**141.90**	**146.16**	**150.54**	**155.06**	**159.71**	**164.50**	**169.44**	**174.52**	**179.75**	**185.15**	**190.70**	**196.42**	**202.32**	**208.39**	**214.64**
verhead Applied	1,456.68	1,488.11	1,520.49	1,553.84	1,588.18	1,623.56	1,660.00	1,697.53	1,736.19	1,776.01	2,389.19	1,977.08	2,020.59	2,065.40	2,111.56
Total Cost of Sales	**2,027.60**	**2,076.16**	**2,126.17**	**2,177.69**	**2,230.75**	**2,285.41**	**2,341.70**	**2,399.69**	**2,459.41**	**2,520.92**	**3,156.45**	**2,767.36**	**2,834.68**	**2,903.81**	**2,975.12**
ross Profit	**1,565.83**	**1,517.27**	**1,467.26**	**1,415.74**	**1,362.68**	**1,308.02**	**1,251.73**	**1,193.74**	**1,134.02**	**1,072.51**	**436.98**	**826.07**	**758.85**	**689.62**	**618.31**
perating Expense															
Equipment Maint. Labor	9.56	9.85	10.14	10.45	10.76	11.08	11.42	11.76	12.11	12.47	12.85	13.23	13.63	14.04	14.46
Equipment Maint. Material	272.63	280.80	289.23	297.90	306.84	316.05	325.53	335.29	345.35	355.71	366.39	377.38	388.70	400.36	412.37
Facility Maint.	112.50	115.88	119.35	122.93	126.62	130.42	134.33	138.36	142.51	146.79	151.19	155.73	160.40	165.21	170.17
Vehicle Maintenance	7.85	8.09	8.33	8.58	8.84	9.10	9.37	9.65	9.94	10.24	10.55	10.87	11.19	11.53	11.87
Vehicle Insurance and Registration	58.88	60.65	62.47	64.34	66.27	68.26	70.31	72.42	74.59	76.83	79.13	81.50	83.95	86.47	89.06
Wastewater Plant Maint.	28.88	29.74	30.63	31.55	32.50	33.47	34.48	35.51	36.58	37.68	38.81	39.97	41.17	42.40	43.68
Insurance	178.25	183.59	189.10	194.77	200.62	206.63	212.83	219.22	225.80	232.57	239.55	246.73	254.13	261.76	269.61
Property Tax	178.25	183.59	189.10	194.77	200.62	206.63	212.83	219.22	225.80	232.57	239.55	246.73	254.13	261.76	269.61
Other Overhead	67.39	90.01	92.71	95.49	98.36	101.31	104.35	107.48	110.70	114.02	117.44	120.97	124.60	128.33	132.18
Depreciation Expense	408.92	408.92	408.92	408.92	408.92	408.92	408.92	408.92	408.92	408.92	981.09	526.73	526.73	526.73	526.73
Tax and Licenses	113.59	117.00	120.51	124.12	127.85	131.68	135.63	139.70	143.89	148.21	152.66	157.24	161.95	166.81	171.82
(Gain)/Loss on Disposal of FA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Overhead Applied	-1,456.68	-1,488.11	-1,520.49	-1,553.84	-1,588.18	-1,623.56	-1,660.00	-1,697.53	-1,736.19	-1,776.01	-2,389.19	-1,977.08	-2,020.59	-2,065.40	-2,111.56
General Administrative Expense	84.38	86.91	89.51	92.20	94.96	97.81	100.75	103.77	106.88	110.09	113.39	116.80	120.30	123.91	127.63
Operating Expense Subtotal:	84.38	86.91	89.51	92.20	94.96	97.81	100.75	103.77	106.88	110.09	113.39	116.80	120.30	123.91	127.63
come from operation	1,481.46	1,430.37	1,377.74	1,323.54	1,267.71	1,210.21	1,150.98	1,089.97	1,027.14	962.42	323.58	709.28	638.56	565.71	490.68
ther Expenses and Losses															
Interest Expenses	210.41	196.39	182.36	168.33	154.30	140.28	126.25	112.22	98.19	84.16	70.14	56.11	42.08	28.05	14.03
come Before Income Tax	1,271.05	1,233.98	1,195.38	1,155.21	1,113.41	1,069.93	1,024.73	977.75	928.95	878.26	253.44	653.17	596.48	537.66	476.65
come Tax	419.45	407.21	394.48	381.22	367.43	353.08	338.16	322.66	306.55	289.82	83.64	215.55	196.84	177.43	157.29
et Income For the Year	851.60	826.77	800.90	773.99	745.98	716.85	686.57	655.09	622.40	588.44	169.80	437.62	399.64	360.23	319.36
	-	-	-	-	-	-	-	-	-	-	-	0.00	-	-	-

Tianjin Medical Waste Treatment Project
Balance Sheet (Value x US $1,000)

Assets

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15
Current Assets															
Cash	745.26	1,765.14	2,759.16	3,726.26	4,665.36	5,575.32	6,455.00	7,303.20	8,118.71	8,900.26	3,982.74	4,731.28	5,441.84	6,113.00	6,743.30
Accounts Receivable	299.45	299.45	299.45	299.45	299.45	299.45	299.45	299.45	299.45	299.45	299.45	299.45	299.45	299.45	299.45
Note Receivable	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Inventory	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Material	32.95	33.94	34.96	36.00	37.08	38.20	39.34	40.52	41.74	42.99	44.28	45.61	46.98	48.39	49.84
Total Current Assets	1,077.66	2,098.53	3,093.57	4,061.71	5,001.89	5,912.97	6,793.79	7,643.17	8,459.90	9,242.70	4,326.47	5,076.34	5,788.27	6,460.84	7,092.59
Long-Term Investment															
Property, Plant and Equipment															
Construction in Progress	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Acquisition Cost	4,543.59	4,543.59	4,543.59	4,543.59	4,543.59	4,543.59	4,543.59	4,543.59	4,543.59	4,543.59	10,396.19	10,396.19	10,396.19	10,396.19	10,396.19
Accumulated Depreciation	(408.92)	(817.85)	(1,226.77)	(1,635.69)	(2,044.61)	(2,453.54)	(2,862.46)	(3,271.38)	(3,680.30)	(4,089.23)	(5,070.32)	(5,597.05)	(6,123.79)	(6,650.52)	(7,177.26)
Total Property, Plant and Equipment	4,134.66	3,725.74	3,316.82	2,907.90	2,498.97	2,090.05	1,681.13	1,272.20	863.28	454.36	5,325.87	4,799.13	4,272.40	3,745.67	3,218.93
Intangible Asset															
Land Lease-Permit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Amortization	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Other Intangible	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Intangible Assets	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Assets	**5,212.33**	**5,824.27**	**6,410.39**	**6,969.61**	**7,500.86**	**8,003.02**	**8,474.91**	**8,915.38**	**9,323.18**	**9,697.06**	**9,652.34**	**9,875.48**	**10,060.67**	**10,206.50**	**10,311.53**

Liability and Stockholders' Equity

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15
Current Liability															
Account Payable	32.95	33.94	34.96	36.00	37.08	38.20	39.34	40.52	41.74	42.99	44.28	45.61	46.98	48.39	49.84
Note Payable	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Accrued Interest	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Income Tax Payable	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Accrued Wages, Salaries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Deposits Received from Customers	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Current Liabilities	32.95	33.94	34.96	36.00	37.08	38.20	39.34	40.52	41.74	42.99	44.28	45.61	46.98	48.39	49.84
Long-Term Debt	3,021.32	2,805.51	2,589.70	2,373.89	2,158.08	1,942.27	1,726.46	1,510.65	1,294.84	1,079.03	863.22	647.41	431.60	215.79	0.00
Total Liabilities	3,054.27	2,839.45	2,624.66	2,409.89	2,195.16	1,980.47	1,765.80	1,551.17	1,336.58	1,122.02	907.50	693.02	478.58	264.18	49.84
Stockholder's Equity															
Capital Stock	1,306.46	1,306.46	1,306.46	1,306.46	1,306.46	1,306.46	1,306.46	1,306.46	1,306.46	1,306.46	1,306.46	1,306.46	1,306.46	1,306.46	1,306.46
Additional Paid-in Capital	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Retained Earnings															
Appropriated Earnings	127.74	251.76	371.89	487.99	599.89	707.41	810.40	908.66	1,002.02	1,090.29	1,115.76	1,181.40	1,241.35	1,295.38	1,343.28
Unappropriated Earnings	723.86	1,426.61	2,107.38	2,765.27	3,399.36	4,008.68	4,592.26	5,149.09	5,678.12	6,178.29	6,322.63	6,694.60	7,034.29	7,340.49	7,611.94
Total Retained Earnings	851.60	1,678.37	2,479.27	3,253.26	3,999.24	4,716.09	5,402.66	6,057.75	6,680.15	7,268.58	7,438.38	7,876.00	8,275.64	8,635.87	8,955.23
Total Liabilities and Stockholders' Equity	**5,212.33**	**5,824.27**	**6,410.39**	**6,969.61**	**7,500.86**	**8,003.02**	**8,474.91**	**8,915.38**	**9,323.18**	**9,697.06**	**9,652.34**	**9,875.48**	**10,060.67**	**10,206.50**	**10,311.53**
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Note

1. Inventory-material: 1 month of supply for waste treatment material and equipment maint. material
2. Appropriated Earning: 15% of net income as required by China laws for future growth and welfare.

Tianjin Medical Waste Treatment Facility
Cash Flow Analysis (Value x US $1,000)

Item	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Total	Per Year
Cash Inflow																		
Cash Sales	0	3,293.98	3,293.98	3,293.98	3,293.98	3,293.98	3,293.98	3,293.98	3,293.98	3,293.98	3,293.98	3,293.98	3,293.98	3,293.98	3,293.98	3,293.98	49,409.70	3,293.98
Cash Collection from Receivable			299.45	299.45	299.45	299.45	299.45	299.45	299.45	299.45	299.45	299.45	299.45	299.45	299.45	299.45	4,192.30	279.49
Proceeds from Sale of FA																		
Total Cash Inflow	-	3,293.98	3,593.43	3,593.43	3,593.43	3,593.43	3,593.43	3,593.43	3,593.43	3,593.43	3,593.43	3,593.43	3,593.43	3,593.43	3,593.43	3,593.43	53,602.00	3,573.47
Cash Outflow																		
Start-up Investment	4,543.59																	
Plant & Equipment Replacement												5,852.60						
Annual Operation Cost Payment		1,703.05	1,754.14	1,806.76	1,860.97	1,916.80	1,974.30	2,033.53	2,094.53	2,157.37	2,222.09	2,288.75	2,357.42	2,428.14	2,500.98	2,576.01	31,674.85	2,111.66
Interest Payment		210.41	196.39	182.36	168.33	154.30	140.28	126.25	112.22	98.19	84.16	70.14	56.11	42.08	28.05	14.03	1,683.30	112.22
Income Tax Payment		419.45	407.21	394.48	381.22	367.43	353.08	338.16	322.66	306.55	289.82	83.64	215.55	196.84	177.43	157.29	4,410.81	294.05
Loan Principal Repayment		215.81	215.81	215.81	215.81	215.81	215.81	215.81	215.81	215.81	215.81	215.81	215.81	215.81	215.81	215.79	3,237.13	215.81
Total Cash Outflow	4,543.59	2,548.72	2,573.55	2,599.41	2,626.33	2,654.34	2,683.47	2,713.75	2,745.22	2,777.92	2,811.88	8,510.95	2,844.89	2,882.87	2,922.27	2,963.12	51,402.28	3,426.82
Annual Net Cash Inflow	(4,543.59)	745.26	1,019.88	994.02	967.10	939.09	909.96	879.68	848.21	815.51	781.55	(4,917.52)	748.54	710.56	671.16	630.31	2,199.72	146.65
Accumulated Cash Flow	(4,543.59)	745.26	1,765.14	2,759.16	3,726.26	4,665.36	5,575.32	6,455.00	7,303.20	8,118.71	8,900.26	3,982.74	4,731.28	5,441.84	6,113.00	6,743.30	6,743.30	449.55

Internal Rate of Return 10%

Note:
1. Cash Sales: Formula: Annual Sales / 12 * 11
2. Annual Operation Cost: Non cash expense, such as depreciation and (Gain)/Loss on disposal of FA, is not included.
3. The analysis assumes no proceeds from disposal of Fixed Assets.

Tianjin Medical Waste Treatment Project

Statement of Cash Flow (x US $1,000)

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15
Cash Flow from Operating Activities															
Net Income	851.60	826.77	800.90	773.99	745.98	716.85	686.57	655.09	622.40	588.44	169.80	437.62	399.64	360.23	319.36
Adjustment to reconcile net income to net cash provided by operating activities															
Depreciation Expense	408.92	408.92	408.92	408.92	408.92	408.92	408.92	408.92	408.92	408.92	981.09	526.73	526.73	526.73	526.73
(Gain)/Loss on disposal of FA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Increase in Accounts Receivable	(299.45)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Increase in Accounts Payable	32.95	0.99	1.02	1.04	1.08	1.12	1.14	1.18	1.22	1.25	1.29	1.33	1.37	1.41	1.45
Increase in Inventory	(32.95)	(0.99)	(1.02)	(1.04)	(1.08)	(1.12)	(1.14)	(1.18)	(1.22)	(1.25)	(1.29)	(1.33)	(1.37)	(1.41)	(1.45)
Net cash provided by operating activities	961.07	1,235.69	1,209.83	1,182.91	1,154.90	1,125.77	1,095.49	1,064.02	1,031.32	997.36	1,150.90	964.35	926.37	886.97	846.10
Cash Flow from Investing Activities															
Purchase of land															
Purchase of building															
Purchase of equipment	-	-	-	-	-	-	-	-	-	-	(5,852.60)	-	-	-	-
Net cash provided by investing activities	-	-	-	-	-	-	-	-	-	-	(5,852.60)	-	-	-	-
Cash Flow from Financing Activities															
Payment of Long-Term Debt	(215.81)	(215.81)	(215.81)	(215.81)	(215.81)	(215.81)	(215.81)	(215.81)	(215.81)	(215.81)	(215.81)	(215.81)	(215.81)	(215.81)	(215.79)
Appropriated Earning															
Payment of Cash Dividends															
Net Cash Provided by financing activities	(215.81)	(215.81)	(215.81)	(215.81)	(215.81)	(215.81)	(215.81)	(215.81)	(215.81)	(215.81)	(215.81)	(215.81)	(215.81)	(215.81)	(215.79)
Net Increase in Cash	745.26	1,019.88	994.02	967.10	939.09	909.96	879.68	848.21	815.51	781.55	(4,917.52)	748.54	710.56	671.16	630.31
Begininning of period Cash	-	745.26	1,765.14	2,759.16	3,726.26	4,665.36	5,575.32	6,455.00	7,303.20	8,118.71	8,900.26	3,982.74	4,731.28	5,441.84	6,113.00
End of period Cash	745.26	1,765.14	2,759.16	3,726.26	4,665.36	5,575.32	6,455.00	7,303.20	8,118.71	8,900.26	3,982.74	4,731.28	5,441.84	6,113.00	6,743.30
	(0.00)	-	-	-	-	-	-	-	-	-	-	-	-	-	-

VOLUME II

CIVILIAN RADIOACTIVE WASTE MANAGEMENT, MONITORING, AND DISPOSAL SYSTEM

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Appendix

Appendix A Economic Analyses

INTRODUCTION

Tetra Tech, Inc. is contracted by United States Department of Commerce, Trade Development Agency to conduct a feasibility study for the improvement of the Tianjin City waste management system. As part of the contract, a final report is prepared to list findings and recommendation for the improvement of Tianjin civilian radioactive waste management system. This final report is comprised of the following elements:

- ✓ Introduction
- ✓ Radioactive Waste Management in the U.S.
- ✓ Radioactive Waste Management in China
- ✓ Radioactive Waste Management in Tianjin
- ✓ Feasibility Study for Improvement of Tianjin Civilian Radioactive Waste Management System
- ✓ Implementation Schedule and Action Plan
- ✓ Other Issues - EMF and Radionuclides in Coal Ash

Since 1950s, the use of radioactive materials in industrial processes and consumer products increases drastically. Most commonly known fact is the use of radioactive uranium as a fuel in nuclear power plants to generate electricity. Other radioactive materials are used to generate power for operations in remote areas, such as spacecraft, remote weather station and navigational buoys in the oceans. Radioactive materials are also used to power heart pacemakers. In consumer products or production processes and industrial processes, small quantity of radioactive materials are generally used as part of the product, for example, smoke detectors contain trace amount of Americium-241 (^{241}Am) and some photocopies use Polonium-210 (^{210}Po) as static electricity arrester to prevent paper jam. Radiation is used to sterilize many consumer products (i.e., baby powder, cosmetics), medical supplies after the product is sealed in packaging. Irradiation is used to sterilize foodstuffs (i.e., food, grains) to prevent spoilage. In industry, radiation sources are used to control paper thickness in the paper manufacturing processes, to determine the height of liquids in beverage containers, to cure inks and coatings, to inspect pipeline weld, and to analyze metal corrosion. In medical application, nuclear medicine has become increasingly important for diagnosis and treatment of disease. Research institutes use radioactive materials to develop new pharmaceutical products. In agricultural research, radiation is used for insect control, development of disease-resistant plants, and the production of fertilizers. Other applications include isotopic tracer used by environmental scientist to understand pollutant migration in the environment, by geologist to understand the age of rock and geological formation, and by archeologists to determine the age of the artifacts (i.e., carbon-14 [^{14}C] dating).

Radioactive wastes are generated from radioactive material itself (i.e., spent fuel rod or source) and from the processes of using it (i.e., materials that are contaminated with radioactive materials). Most radioactive waste is very similar to municipal and industrial wastes in forms and shapes, except it emits ionizing radiation - alpha (α), beta (β) or gamma (γ) radiation - depending on the substance contained in the radioactive waste. The radiation can be harmful to living beings and the environment.

Alpha radiation occurs by the ejection of a positively charged alpha particle during certain radioactive transformation. Alpha radiation is more damaging than the same dose of beta or

gamma radiation if ingested or inhaled, but can be stopped by a sheet of paper (i.e., weakest penetrating power). Beta radiation is the emission of a negatively charged particle (i.e., beta particle) by the nucleus of certain radioactive atoms during radioactive decay. A beta particle is identical to an electron. Beta radiation is less damaging than the same doses of alpha radiation but has more penetrating power. Beta radiation can be stopped by a thin sheet of metal or plastic. Gamma radiation is a high energy, short wavelength radiation emitted from the nuclei of atoms. Gamma ray is less damaging than the same dose of alpha radiation but much more penetrating, it can be stopped by thick slabs of lead or concrete.

1.0 RADIOACTIVE WASTE MANAGEMENT IN THE US

1.1 Classification of Radioactive Wastes

1.1.1 US - High and Low Level Radioactive Wastes

Radioactive waste can be classified according to the level of radioactivity or their origin. In the United States (US), radioactive waste is divided into to two groups - high level waste (HLW) and low level waste (LLW). According to Nuclear Regulatory Commission (NRC), high-level radioactive wastes refer to the highly radioactive materials produced as a byproduct of the reactions that occur inside nuclear reactors. High-level wastes are: (a) spent or used reactor fuel; and, (b) waste materials remaining after spent fuel is reprocessed (http://www.nrc.gov/waste/high-level-waste.html).

Spent nuclear fuel is used fuel from a reactor that is no longer efficient in creating electricity due to slow fission process. However, the spent fuel is thermally hot, highly radioactive, and potentially harmful. Spent fuel can be reprocessed to extract isotopes and then be used again as reactor fuel. However, commercial reprocessing is currently not practiced in the US (but still in practice in France). Significant quantities of high-level radioactive waste are produced by the defense reprocessing programs at Department of Energy (DOE) facilities, and are managed by DOE. The waste generated from nuclear fuel reprocessing is highly radioactive and must be properly disposed of along with all high-level waste from spent reactor fuel.

Low-level wastes refer to wastes with radioactivity ranges from just above background levels found in nature to very highly radioactive, such as parts from inside the reactor vessel in a nuclear power plant. Low level wastes are generated from materials that are contaminated with radioactive material or have become radioactive through exposure to neutron radiation (http://www.nrc.gov/waste/low-level-waste.html).

Nuclear power plant operation generates various low level wastes, including contaminated protective equipment such as protective shoe covers and clothing; waste from water or gas treatment at nuclear power plants such as filters and sludge; wiping rags and mops from cleaning; used parts such as pipes and valves; and, wastes from decommissioning of nuclear power plants. Low level wastes also are generated from medical, agriculture and industrial applications. The production and use of radioactive materials in these applications also generate low level radioactive waste, such as equipments and tools (i.e., used radiation source), luminous dials, medical tubes, swabs, injection needles, syringes, and laboratory animal carcasses and tissues.

1.1.2 IAEA's and European Classification - High-, Intermediate- (Medium) and Low-Level Radioactive Wastes

The International Atomic Energy Agency (IAEA) radioactive waste classification system contains three levels of radioactive wastes - high- (HLW), intermediate- (ILW) and low-level (LLW) wastes. (IAEA: "Classification of Radioactive Waste" Safety Series No. 111-G-1.1, 9 June 1994) IAEA defines high-level wastes as (a) the highly radioactive liquid, containing mainly fission products, as well as some actinides, which is separated during chemical reprocessing of irradiated fuel (aqueous waste from the first solvent extraction cycle and those waste streams combined with it), (b) any other waste with radioactivity levels intense enough to generate significant quantities of heat by the radioactive decay process, and (c) spent reactor fuel, if it is declared a waste. Intermediate- (or medium) level wastes are radioactive wastes require shielding but need little or no provision for heat dissipation during its handling and transportation. Low-level wastes are wastes that do not require shielding during normal handling and transportation. IAEA further differentiates intermediate- and low-level wastes group into short- and long-lived waste, and alpha bearing waste. Short-lived waste refers to radioactive waste which will decay to an activity level which is considered to be acceptably low from a radiological viewpoint, within a time period during which administrative controls can be expected to last. (Such waste can be determined by radiological performance assessment of the storage or disposal system chosen.) Long-lived waste is radioactive waste that will not decay to an acceptable activity level during the time which administrative controls can be expected to last. Alpha bearing waste is radioactive waste containing one or more alpha emitting radionuclides, usually actinides, in quantities above acceptable limits established by the national regulatory body.

Similarly, Belgian Agency for Radioactive Waste and Enriched Fissile Materials categorizes radioactive wastes divided into three groups - low-, medium- and high-level wastes (http://www.nirond.be/engels/6.4_classificatie_eng.html) . Each group is assigned with a definite radiation level according to their exposure risks. Low-level waste is radioactive waste with a contact dose rate of less than 2 milli-Sieverts (mSv) per hour. This category of waste comes from the nuclear power generation, including nuclear power plant operations and production of unspent nuclear fuel; from the use of radioactive sources in medicine, agriculture and industry; and, in particular from the decommissioning of nuclear facilities. Low-level wastes include filters, resins, protective equipment (clothing, gloves), paper, biological waste, activated concrete, residues from nuclear power plant wastewater treatment, and cleaning wastes from nuclear power plant decommission, that have been in contact with radioactive materials. Medium-level wastes has a contact dose rate of between 2 mSv to 3 Sv per hour. Most of this category of waste comes from the production and reprocessing of nuclear fuel and from decommissioning activities, including filters and resins from nuclear power plants. High-level waste has a contact dose rate of greater than 2 Sv per hour. This type of waste emits heat. This category of waste consists of fission products from the reprocessing of spent nuclear fuel, the spent fuel itself, and any other excess fissile materials. This classification method is compatible with those of IAEA and the European Union. It categorizes radioactive waste according to its activity level and life span.

1.1.3 Sources of Radioactive Waste

In fact, radioactive wastes are generally classified according to the origins of the wastes, not their physical and chemical properties. The origins of radioactive waste can be categorized as:

1.1.3.1 High-Level Waste (HLW)

High level waste has two major sources: spent fuel from irradiated commercial nuclear reactor fuel, and, reprocessing waste, such as liquid waste from solvent extraction cycles in reprocessing. Also the solids into which liquid wastes may have been converted. (Note: The DOE defines HLW as reprocessing waste only, while the NRC defines HLW as spent fuel and reprocessing waste.)

1.1.3.2 Transuranic Waste (TRU)

Transuranic waste contains elements with atomic numbers (number of protons) greater than 92, the atomic number of uranium. TRU includes only waste material that contains transuranic elements with half-lives greater than 20 years and concentrations greater than 100 nanocuries per gram (nCi/g). If the concentrations of the half-lives are below the limits, it is possible for waste to have transuranic elements but not be classified as TRU waste.

1.1.3.3 Uranium and Thorium Mill Tailings

Uranium mill tailings are primarily the sandy process waste material from a conventional mill. This ore residue contains the radioactive decay products from the uranium chains (mainly the Uranium-238 [238U] chain) and heavy metals. The tailings or wastes produced by the extraction or concentration of uranium or thorium from any ore processed primarily for its source material content are byproduct material. This includes discrete surface waste resulting from uranium solution extraction processes, such as in situ leach, heap leach, and ion-exchange. Byproduct material does not include underground ore bodies depleted by solution extraction.

1.1.3.4 Low-Level Waste (LLW)

Any radioactive waste that is not classified as high-level, spent fuel, transuranic or byproduct material such as uranium mill tailings is low level waste. LLW has four subcategories: Classes A, B, C, and Greater-Than Class-C (GTCC). On average, Class A is the least hazardous while GTCC is the most hazardous. Since "low-level" radioactive waste is defined by what it is not, it thus includes everything from slightly radioactive trash (such as mops, gloves, and booties) to highly radioactive activated metals from inside nuclear reactors. It includes both short-lived and long-lived radionuclides. NRC defines three classes A, B and C based on the concentration and half-lives of radionuclides in the waste.

1.1.3.4.1 LLW-Class A

LLW-Class A is the least radioactive of the four LLW classes. Class A LLW contains materials that are primarily contaminated with "short-lived" (half lives on the order of decades, mostly less than 5 years) radionuclides.

1.1.3.4.2 LLW-Class B

Class B LLW contains wastes that are contaminated with a greater amount of "short-lived" radionuclides than Class A.

1.1.3.4.3 LLW-Class C

Class C LLW contains wastes that are contaminated with greater amounts of long-lived and short-lived radionuclides than Class A or B.

1.1.3.4.4 LLW-GTCC

GTCC (Greater Than Class C) LLW is the most radioactive of the low-level classes. Table 1 is NCR limits defining Class A, B and C LLW.

Table 1. NRC Limits Defining Class A, B, and C LLW (Curies per Cubic Meter)

A. "Long-lived Radionuclides"	Half-life years	Class A	Class B	Class C
Carbon-14	5,700	0.8	N/A	8.0
Carbon-14 in activated metal	5,700	8.0	N/A	80.0
Nickel-59 in activated metal	75,000	22.0	N/A	220.0
Niobium-94 in activated metal	30,300	0.02	N/A	0.2
Technetium-99	213,000	0.3	N/A	3.0
Iodine-129	15.7 million	0.008	N/A	0.08
Alpha-emitting transuranics with half-lives greater than 5 years	>5	10.0*	N/A	100*
Plutonium-241	14	350.0*	N/A	3,500*
Curium-242	163 days	2,000*	N/A	20,000*
B. "Short-lived Radionuclides"	**Half-life years**	**Class A**	**Class B**	**Class C**
Tritium	12.3	40	no limit **	no limit**
Cobalt-60	5.3	700	no limit**	no limit **
Nickel-63	100.1	3.5	70	700
Nickel-63 in activated metal	100.1	35	700	7,000
Strontium-90	28.5	0.04	150	7,000
Cesium-137	30	1	44	4,600
total of all nuclides with less than 5-year half-life	-	700	no limit **	no limit**

Source: NRC 1988 (10 CFR Part 61.55)

* Units are in nanocuries per gram (note that Pu-241 and Cm-242 have long-lived daughter products.).

** There are no limits established for these elements in Class B or C wastes. If waste is contaminated with these radionuclides in concentrations greater than their Class A limits, the waste is Class B, unless the concentrations of other radionuclides determine the waste to be Class C or above independent of these nuclides.

(Adapted from Arjun Makhijani and Scott Saleska, "High-Level Dollars, Low-Level Sense", 1992, IEER Publication, Institute for Energy and Environmental Research)

1.1.3.5 Naturally-Occurring and Accelerator-Produced Radioactive Materials (NARM)

NARM wastes are orphan wastes not consistently regulated under any current federal standard. NARM includes such materials as radium-226 (^{226}Rd) and thorium-230 (^{230}Th) produced outside the nuclear fuel-cycle, and radionuclides produced by particle accelerators. NARM wastes are generated by both federal and non-federal facilities. Although all elements up to and including uranium are found in nature, no elements with atomic numbers great than uranium (transuranic elements) are naturally occurring. Thus, transuranic elements are the artificial elements. All transuranic elements are unstable (and thus radioactive), many of them are alpha-emitters, and many (although not all) have very long half-lives.

1.1.3.6 Mixed Waste

In both the commercial and military sectors, some of the radioactive wastes generated are mixed with hazardous substances, such as organic solvents or other toxic chemicals. Much of this waste (especially the transuranic waste) contains substantial quantities of long-lived radionuclides, such as plutonium-239 (^{239}Pu) and technetium-99 (^{99}Tc). The radioactive components of mixed wastes are regulated under the Atomic Energy Act by the NRC for commercial sources, and by the DOE for military sources. The hazardous components, however, are subject to regulation by the EPA according to the Resource Conservation and Recovery Act (RCRA).

Radioactive waste is produced by a number of sources in the US, but by far the largest quantities, in both radioactivity and volume, are generated by the commercial nuclear power and military nuclear weapons production industries, and by nuclear fuel cycle activities to support these industries such as uranium mining and processing.

1.1.4 Low-Level and Low-Activity Radioactive Waste

Low level radioactive waste (LLW or LLRW), as defmed by NRC (Nuclear Waste Policy Act, section 2(16)), is a regulatory term defined as the broad class of radioactive waste that is not included in the following classes of radioactive waste: spent nuclear fuel; high-level waste; transuranic waste; and, uranium and thorium mill tailings. As discussed in section 2.3.4, the NRC further defines three levels of LLRW - Classes A, B and C, based on their radionuclide content and half-life (10 CFR Part 61 - Licensing Requirements for Land Disposal of Radioactive Waste).

In EPA's November 18, 2003 Advanced Notice of Proposed Rulemaking (ANPR), a new term of "low activity radioactive waste" (LARW) was proposed for the management of mixed waste disposal. However, LARW is still only a conceptual term that does not have a statutory or regulatory meaning. Furthermore, in the National Academies' Board on Radioactive Waste Management (BRWM) 2003 "Improving the Regulation and Management of Low Activity Radioactive Wastes - Interim Report on Current Regulations, Inventories and Practices (National Research Council of the National Academies, National Academies Press, 2003, Washington, D.C.), the Board also used the term "low-activity radioactive waste". LARW is a much broader category than LLRW. LARW may contain low level radioactive waste and naturally occurring or other long-lived radionuclides at well above background levels, and it may represent a significant chronic, or an acute in some cases, hazard to public and environmental health.

There are five waste types under LARW by BRWM. They are (1) NRC's LLRW - Classes A, B, and C, generated by nuclear utilities, industries, medicine and research (or called commercial low-level wastes), as well as defense low-level waste generated and managed by DOE. (2) Slightly radioactive solid materials, such as debris, rubble and contaminated soils that are generated from decommissioning of nuclear facility and site cleanup. They contain a very large volume but produce very low or practically undetectable levels of radiation. In most cases, their level is even lower than the NRC's LLRW Class A wastes. (3) Discrete sources, such as out-of-service radiation sources and associated materials that are generated by industrial, medical, and research applications. Although it is defined by statute as "Low Level Radioactive Waste", but in fact, they may emit very high radiation to cause acute health hazard. Some large out-of-service sources may in fact exceed NRC's LLRW Class C wastes. (4) Uranium and thorium ore processing wastes. These wastes are produced in large volumes from the recovery of uranium and thorium for nuclear applications. The radiological hazards include radioactive uranium and thorium isotopes, and their decay products radium and radon gas. Radium can migrate into drinking water, and radon gas can seep into human dwellings with poor ventilation. (5) Naturally occurring and technological enhanced naturally occurring radioactive materials (NORM and TENORM) wastes, which are produced coincidentally from the recovery of natural resources (such as extraction of rare earth materials and other mining operations, oil and gas productions) and water treatment. Similar to uranium and thorium wastes, these wastes are produced in large volume and their radioactive hazards are from uranium, thorium and their decay products - radium and radon.

The first three categories by statutory definition are LLRW and their physical and radiological properties, and health hazards, can vary widely. Federal government has the authority over the first four categories under Atomic Energy Act, whereas state government has the authority over the NORM and TENORM. Table 2 lists National Academies' BRWM's category of low activity radioactive wastes.

The advantage of using the term of "low -activity" waste is to focus on their inherent radiological properties rather than their origins. With the capability of categorizing radioactive wastes based on their radioactivity, it will eliminate the current shortcomings of disposing wastes with same origins but with very different strength of radioactivity.

1.2 Development of Regulatory Framework for Radioactive Waste Management in the US

Prior to the promulgation of Atomic Energy Act in 1954, the use of radioactive materials such as uranium and thorium in industry and medicine was regulated by the states. During World War II, the Army Corps of Engineers managed the first large scale use of radioactive materials in Manhattan Project. The first piece of legislation for radioactive material control was the McMahon Act in 1946, or later on called Atomic Energy Act of 1946. The McMahon Act was intended to ensure the security of nuclear materials rather than to control their radiological hazards. This Act also defined three categories of regulated nuclear materials, namely, source, byproduct and special nuclear. The Act also created the Atomic Energy Commission (AEC, later as Nuclear Regulatory Commission or NRC) to oversee all nuclear activities begun in the Manhattan Project.

Four federal agencies are responsible for the management of radioactive wastes in the US, they are: Nuclear Regulatory Commission, Department of Energy, Environmental Protection Agency and Department of Transportation. NRC licenses and regulates the commercial use of radioactive materials, limits the amount of radiation that people can be exposed to from nuclear power plants and industrial and medical facilities, and establishes

procedures for safe transport of radioactive wastes. DOE manages the storage, treatment, transportation, and disposal of radioactive waste generated by its science research facilities, the nuclear weapon complex, the Navy's nuclear submarines and ships, and the cleanup of its contaminated DOE sites. EPA issues standards and guidance to protect people from radiation exposure, monitor radiation levels in the environment, assesses the health effects of radiation on people, and oversees and conducts cleanups of contaminated sites. DOT ensures that radioactive waste carriers comply with routing, packaging, labeling, training, documentation and other radioactive waste transportation regulations and guidelines.

Table 2. National Academies' Board on Radiological Waste Management - Low Activity Radioactive Wastes Categorization

Category	Principle Origin	Typical Examples	Reason for Category
Defense and commercial low-level waste	Operation at DOE sites, nuclear power and research reactors, medical facilities	Trash, equipment, construction materials, process residues, soils	These are the wastes that typically described as low level wastes and disposed in near-surface facilities at DOE or commercial sites. They meet the statutory definition of Atomic Energy Act 11e.(1) byproduct materials and the exclusionary definition of "low level waste" under the Nuclear Waste Policy Act. The relatively short-lived radioactive isotopes and activity levels of the waste fit into NRC's Classes A, B or C.
Slightly radioactive solid materials	Decommissioning of nuclear power facilities at DOE and civilian sites, and site clean-up	Debris, rubble, construction materials, soils	These wastes represent the low end of the spectrum of materials defined, regulated, and managed as low level waste. They produce very low or essentially undetectable levels of radiation, but they arise in very large volumes. The descriptor "slightly radioactive solid materials" was introduced by NRC in 2002.
Discrete sources	Application of radiation source in industry, medicine and research	Out of use sealed radiation sources or materials used to make the sources, accelerator-produced radioactive materials	These wastes represent high end materials that meet the statutory definition of "low level waste", although they may be capable of producing acute radiation effects in human and serious contamination incidents. They may exceed the NRC's Class C limit for waste that is acceptable for near-surface disposal.
Uranium and thorium ore processing wastes	Recovery of uranium or thorium for DOE or civilian nuclear applications	Mining and milling tailings, process residues, soils, equipment	These low-activity wastes do not meet Nuclear Waste Policy Act's definition of "low-level waste", but they are federally regulated under the Atomic Energy Act definition 11e.(2) byproduct materials. Their radioactivity arises from long-lived, natural uranium and thorium isotopes and their decay products. There are large volumes of these wastes, some dating back to the Manhattan Project era.
Naturally occurring and technological enhanced naturally occurring radioactive materials (NORM & TENORM)	Recovery and processing of mineral resources unrelated to nuclear applications, municipal wastewater treatment	Commercial ore mining, residue, phosphate mining and fertilizers, scale and sludge from oil and gas productions, water treatment filters, resins and sludges	These low-activity wastes meet neither the Nuclear Waste Policy Act definition of "low-level waste", nor the Atomic Energy Act definition 11e.(2) byproduct materials - hence they are not directly subject to federal regulation. The origin of the radioactivity in these wastes and their large volumes are comparable to uranium and thorium ore processing wastes.

(Adapted from 2003 National Academies' Board on Radioactive Waste Management 2003 "Improving the Regulation and Management of Low Activity Radioactive Wastes - Interim Report on Current Regulations, Inventories and Practices [National Research Council of the National Academies, National Academies Press, 2003, Washington, D.C.])

1.2.1 Federal Statues

1.2.1.1 Atomic Energy Act (AEA) of 1954, as Amended

The Atomic Energy Act of 1954 replaced the McMahon Act and established the framework for the commercial nuclear industry. The purpose of the AEA is to assure that the proper management of source, special nuclear, and byproduct material. The AEA provided the definition of the followings:

- ✓ Source material - includes uranium, thorium, or any other material that is determined by the NRC to be source material; or, ores containing one or more of the foregoing materials, in such concentration as the NRC may by regulation determine from time to time.
- ✓ Special nuclear material - includes plutonium, uranium enriched in the isotope 233 or the isotope 235, and many other materials that the NRC determines to be special nuclear materials, but does not include source material; or, any material artificially enriched by any of the foregoing, but does not include source material.
- ✓ Byproduct material - includes any radioactive material (except special nuclear material) yielded in or made radioactive by exposure to radiation incident to the process of producing or utilizing special nuclear material; and, the tailing or wastes produced by the extraction or concentration of uranium or thorium from any ore processing primarily for its source material content.

However, NORM from non-nuclear activities are not included in the AEA, such as radioactive wastes produced from mining, oil and gas production, and waste treatment. AEA references the Nuclear Waste Policy Act of 1982 for the definition of high-level radioactive waste, spent nuclear fuel, and the exclusionary definition of low-level radioactive waste. The definition of transuranic waste (material contaminated with elements of atomic weight greater than 92) was added to the AEA in 1988.

1.2.1.2 Reorganization Plan No. 3 (1970) and Energy Reorganization Act of 1974

This reorganization plan is not a statute; however, it was legally significant since it delineated the responsibilities and interactions of all federal agencies. In 1974, the Energy Reorganization Act amended AEA and divided the federal authority over the defense and civilian uses of nuclear materials and facilities. The Energy Reorganization Act disbanded AEC and created NRC to control commercial nuclear activities and the Energy Research and Development Administration (ERDA) to control defense nuclear activities. ERDA was later replaced by DOE with the pass of the Department of Energy Organization Act in 1977.

EPA was established in 1970 and has the authority under AEA to set radiation protection criteria and standards and issue radiation protection guidance for federal agencies, and has control of radioactive materials under other statute, such as mixed wastes in RCRA. The AEA and the statutes that amended it (including the Energy Reorganization Act) delegate the control of nuclear energy primarily to DOE, NRC and EPA.

1.2.1.3 Department of Energy Organization Act of 1977

DOE was established under the Department of Energy Organization Act in 1977 as a cabinet level agency. DOE is primarily responsible for nuclear wastes generated from defense program.

1.2.1.4 Uranium Mill Tailing Radiation Control Act of 1978

The Uranium Mill Tailing Radiation Control Act (UMTRCA) addresses the regulation and control of uranium mill tailings (byproduct materials as defined by AEA). UMTRCA authorized EPA to be responsible for establishing health and environment clean up standards for uranium milling sites and contaminated vicinity properties; NRC to be responsible for licensing and regulating uranium production and related activities including decommissioning; and, DOE to be responsible for remediation of inactive mill tailing sites and long-term monitoring of all the decommissioned sites.

1.2.1.5 Low-Level Radioactive Waste Policy Act of 1980, as Amended in 1985

The Low-Level Radioactive Waste Policy Act (LLRWPA) establishes state (including regional compacts of states) and federal responsibilities for the disposal of LLW, and defines the roles of federal agencies (i.e., DOE and NRC). The LLRWPA defines LLW the same way as in the Nuclear Waste Policy Act (see below), although transuranic wastes are not specifically excluded in the 1985 Amendments. The LLRWPA also refers to definition used by NRC classification of LLW (Classes A, B and C) in 10 CFR Part 61 (see Table 1).

1.2.1.6 Nuclear Waste Policy Act of 1982, As Amended

The Nuclear Waste Policy Act (NWPA) provides statutory definition of "high-level" radioactive waste and spend nuclear fuel. NWPA employed an exclusionary definition for "low-level" radioactive waste, that is, the low-level radioactive waste is the material that is not high level radioactive waste, spent nuclear fuel, transuranic waste, or AEA byproduct material. The NWPA provides authority for the NRC to classify materials as high-level waste. However, the NWPA does not include wastes containing naturally occurring or accelerator-produced radioactive materials (i.e., non-AEA-defined nuclear fuel cycle material).

1.2.1.7 Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as Amended by the Superfund Amendments and Reauthorization Act of 1986

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) or Superfund provides the authority to EPA, in conjunction with state regulators, to investigate and remediate sites placed on the National Priority List (NPL). Many NPL sites were contaminated with radioactive materials, including those licensed by NRC or controlled by DOE. EPA has the responsibility to develop guidance for cleaning up contamination soil and materials, including TENORM.

1.2.1.8 Resource Conservation and Recovery Act of 1976 and Hazardous and Solid Waste Amendments (1984)

The Resource Conservation and Recovery Act (RCRA) provides for the cradle-to-grave control of chemically hazardous wastes by imposing management requirements on generator and transporters of hazardous waste and on owners and operators of treatment, storage and disposal facilities. RCRA specifically excludes materials regulated by AEA from its jurisdiction, however, RCRA is applicable to the hazardous constituents in waste contaminated with both chemically hazardous and radioactive materials (also called mixed waste), which could include accelerator-produced materials.

1.2.2 Federal Regulations - Code of Federal Regulations (CFR)

Other federal regulations that are related to radioactive material and waste management are summarized below.

1.2.2.1 10 CFR Part 61 - Licensing Requirements for Land Disposal of Radioactive Waste

NRC's licensing requirements for land disposal of radioactive waste apply to all low-level radioactive wastes, including source, special nuclear and byproduct materials that are acceptable for disposal in a near-surface facility. Any radioactive waste that is not classified as high-level radioactive waste, transuranic waste, spend nuclear fuel or byproducts materials from uranium or thorium mill tailing and wastes is considered as low level radioactive waste. Three classes of low level radioactive wastes - A, B and C can be disposed of in near-surface facilities. However, disposal of GTCC waste in a deep geological disposal facility is the responsibility of DOE.

1.2.2.2 10 CFR Part 20, Standards for Protection Against Radiation, Subpart K - Waste Disposal

This regulation defines disposal of radioactive wastes by release into sanitary sewerage, treatment or disposal by incineration, disposal of specific wastes that are below specified activity levels (i.e., tritium or carbon-14 below 0.05 microcurie (or 1.85 kBq) per gram in scintillation counting liquid or animal tissue).

According to 10 CFR Part 20.2003, the quantity of tritium and carbon-14 released into sanitary sewerage in a month is the quantity of radioactive materials released divided by the average monthly volume of water released into the sewer. The quantity of radioactive materials released into the sanitary sewer system in a year should not exceed 5 curies (185 GBq) of tritium, 1 curie (37 GBq) of Carbon-14, and 1 curie of all other radioactive materials combined.

1.2.2.3 10 CFR Part 40, Domestic Licensing of Source Material, Appendix A - Criteria Relating to the Operation of Uranium Mills and the Disposition of Tailing or Wastes Produced by the Extraction or Concentration of Source Material from Ores Processed Primarily for their Source Material Contents (Incorporating 40 CFR Part 192 - Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings)

The criteria, including technical criteria, financial criteria, site and byproduct material ownership, long-term site surveillance, and hazardous constituents, apply to uranium mill tailing generated at the mill sites licensed in or after 1978, when the Uranium Mill Tailing Radiation Control Act (UMTRCA) was enacted. NRC, by its interpretation of the UMTRCA, does not have the jurisdiction to regulate mill tailing generated before 1978.

1.2.2.4 10 CFR Part 71 - Packaging and Transportation of Radioactive Materials by NRC

NRC regulation sets standards for packaging and transportation requirements for shipment of both high- and low-level radioactive wastes.

1.2.2.5 49 CFR Parts 172 - Hazardous Materials Table, Special Provisions, Hazardous Materials Communication Requirements and Emergency Response Information Requirements. Part 173 - Shippers - General Requirements for Shipments and Packaging by DOT

DOT regulation defines shipments and packaging and emergency response requirements for hazardous materials, which includes radioactive materials. NRC and DOT regulations are based on international safety standards set by the IAEA.

1.2.2.6 40 CFR Part 61 - National Emission Standards for Hazardous Air Pollutants (NESHAP) Under Clean Air Act: Radon and Radioisotope Emissions

EPA sets standards for radon and radioisotope emissions under NESHAP requirements. Subpart B is the national emission standards for radon emissions from underground uranium mines. Subpart H is the national emission standards for emission or radionuclides other than radon from DOE facilities. Subpart I is the national emission standards for radionuclide emissions from facilities licensed by the NRC and federal facilities not covered by subpart H (i.e., non-DOE facilities). Subpart K is the national emission standards for radionuclide emissions from elemental phosphorus plants. Subpart Q is the national emission standards for radon emissions from DOE Facilities. Subpart R is the national emission standards for radon emissions from phosphogypsum stacks.

1.2.2.7 40 CFR Part 122.2 - EPA Administered Permit Program: The National Pollutant Discharge Elimination System (NPDES) Under Clean Water Act

EPA defines water pollutant including radioactive materials except those regulated under the AEA. EPA regulates radionuclides and radiation in discharges and establishes water quality standards. This includes TENORM radionuclides, for example radium and accelerator-produced isotopes, with the exception of uranium and thorium.

1.2.2.8 40 CFR Part 266 - Standards for the Management of Specific Hazardous Wastes and Specific Types of Hazardous Waste Management Facilities

Under RCRA, EPA defines "Conditional Exemption for Low-Level Mixed Waste Storage and Disposal" in Subpart N of 40 CFR Part 266 and exempts certain mixed waste from RCRA requirements if it satisfied specific criteria, i.e., storage container requirements, chemical capability, proof of qualified trained personnel, storage inventory and emergency plan.

1.2.2.9 40 CFR Part 300 - National Oil and Hazardous Substance Pollution Contingency Plan (or National Contingency Plan, NCP) , Appendix A - Hazard Ranking System (HRS)

Superfund's 1990 National Oil and Hazardous Substances Pollution Contingency Plan (NCP) addresses radioactive and mixed waste in the Hazard Ranking System (HRS). In general, sites containing mixed radioactive and other substances involve more evaluation than sites containing only radionuclides. EPA has issued guidance on removal and cleanup of sites contaminated with radioactive materials.

1.2.2.10 EPA November 18, 2003 Advance Notice of Proposed Rulemaking - Mixed Waste Land Disposal

In 2003, EPA requested public comments on method to define alternatives for disposal of low-activity radioactive waste, including exemption for mixed waste containing small amount of radioactive material for disposal in a RCRA Class C disposal facility. The public comments period was extended to May 17, 2004.

1.2.3 Department of Energy Regulations and Orders

DOE is responsible for the management of defense nuclear wastes, including both high- and low-level radioactive wastes in its facilities. DOE adopts the classification scheme as outlined in Nuclear Waste Policy Act, i.e., using exclusionary definition of low-level radioactive waste, that is, the low-level radioactive waste is the material that is not high-level radioactive waste, spent nuclear fuel, transuranic waste, or AEA byproduct material. NRC's low-level waste classification system - Classes A, B and C is not used.

1.2.3.1 DOE Order 435.1 - Radioactive Waste Management of 1999

DOE issued the Order of "Radioactive Waste Management" in 1999 along with a technical manual and an implementation guide to manage radioactive waste generated in its facilities. The Order covers all high-level waste, transuranic waste, and low-level wastes by all DOE facilities, including accelerator-produced waste, mixed waste (radioactive constituent in the waste), byproduct materials and naturally occurring radioactive material at the DOE facilities. However, this Order does not apply to spent fuel from nuclear reactors.

1.2.3.2 10 CFR Part 835, Occupational Radiation Protection of 1998

The DOE occupational radiation protection directive establishes radiation exposure standards, limits, and program requirements for protecting individuals and general public from ionizing radiation resulting from DOE activities. The radiation protection program

(RRP) includes program, plans, procedures, schedules, and other measures undertaken to ensure that the health and safety of the work force are adequately protected. The program is to maintain individual and collective radiation doses below regulatory limits by employing a process of "as low as is reasonably achievable" (ALARA) taking into account social, technical, economic, practical, and public policy considerations.

1.2.4 State Regulations

State legislatures can pass laws to establish state regulations on low-level radioactive waste. State agencies enforce the state regulations. However, there are some limits on the scope of state regulation because the federal government has preempted the regulation of most radioactive materials and reserved such power to itself. Although a state has no jurisdiction to enforce federal regulations, it can become an agreement state. Under this agreement, the state develops and enforces its own regulations, but those regulations are similar to and must be approved by the federal agency responsible for the same types of regulations (i.e., NRC).

Federal statues provide three key responsibilities for the states, they are:

- Each state must manage the disposal of low-level radioactive wastes generated in the state (does not include NORM wastes).
- States can become an Agreement State and assume portion of the NRC's regulatory authority for the low level waste or uranium mill tailing.
- State has the authority to regulate non-AEA wastes, because they are not regulated by federal statues.

The LLRWPA of 1980 requires every state to provide for disposal of its own LLW, either alone or in cooperation with other states (Interstate Compacts). However, the majority of states failed to designate disposal site in a timeframe as required by the law. The LLRWPA Amendment Act of 1985 provided three incentives. The first was to provide those states that form regional compacts with monetary incentives. The second was to allow states hosting disposal site to impose substantial surcharges for waste disposal on those states that failed to comply, and, after 1990 to deny non-compliant states access to disposal facilities. The third was that if a state was failed to provide disposal of its waste by 1996, then the state could be required to take title of the waste from the waste generator and take possession of the waste. Further, the state would be liable for any damages incurred by the waste generator resulting from the failure of the state to take the waste.

1.2.4.1 Agreement State Program and Interstate Compacts

NRC provides assistance to States expressing interest in establishing programs to assume NRC regulatory authority under the Atomic Energy Act of 1954, as amended. Under the Act, NRC relinquishes to the States portions of its regulatory authority to license and regulate byproduct materials (radioisotopes); source materials (uranium and thorium); and certain quantities of special nuclear materials. The mechanism for the transfer of NRC's authority to a State is an agreement signed by the Governor of the State and the Chairman of the Commission.

NRC assistance to States entering into Agreements includes review of requests from States for Agreements, or amendments to existing agreements, meetings with States to

discuss and resolve NRC review comments, and recommendations for Commission approval of proposed agreements. Additionally, NRC conducts training courses, workshops; evaluates technical licensing and inspection issues from Agreement States; evaluates State rule changes; participates in activities conducted by the Conference of Radiation Control Program Directors, Inc.; and provides early and substantive involvement of the States in NRC rulemaking and other regulatory efforts. The NRC also coordinates with Agreement States the reporting of event information and responds to allegations reported to NRC involving Agreement States

On March 26, 1962, the Commonwealth of Kentucky became the first Agreement State. In December 1964, the then U.S. Atomic Energy Commission hosted the first annual joint meeting with a group of these States. Today, 33 States have entered into Agreements with NRC, and two others are currently being evaluated. Table 3 shows the interstate compacts for low-level waste disposal as March of 2004.

Table 3. Interstate Compacts for Low-Level Waste Disposal

Interstate Compact	Participating States	Host State
Northwest (8)	Alaska, Hawaii, Idaho, Montana, Oregon, Utah, Washington, Wyoming	Washington
Southwestern (4)	Arizona, California, North Dakota, South Dakota	California
Rocky Mountain (3)	Colorado, New Mexico, Nevada	-
Midwest (6)	Indiana, Iowa, Minnesota, Missouri, Ohio, Wisconsin	-
Central (5)	Arkansas, Kansas, Louisiana, Nebraska, Okalahoma	Nebraska
Texas (3)	Maine, Texas, Vermont	-
Central Midwest (2)	Illinois, Kentucky	Illinois
Appalachian (4)	Delaware, Maryland, Pennsylvania, West Virginia	Pennsylvania
Northeast or Atlantic (3)	Connecticut, New Jersey, South Carolina	Connecticut, New Jersey
Southeast (6)	Alabama, Florida, Georgia, Mississippi, Tennessee, Virginia	-
Unaffiliated States (9)	District of Columbia, Massachusetts, Michigan, New Hampshire, New York, Puerto Rico, Rhode Island, North Carolina	Massachusetts, Michigan, New York, North Carolina
(Adapted from NRC, http://www.nrc.gov/waste/llw-disposal/compacts.html)		

There are three licensed low-level waste disposal facilities are located in Agreement States. They are:

- Barnwell, South Carolina - this facility accepts wastes from all U.S. generators except those in Rocky Mountain and Northwest compacts. Beginning in 2008, Barnwell will only accept wastes from Northeast compact (Connecticut, New Jersey and South Carolina). This facility is licensed by the State of South Carolina to accept Class A to C wastes.
- Hanford, Washington - this facility accepts wastes from the Northwest and Rocky Mountain compacts. This facility is licensed by the State of Washington to accept Class A to C wastes.
- Envirocare in Clive, Utah - Envirocare accepts wastes from all regions of the US. This facility is licensed by the State of Utah to accept Class A waste only.

Periodically, the Management Review Board of the NRC will conduct an evaluation of state's performance of radiological management, e.g., Integrated Materials Performance Evaluation Program, under the Agreement State Program, and issue a report listing all findings and recommendations to improve state's performance. The most recent review of California Agreement State Program was conducted in April 2004 (NRC, 2004 "Final

Report on the Integrated Materials Performance Evaluation Program, Review of California Agreement State Program).

1.2.4.2 State Regulations

Each state has its own radioactive waste management rules and regulations. For example, The Radiologic Health Branch within the Food, Drug, and Radiation Safety Division of the Department of Health Services (DHS), State of California, is responsible for the enforcement of radiation control laws and regulations designed to protect the public, radiation workers, and the environment. The radiation control program includes licensing of radioactive materials, registration of X-ray-producing machines, certification of X-ray and radioactive material users, inspection of facilities using radiation, investigation of radiation incidents, and surveillance of radioactive contamination in the environment. Table 4 lists the examples of California state regulations pertaining to radioactive material management. Details of California Health and Safety Code (HSC) regarding to radiation safety and management can be found in the following link: http://www.leginfo.ca.gov/calaw.

Table 4. Examples of California State Radioactive Material Management Regulations

California Code of Regulations (CCR)	Content
TITLE 17. Public Health, Division 1. State Department of Health Services, Chapter 5. Sanitation (Environmental), Subchapter 4. Radiation.	Radiation source management - regulates the procession and use of radioactive materials and radiation devices (i.e., X-ray machines).
TITLE 17. Public Health, Division 1. State Department of Health Services, Chapter 5. Sanitation (Environmental), Subchapter 4.5. Radiologic Technology.	Radiologic technology management - regulates certificates, permits, and approval for the education, performance, and practice of radiology and radiologic technology in California.
TITLE 17. Public Health, Division 1. State Department of Health Services, Chapter 5. Sanitation (Environmental), Subchapter 4.6. Nuclear Medicine Technology.	Nuclear medicine technology management - regulates certificates for performing nuclear medicine technology.

Section 114960 of the California Health and Safety Code (HSC) - Radiation Control Law describes state's responsibility to institute and maintain a regulatory program to protect the public health and safety for source of ionizing radiation. The program should be compatible with federal regulations, as an integrated effective system of regulation within the State, and as a system to be consonant as possible with those of other states. The Radiation Control Law provides the policy to: (1) effectively regulate source of ionizing radiation for the protection of the occupational and public health and safety; (2) promote an orderly regulatory pattern within the State, among the states, and between federal government and the State, and facilitate intergovernmental cooperation with respect to use and regulation of sources of ionizing radiation to the end that duplication of regulation may be minimized; (3) establish procedures for assumption and performance of certain regulatory responsibilities with respect to byproduct, source and special nuclear materials; and (4) permit maximum utilization of source of ionizing radiation consistent with the health and safety of the public.

Section 106965 of the California Health and Safety Code (HSC) - management of practice of radiologic technology, describes license and permit requirements for a person to administer or use diagnostic or therapeutic X-ray on human beings, including mammography.

Sections 107150 to 107175 of the California Health and Safety Code (HSC) regulate the practice of nuclear medicine technology. Nuclear medicine technology means that technology applied under the supervision of a physician and surgeon or a licensed clinical bioanalyst, when performing in vitro procedures, that pertains to the utilization of radiopharmaceuticals for the diagnosis and treatment of disease in humans and includes: (1) the standardization of radiopharmaceutical dosages prior to administering the preparation of radiopharmaceutical agents in accordance with department regulations, (2) the administration of radiopharmaceuticals in accordance with statute or regulation, and (3) the calibration and use of radiation detection instruments and equipment to obtain clinical information. Nuclear medicine technology includes in vitro tests performed in a licensed clinical laboratory that use a radioactive marker substance not administered to human subjects and in vivo nuclear medicine procedures that involve administration of a radioactive marker substance to humans. The code further regulates certificates for performing nuclear medicine technology. Any practice of nuclear medicine technology should be performed by a licensed physician and surgeon, clinical laboratory technologist, bioanalyst, or clinical chemist. And in vitro procedures using radioactive materials shall be performed in a licensed clinical laboratory.

1.3 Low-Level Radioactive Waste Generation and Disposal in the U.S.

Since the focus of this feasibility study is on the management of radioactive wastes generated by civilian use, therefore, only the low-level radioactive waste generation and management practice in the US are presented.

1.3.1 Low-Level Radioactive Waste Generation by States

According to DOE's "1998 State-by-State Assessment of Low-Level Radioactive Wastes Received at Commercial Disposal Sites, National Low-Level Waste Management Program" report (prepared by Idaho National Engineering and Environmental Laboratory and Lockheed Martin Technologies Company for DOE, May 1999, DOE/LLW252), there are five major categories of low level radioactive waste source - academic, government, industrial, medical, and utility. Table 5 shows 1998 waste distribution by state as reported by disposal site operators as of March 1, 1999.

Table 5. 1998 Distribution of Low-Level Waste Disposal by State

State	Volume (ft^3)	Activity (curies)	State	Volume (ft^3)	Activity (curies)
Alabama	7552.41	3,583.19	New Hampshire	261.55	85.76
Alaska	0	0	New Jersey	8,553.44	21,182.92
Arkansas	3,885.56	246.07	New Mexico	396.34	12.31
Arizona	365.64	7.25	New York	13,833.88	54,757.14
California	12,202.46	570.62	N. Carolina	7,390.20	4.40
Colorado	1,749.18	974.60	N. Dakota	48.77	1.92
Connecticut	8,653.00	223.28	Ohio	130,507/19	99.75
Delaware	173.79	0.07	Okalahoma	795.98	0.02
Dis. Of Columbia	245.15	25.94	Oregon	92,742.95	551.06
Florida	39531.35	2,088.63	Pennsylvania	42,686.01	43,69950
Georgia	9,916.08	1,232.77	Puerto Rico	11.18	<0.01
Hawaii	1,809.13	692.31	Rhode Island	53.20	21.67
Idaho	6.29	22.04	S. Carolina	14,135.48	1,188.91
Illinois	64,947.44	112,662.21	S. Dakota	2.20	18.93
Indiana	73.31	45.32	Tennessee	435,276.41	723.07
Iowa	1,035.88	266.70	Texas	13,067.38	1,887.28
Kansas	1,013.83	353.53	Utah	17,204.38	1.99
Kentucky	3,006.28	5.09	Vermont	25.58	<0.01
Louisiana	1,234.75	291.98	Virginia	24,752.62	2,538.10
Maine	4,125.40	1,066.91	Washington	30,809.97	149.84
Maryland	7,604.61	531.54	West Virginia	48.02	37.33
Massachusetts	155,654.26	18,998.41	Wisconsin	1,544.07	8.05
Michigan	81,700.98	37,423.61	Wyoming	4.10	0.03
Minnesota	1,316.63	313.95	Unknown	157,187.83	40.48
Mississippi	776.66	17,375.75	Total	1,419,034.12	334,562.76
Missouri	16,127.81	811.53	Note: Unknown - brokered low-level waste disposed at Envirocare facility in Utah, state or origin are unknown.		
Montana	8.81	0.03			
Nebraska	2,921.86	7,747.48			
Nevada	56.44	0.02			

It should be noted that the statistics result was primarily derived from disposal records kept at two facilities - Barnwell and Richland disposal sites. The data from Clive facility was not included in the analysis until 1998.

Table 6 lists typical waste forms by generator categories.

Table 6. Typical Waste Forms by Generator Categories

Source Categories	Type of Waste Forms
Academic (university hospitals, and university medical and non-medical facilities)	Compacted trash or solids
	Institutional laboratory or biological wastes
	Absorbed liquids
	Animal carcasses
Government (state and federal agencies)	Compacted trash or solids
	Contaminated plant hardware
	Absorbed liquids
Industrial (private industries including research and development company, manufacturers, non-destructive testing, mining, fuel fabrication facility and radiopharmaceutical manufacturers)	Depleted uranium
	Compacted trash or solids
	Contaminated plant hardware
	Absorbed liquids
	Sealed sources
Medical (hospitals, clinics, research facilities, private medical offices)	Compacted trash or solids
	Institutional laboratory or biological waste
	Absorbed liquids
	Sealed sources
Utilities (commercial nuclear power plants)	Spent resin
	Evaporator bottoms and concentrated wastes
	Filter sludge
	Dry compressible waste
	Irradiated component
	Contaminated plant hardware

1.3.2 Waste Volume Changes and Disposal Availability in the U.S.

Based on the DOE's 1999 report, the volume of low level radioactive waste disposed of at commercial disposal sites exceeded 3.7 million cubic feet in 1980. However, the volume has declined from 1981 to 1990, but, there was a slight increase in 1991-1992, and then slightly increased since 1992. This increase is believed to be the result of the anticipated increase in disposal costs and, in 1992, the anticipated closure on January 1, 1993, of the Barnwell, South Carolina, Beatty, Nevada, and Richland, Washington disposal facilities to "out-of-region" generators (please refer to section 2.2.4.1 - Agreement State Program and Interstate Compacts of this report).

On December 31, 1992, Beatty, Nevada facility stopped receiving low-level waste for disposal completely. Richland, Washington facility will be restricted to receive wastes from Northwest and Rocky Mountain compact states only. The Barnwell, South Carolina facility continued to receive waste generated by the member states of the Southeast compact and those states that had contracts with the Southeast Commission through June 1994. On July 1, 1994, the Barnwell facility only received from the member states of the Southeast compact. South Carolina withdrew from the Southeast compact and on July 1, 1995, the Barnwell facility began receiving waste from all states, with the exception of North Carolina.

In summary, as of July 1, 1995, North Carolina is the only state that is being denied radioactive waste disposal access. The Barnwell facility is operated by Chem-Nuclear Systems, LLC, and accepts wastes from all states except North Carolina. The Richland facility is operated by US Ecology and accepts wastes from only member states of the Northwest and Rocky Mountain compact regions. The Clive, Utah facility is operated by

Envirocare and accepts low-level wastes since 1994; however, their data was not included in the DOE report until 1998.

Furthermore, in a congressional testimony before the Committee on Energy and Natural Resources, United States Senate, presented by US Government Accounting Office (GAO) on September 30, 2004 titled "Low-Level Radioactive Waste: Future Waste Volume and Disposal Options are Uncertain", GAO presented the findings from examining the adequacy of disposal availability for Classes A, B and C wastes, and the recovery efforts involving Greater-than-Class-C waste, and provided recommendations. GAO examined the followings: (1) the changes in low-level waste disposal availability since 1999; (2) recent low-level waste disposal volume and potential future volume; (3) any current or anticipated shortfalls in disposal availability; (4) the potential effects of any such shortfalls; (5) the effectiveness of the Low-Level Radioactive Policy Act of 1980 in developing regional disposal options for Class A, B and C wastes; and, (6) the status of DOE's effort to dispose of Great-Than-Class-C wastes.

There are several major changes since 1999, including:

- In 2001, South Carolina enacted legislation restricting the use of the Barnwell facility only to generators in the three-member Northeast (or Atlantic) compact after mid-2008. In the past, the state legislature has changed its position on restricting access to this facility, both closing and reopening of the facility to non-compact member states over the years.

- In 2001, Utah state regulatory authority issued a license to Envirocare to accept Class B and C wastes, but still pending the Utah legislature and governor's final approval. Currently, Utah state has imposed a moratorium on approving the use of this license until February 2005, after a review of the recommendations of a hazardous waste regulation and policy task force. The task force is expected to issue its final report by November 2004. Granting approval for Envirocare to use its Class B and C waste license could help to alleviate a shortfall in Class B and C waste disposal capacity.

- In 2003, Texas passed a legislation allowing a geographic area in the state to be used for a new low-level radioactive waste disposal facility, along with a license application process for this facility. In August 2004, a private company submitted a license application to the Texas Commissions on Environmental Quality for approval to construct and operate a disposal facility 30 miles west of Andrews, Texas. It is projected that the facility could be licensed for operation in 2007. Access to this facility by non-compact states is yet to be determined. If this facility were permitted to accept waste nationally, it would help to mitigate a potential shortfall in disposal capacity for Class B and C wastes.

- In 2004, the 8th District Court of Appeals affirmed a federal district court's decision that Nebraska (as a hosting state for Central compact) is liable for $151 million damage for withdrawing its obligation to build a disposal facility. Later the Central compact states and Nebraska reached a settlement for $141 million plus interest. Under the settlement, if Nebraska and other compact member states can negotiate with Texas for access to the proposed facility, the settlement amount could be reduced to $131 million plus interest.

- In 2001, DOE significantly decrease its involvement in providing guidance and oversight of low-level radioactive waste management by the states. As of May 2000, the DOE reporting requirement of low-level radioactive waste

management as mandated by the Act was officially terminated. Furthermore, DOE ended their technical assistance activities after realignment of their emphasis.

- Since late 1990s, NRC has decreased its direct involvement in state's low-level radioactive waste management due to the fact that no new disposal facilities were being developed and more states have taken on the responsibility from NRC for the regulation of radioactive wastes.

These findings indicate that the radioactive waste management system in the US is a very complicated and dynamic system which could be changed with time.

GAO also concluded that the overall annual low-level radioactive waste disposal volume have increased recently (i.e., over 120 million cubic feet in 2003, although 99% of the waste are Class A), primarily due to the clean-up effort at DOE sites and decommissioning of nuclear power plants. However, volume of Class B waste actually declined from 23,500 cubic feet in 1999 down to 12,400 cubic feet in 2003. Volume of Class C waste fluctuated widely from 1999 to 2003, with over 20,000 cubic feet in 1999, 11,000 cubic feet in 2002, and over 23,000 cubic feet in 2003. Almost 99 percent of all Class B and C wastes were disposed in Barnwell facility.

GAO also determined that the DOE's Manifest Management Information System (the on-line commercial disposal low-level radioactive waste database maintained by DOE) is not considered as up-to-date as expected. For example, the volume of waste shipped from DOE facilities to the commercial disposal facility was not captured in time by the database. And, the database does not collect essential information such as volume of waste storage and reduction.

As for the future disposal volume of low-level radioactive waste, GAO concluded that there is uncertainties in projecting future disposal volume due to it will largely depend on the disposal decision made by the nuclear utility companies and DOE, as well as on possible changes in regulatory standards for what constitutes low-level radioactive waste (refer to section 2.2.2.10 - EPA ANPR). However, the disposal availability appears to be adequate to serve the nation's needs until mid-2008, when many states might lose disposal access for their Class B and C wastes. Class A disposal availability is not a potential problem in short or long term. All three commercial disposal facilities have enough capacity to accommodate all wastes until Mid-2008.

Although after mid-2008, disposal availability for the Class B and C wastes generated in the 36 states outside the Northwest, Rocky Mountain, and Atlantic compacts is uncertain. Nevertheless, concern over disposal availability can be resolved by extending access to Barnwell facility, or creating new disposal options for these classes of wastes. Furthermore, the utilities, the greatest generator of Class B and C wastes, can store these wastes on site if they don't have other disposal options.

In addition to using disposal facilities as the final solution for low-level radioactive wastes, license users of radioactive materials can continue to minimize waste generation, process waste into safer forms, and store waste pending the development of additional disposal options. Although some of these options could be quite costly. The options include material substitution (substituting non-radioactive material for radioactive materials), waste separation, recycling, and volume reduction by compaction and incineration, and dilution; and, on-site storage for short-lived isotopes to decay to innocuous level prior to final disposal.

Although the objective of the Low-Level Radioactive Waste Policy Act (LLRWPA) is to request each state to manage the disposal of their own wastes. However, the Act has not effectively facilitated the development of additional regional disposal capacity for all three classes of waste. In fact, only one commercial disposal facility (Envirocare) has been developed since passage of the Act. The conditions that are delaying the development of new facility include significant decrease in commercial low-level radioactive waste generation, available capacity of the three existing facilities to meet national disposal needs, rising costs of developing disposal facilities, and, public and political resistance in host states.

It is estimated that there could be 250,000 to 500,000 greater-than-class-C sealed sources currently in use in the US. The actual number of greater-than-class-C sealed sources that are no longer wanted is not known since there is no tracking system for these sources. Under LLRWPA, DOE is responsible for providing a disposal facility for greater-than-class-C waste and used greater-than-class-C sealed sources. DOE has not developed a permanent disposal facility, but did create the Off-Site Source Recovery Project and has been recovering unwanted great-than-Class C sealed sources from their owners and temporarily storing them at the Los Alamos National Laboratory in New Mexico. So far, more than 10,000 sealed sources have been recovered. However, the project is under funded and not in line with the mission of the responsible office (Office of Environmental Management), which is to accelerate the cleanup and closure of contaminated DOE weapons development facilities. Also, the Los Alamos National Laboratory has no more space that meets DOE's security standards for additional sealed sources containing Plutonium-239. Therefore, over 400 unwanted sealed sources containing Plutonium-239 were stored at the owner's facility (150 owners, and mostly universities) with security concern. There were no temporary storage facilities available for storing sealed sources containing strontium-90 and cesium-137. With the transfer of the responsibility from DOE to National Nuclear Security Administration (NNSA) and additional funding, additional space for storing plutonium-239 with proper security requirements was added at Los Alamos National Laboratory and at the Nevada Test Site. So far, 400 sealed sources have been recovered and additional 400 sources have been identified and will be recovered. The recovered sources eventually will be shipped to the Waste Isolation Pilot Plant in Carlsbad, New Mexico for permanent disposal. In addition to recovering plutonium-239 containing sources, NNSA will begin recovering strontium-90 and cesium-137 in 2005.

1.4 Radioactive Waste Storage, Transport, Treatment and Disposal in the US

1.4.1 Radioactive Waste Storage

Radioactive waste is generated from radioactive materials that are no longer of any use; radioactively contaminated equipment; or the unused byproduct of using, refining, and processing radioactive materials. Almost all activities that use radioactive materials generate some radioactive wastes. Radioactive waste can be in liquid, gas or solid form (refer to Table 6 - Typical Waste Forms by Generator Categories).

Most of the radioactive wastes are stored temporarily on-site by the generator prior to shipping to an off-site treatment or disposal facility for final disposal. Radioactive waste with a short half-life is placed in long-term storage facility to allow the radioactivity to decay to a safe level before final disposal. In other cases, the storage period can be very long when an appropriate treatment process or final disposal facility is not available. For example, high-level radioactive waste and nuclear spent fuel are stored on-site for long

period of time since the final repository facility (i.e., Yucca Mountain facility) is still under development. All radioactive wastes are stored in a metal drum, metal or wooden container depending on the chemical and physical characteristics of the waste and the type and concentration of radionuclides.

Storage of mixed waste is a different situation due to the unique property of mixed waste, both hazardous and radioactive. Federal regulation (RCRA) prohibits the storage of untreated waste except to facilitate proper recovery, treatment, or disposal. Therefore, federal and state regulations are being developed to allow mixed wastes to be stored on site for longer period of time in anticipation of treatment.

1.4.1.1 Wet and Dry On-Site Storage for High Radioactive Waste

High-level radioactive wastes such as spent nuclear fuel are stored in two ways - wet or dry storage. In addition, it can be stored either at the reactor where it was used or away from the reactor at another site.

Currently, most spent nuclear fuel is safely stored in specifically designed pools at individual reactor site. The water-pool storage involves storing spent fuel in rods under at least 20 feet of water, which provides adequate shielding from the radiation for anyone near the pool. The rods are moved into the water pool from the reactor along the bottom of water canals, so that the spent fuel always is shielded to protect worker. A typical spent fuel rod is about 12 feet long and 3/4 inch in diameter. The rods are arranged in square-like arrays, or called fuel assemblies, that range in size from an array of 6 rods by 6 rods to an array of 17 rods by 17 rods. The fuel pools vary in size from a capacity of 216 to 8,893 fuel assemblies.

Most pools were originally designed to store several years of spent fuel produced at the site. Due to the delay in developing a final repository facility for the spent fuel, operators have redesigned and rebuilt equipment in the pools to increase storage capacity. However, this option is limited by the size of the spent fuel pool and the need to keep the individual fuel rods from getting too close to other rods and initiating a criticality or nuclear reaction.

A commercially storage facility operated by General Electric Company can store spent fuel off-site using the wet storage pool technology. However, this facility is currently full and no plans to accept additional spent fuel.

If pool capacity for storing spent fuel is exhausted, operators may consider the use of above-ground dry storage casks. In dry storage, spent fuel is surrounded by inert gas inside a container called cask. The cask material can be metal or concrete, and the casks can be used for both storage and transportation. They can be placed either horizontally or vertically on a concrete pad. A total of 17 nuclear power plants are using dry storage to store spent fuels.

Both dry and pool storage are safe methods, but there are significant difference. The utilities and licensees using pool storage must have a very consistent operational process to safeguard the safe operation of a pool storage facility, including satisfactory performance of many mechanical systems using pumps, piping and instrumentation. On the other hand, dry storage is a simpler method and uses less support system, and therefore, carries less risk from potential human or mechanical failure. However, it should be noted that dry storage is not suitable for spent fuel storage until the fuel is taken

out of the reactor for a few years and the amount of heat generated by radioactive decay has been drastically reduced.

Currently, there are approximately 160,000 spent fuel assemblies, containing 45,000 tons of spent fuel from nuclear power plants in storage. Among them, 156,500 fuel assemblies are stored at nuclear power plants, and approximately 3,500 assemblies are stored at the GE-operated commercial storage facility. The majority (>95%) of the assemblies are stored in water pools, and less than 5% are stored in dry casks. About 7,800 used fuel assemblies are taken out of reactor each year.

1.4.1.2 Low-Level Radioactive Waste Storage

Normally low-level radioactive waste is packaged in containers that are appropriate to its radiation level of hazard. Some low-level radioactive waste requires proper shielding with lead, concrete or other materials to protect workers and public from radiation hazard. Workers are trained to maintain safe distance from the more highly radioactive materials, to limit the amount of time they spend near the materials, and to monitor the waste to detect any releases.

Nuclear power plants may store waste in special buildings that provide an extra degree of shielding. Safe distances must be maintained between the buildings containing radioactive materials and the fence restricting public access to the property. Hospitals typically store their radioactive waste in special containers or separate rooms. All radioactive waste storage areas are properly posted so that workers and the public will not unintentionally enter the area.

As mentioned earlier, some low-level radioactive waste may be stored to allow the short-lived radionuclides to decay to a safe level prior to final disposal.

1.4.2 Transportation of Radioactive Waste

NRC, DOT and state agencies regulate the transportation of radioactive wastes. NRC and DOT regulates highway and rail transportation of radioactive wastes. DOT regulations cover all aspects of transportation, including packaging, shipper and carrier responsibilities, and documentation for all levels of radioactive materials from exempted quantities to very high levels.

NRC regulations primarily address special packaging requirements for more highly radioactive materials such as spent fuel, and some low-level radioactive waste. The type of packaging required depends on the total quantity of radioactivity, the form of the materials, and the concentration of radioactivity. All packaging used to transport radioactive materials must meet certain general requirements set by DOT and NRC. Often the packaging used for transport is also used for disposal. DOT and NRC regulations are primarily based on international safety standards set by the IAEA.

Some state agencies also enacted regulations for the transportation of radioactive materials. State regulations typically address issues such as permitting, notification, determination of routes, financial liability, and inspection. States also enforce the federal regulations.

Radioactive waste transportation requirements include packaging, identifying materials, labeling packages and vehicles, training drivers, documentation, and reporting any

incidents involving accidental releases. The followings are DOE requirements for transportation of radioactive materials and wastes (National Safety Council's Environmental Health Center. January 2002 "A Guide to the US Department of Energy's Low-Level Radioactive Waste").

1.4.2.1 Packaging

Table 7 lists types of packaging used for transporting radioactive materials. Most low-level radioactive waste is shipped in Industrial (IP) or Type A packages. In general, DOE is responsible for determining the appropriate packaging for its own waste and ensure that each package that contains radioactive materials meets DOT and NRC requirements for design, materials, manufacturing methods, minimum thickness, tolerance and testing. Containers must be properly marked to indicate that all requirements are met. Type B packaging design for commercial waste must receive a certificate of compliance from NRC. However, DOE has the authority to self-certify Type B packaging. Certified packaging currently being used throughout the DOE facilities is reviewed and recertified every five years.

1.4.2.2 Labeling Packages

All packages must be properly labeled according to the hazard contents in the package. Although the package required for transporting radioactive material is based on the quantity of radioactivity inside the package, however, the label required on the package is based on the radiation hazard outside the package for worker protection. There are three labels to be used depending on the radiation level at the surface and at one meter from the surface. Three labels - White 1, Yellow 2 and Yellow 3, are referring to the color of the label and the numeral displayed. Table 8 lists three different labels and permissible radiation levels.

Table 7. Package Labeling Requirements

Label	Surface Radiation Level	And/Or	Radiation Level at 1 Meter from the Surface
White 1	Does not exceed 0.5 mrem/hr	-	Not applicable
Yellow 2	Does not exceed 50 mrem/hr	And	Does not exceed 1 mrem/hr
Yellow 3	Exceed 50 mrem/hr	OR	Exceed 1 mrem/hr
(Adapted from National Safety Council's Environmental Health Center. January 2002 "A Guide to the US Department of Energy's Low-Level Radioactive Waste", January 2002)			

1.4.2.3 Labeling Vehicles

In addition to labeling the packages, transporting vehicles (i.e., truck or rail cars) also need to be properly labeled with a diamond shape sign with "RADIOACTIVE" on the outside of the vehicle if they meet one of two criteria: (1) they contain low specific activity materials shipped as exclusive use, or (2) they are carrying packaging with Yellow-3 labels.

Table 8. Types of Transportation Packaging

Type of Packaging	Materials Transported	Packaging Design	Required Tests
Excepted	Materials with extremely low level of radioactivity such as instruments, or items like smoke detectors	Must meet general design requirements; packaging is made of such materials as fiberboard, or sturdy wooden or steel crates.	Packaging must: (1) be leak free, (2) be securely closed, (3) have sufficient cushioning and absorbency
Strong-tight	Materials with low levels of radioactivity, such as natural uranium and rubble from decommissioning nuclear reactors	Designed to withstand normal handling and stresses. Materials vary from cardboard or wood boxes to 55-gallon drums	Same as above. Meet the same requirements as the excepted packages.
Industrial (IP)	Materials with low amount of radioactivity that present a limited hazard such as contaminated equipment and waste solidified in concrete or glass	Must meet general design requirements plus requirements relating to normal transport and minor mishap conditions. Three categories based on packaging strength: IP-1, IP-2 and IP-3. Generally IP packages are constructed of steel.	IP-1: Must meet the same requirements as the excepted packages. IP-2: Must withstand of a free drop to a flat, hard surface and compression of at least five times its weight. IP-3: Must meet all tests required for Type A packaging.
Type A	Materials with higher concentration or amount of radioactivity than for excepted IP or IP.	Designed to withstand normal transport and minor mishap conditions; consists of inner containment vessel of glass, plastic, or metal, surrounded by an outer container of polyethylene, rubber, wood, or metal.	Must withstand (1) water spray for one hour; (2) penetration by dropping a 13.2 pound bar on the package; (3) vibration for one hour; (4) compression of at least five times its weight; and (5) free-drop on a flat hard surface (for packages less than 11,000 lbs).
Type B	Metals with high radioactivity levels including spent nuclear fuel and high-level waste	Design to withstand normal transport and severe accident conditions; packaging designs are certified by NRC, and DOE can self-certify; outer packaging is stainless steel and the inner canister is metal.	In addition to Type A requirements, Type B must also withstand: (1) free drop of 30 feet; (2) puncture test (dropping package onto a steel rod); (3) crush test; (4) exposure to 1,475°F (~800°C); (5) immersion in 50 feet of water

(Adapted from National Safety Council's Environmental Health Center. January 2002 "A Guide to the US Department of Energy's Low-Level Radioactive Waste", January 2002)

1.4.2.4 Training

Drivers who operate vehicles for shipments of radioactive wastes are required to receive proper training according to DOT requirements, and training on emergency response appropriate for the materials they are carrying.

1.4.2.5 Documentation and Communication

Federal regulations require that every shipment of radioactive waste be properly documented through shipping papers (a bill of lading or manifest). A copy of the shipment manifest must be provided to the disposal facility and the shipper must receive an acknowledgement that the facility received the waste. If the shipper does not receive acknowledgement within one week of shipment, it must begin an investigation.

Furthermore, states may require shipper's communication before and during radioactive waste shipments, particularly when there is an incident. For example, the carrier should notify local emergency response officials, through its dispatch center (e.g., 911 system) and the shipper. Local authority will assume incident command.

1.4.2.6 Shipping Routes

Generally, the carrier will select the shipping routes for highway shipment of radioactive waste according to DOT regulations and local requirements. Routes are selected to minimize radiological risk with consideration to factors such as accident rates, time in transit, population density, time of day, and day of the week. Radioactive waste is normally transported along the interstate highway system.

1.4.2.7 Emergency Response to Radioactive Waste Transportation Incidents

Local, state and federal governments and carriers are responsible for emergency response to radioactive waste transportation incidents. Local emergency response personnel typically are the first responders and incident commanders for a transportation accident. Although many local authorities have specialized hazardous materials response unit, however, state and federal technical assistance are normally required during a radiological incidents. Some states have emergency response units that are capable of handling radioactive material incident to support local authorities. Federal emergency response office (Federal Emergency Management Agency, or FEMA) and other federal agencies have developed a Federal Radiological Emergency Response Plan to manage radiological incidents. DOT requires shipper to report any transportation accident involving radioactive materials and has a comprehensive training program on handling radiological incidents.

1.4.3 Radioactive Waste Treatment and Disposal

Radioactive waste treatment is the use of technologies to change the physical, chemical or biological characteristics of the waste to reduce its volume, toxicity, or both to make the waste safer for disposal. Due to unique characteristics of radioactive waste, available technologies for treating radioactive wastes are limited. Selection of treatment technology is based on composition, quantity and forms of the waste material.

1.4.3.1 High-Level Radioactive Waste Treatment and Disposal

There is no known treatment technology for treating high-level radioactive waste. In the US, high-level radioactive waste will be disposed of underground, in a deep geologic repository. Yucca Mountain, Nevada, will be the single candidate site for characterization as a potential geologic repository. Although other alternative such as reprocessing of spent fuel to extract plutonium from spent fuel to be used as a reactor fuel has been considered in the past, however, this option is not pursued further due to cost and security (i.e., nuclear proliferation) concerns.

1.4.3.2 Low-Level Radioactive Waste Treatment and Disposal

Most commonly used technologies for treating low-level radioactive waste prior to disposal are volume reduction and immobilization (solidification). Volume and size reduction includes compaction, shredding or incineration of solid radioactive waste, and evaporation or filtration of water in liquid radioactive waste. However, the residual liquid wastes need to be solidified before final disposal. Immobilization is to stabilize radioactive waste in a suitable medium (i.e., cement) to immobilize the waste so there is no potential release of waste into the environment after it is stored.

Waste volume/size reduction techniques are commonly used for solid form of radioactive waste including compaction, cutting, crushing and shredding, incineration and pyrolysis. Incineration and pyrolysis are commonly known as thermal treatment.

Compaction is performed by using a mechanical compactor with a hydraulic driver to compact the waste container into a small size to achieve volume reduction. Compactor can be a drum compactor, box compactor or super-compactor (simply a compactor with a much more powerful hydraulic driver). The principle is to compress plastics, clothing, paper, small tubing (metal or plastic), and small containers. The process normally requires 55 gallon metal drums and a hydraulic press fitted with a plate on the ram just a little smaller than the mouth of the drum. The compressible waste is placed in the drum, a plastic disc that is slightly larger than the mouth of the drum is placed on the top of the material and the ram is lowered to compress the material. The plastic disc will seat in the drum groves and keep the material from expanding when the ram is lifted. Caution should be exercised when using this technique to keep from puncturing the side of the drum with the contents if metal objects are placed in the drum for compression.

Cutting is normally used to reduce large size of waste into a smaller piece so it can be fitted into a container or to be fed into an incinerator. Plasma-jets, laser torches and explosive fuses are commonly used for cutting. Crushing technique is used for size reduction of friable solid (i.e., glass, concrete, and ceramics). Any mill, grinder, crushing machine can be used. Shredding reduces void space and is particularly effective when plastics are compacted. Air trapped between folds of a plastic bulky object and plastic bags can be eliminated by shredding to save space.

Incineration is a thermal treatment using heat to destruct combustible portion of the waste (oxidation) and the end product is ash, including fly ash and bottom ash. This method requires an incinerator and careful monitoring of the airborne effluents from the incinerator stack. Radionuclide in the waste is concentrated in the ash, which must be treated, i.e., encapsulation or vitrification, before disposal. There are several different configuration of incineration such as rotary kiln incineration, fluidized bed incineration, circulating bed incineration and infrared incineration. Pyrolysis is another form of

thermal treatment. Pyrolysis is similar to incineration except the temperature is lower and the thermal dissociation of waste is in the absence of oxygen (reduction). Ash from pyrolysis must be treated in a similar way as incineration fly or bottom ash.

Although volume reduction can be beneficial for reducing space required for transportation and disposal, however, it should be noted that it is also a process of concentrating waste radionuclides, which might add to hazards and cost for transportation and disposal.

Other newer technologies for waste reduction are vitrification, plasma arc furnace treatment, and molten metal treatment. These are high temperature thermal treatment. At these temperatures, water is evaporated, and dry materials such as paper, wood, and plastic are vaporized. The remaining is a small volume of residue containing radioactive materials and a much larger volume of gases. The gases are collected, sampled, treated if necessary, and then released. The filters and purifiers used to treat the gases capture radioactive materials and must eventually be disposed of as low-level radioactive waste. Final products from these high temperature thermal processes also immobilize concentrated radionuclides.

In vitrification, the low-level radioactive waste is mixed with glass-making material and heated. The temperature is typically greater than 1,200 degrees Celsius (2,192 F). The mixture melts, and the melted material is used to make glass "beads" or disks about one inch in diameter and one quarter inch thick. One advantage of vitrified waste is that the radioactive material is bound up in the glass and is not easily released, even if water comes in contact with the waste after it is placed in a disposal facility.

Plasma arc furnace treatment uses plasma arc, which is a high-temperature gas that has an electrical charge, to thermally treat the waste. Plasma technology has been used for decades in basic industrial applications such as metal processing, surface coating, and making new materials. A plasma arc furnace is a chamber with a plasma torch, a port through which waste materials are fed, an exhaust port, and a tray to collect the melted waste. Waste material is fed into the plasma chamber, where it is melted by the torch at a temperature of 7,000 to 12,000 degrees Celsius (12,632 - 21,632 F). The melted waste, still radioactive, looks glassy when it cools. It takes up less space than the original waste and is in a more stable physical form.

In molten metal treatment, low-level radioactive waste is passed through a bath of molten metal. The metals most often used are iron and nickel. They are heated to temperatures between 1,500 and 1,575 degrees Celsius (2,732 -2,867 F). Many of the radioactive materials are captured in a froth that rises to the top of the metal and is skimmed off. It hardens and becomes slag. Some radioactive materials remain in the molten metal. The slag is disposed of as low-level radioactive waste, and the metal may be disposed of or used as shielding inside containers for radioactive material.

Radioactive waste can also be stabilized or immobilized using encapsulation technology - micro-encapsulation using bitumen (asphalt), polyethylene or polypropylene, macro-encapsulation using polyethylene polymer, sulfur polymer cement, or thermosetting resins (polyacrylamide) to minimize the likelihood of an inadvertent release of the contents at some future point. Polymer solidification can be applied to a wide range of wastes.

Solidification of liquid waste is very dependent on the makeup of the liquid and therefore requires experimentation with the different solutions being offered. For water based solutions, Portland cement as a solidification agent is widely used. Vitrification, mentioned earlier, is yet another method used for processing liquid waste and combines semi-liquids and liquids with glass. In this process, the radioactive liquid is combined with glass particles and heated to a very high temperature to produce molten glass. This molten glass is then poured into stainless steel canisters. When the mixture cools, it hardens into a stable glass that traps the radioactive material and prevents migration into the surrounding environment. Liquid radioactive waste can also be treated by calcining process. The liquid waste is injected into a calcining vessel where they solidify quickly on a hot fluidized bed. The end product is water vapor and small radioactive grains that can be withdrawn and transported through pipe to the steel drums for disposal.

One proposed waste treatment which has been studied recently is transmutation, the process of transmuting, or changing, the nucleus of an atom. It is possible to transform a long-lived radioactive nucleus into one that has a shorter half-life and will decay more quickly. In this process, radioactive nuclei of one kind are first separated from all other types of radioactive and non-radioactive nuclei. Then they are bombarded with high-speed subatomic particles from accelerators or nuclear reactors. When these subatomic particles are captured by radioactive nuclei, the nuclei change. The new nuclei have different characteristics, including a different half life. As a method for reducing the volume of low-level radioactive waste, however, transmutation has several drawbacks. It requires the difficult and expensive separation of one type of radioactive atom from all other radioactive and non-radioactive atoms in the waste. It has only been done in specialized laboratories with small amounts of radioactive material. In addition, it requires the use of accelerators or nuclear reactors which are expensive to build and operate and which, themselves, generate radioactive waste.

Historically, two methods of low-level radioactive waste disposal have been used: (1) near surface land disposal and (2) ocean disposal. Near surface land disposal involves confining low-level waste either at or below the earth's surface. Ocean disposal, employed by the Atomic Energy Commission prior to 1970, involved depositing waste containers on the ocean floor. This method is no longer used. Other disposal options such as mine disposal, deep well injection, and beneath seabed disposal are used or being considered around the world but are not currently used or under consideration in the US.

The near surface land disposal facility is the most commonly considered design in the US for low-level radioactive waste disposal. This includes both above grade and below grade facilities. There are seven different options and are discussed below.

(1) Improved Shallow Land Burial involves the placement of waste containers in trenches that are well above the water table. Trenches are typically 20 - 30 feet deep and 100 feet wide. Sand, gravel, or crushed stone is spread on the bottom of the trench to promote free drainage of water and to provide a dry foundation for the waste containers. The trench has a drain system equipped with monitoring devices to detect water that has seeped into the trench and any radionuclides that may have escaped from their containers into the water. When the trenches are full, any spaces between containers are filled with sand, and the trenches are capped (covered) with compacted clay. Figure 1 shows a simplified example of the improved shallow land burial site.

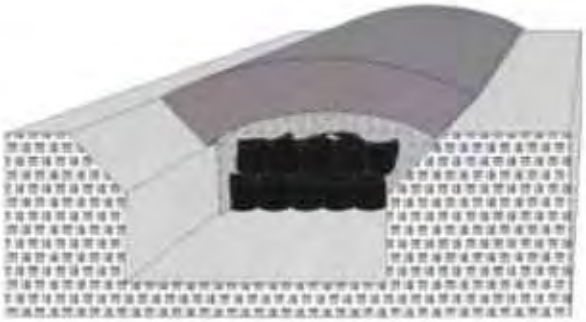

Figure 1. Example of a Simplified Improved Shallow Land Burial/Modular Concrete Canister Site

(2) Modular Concrete Canister Disposal is virtually identical to Shallow Land Burial except for the type of container used. In Shallow Land Burial, the waste is buried in the steel or wood containers in which it was shipped to the disposal site. In Modular Concrete Canister Disposal, the steel or wood containers are placed in large concrete canisters which are then stacked on top of each other in the trenches.

(3) Above Grade Vaults are rectangular structures, similar in size to warehouses. They are built above grade using reinforced concrete, metal, or masonry blocks. Each vault is graded for drainage and is equipped with monitoring systems and sump pumps. Figure 2 shows an example of above grade vault disposal site.

Figure 2. Example of a Simplified Above Grade Vault Site

(4) **Below Grade Vaults** are underground facilities similar in size to Above Grade Vaults. They are constructed of metal or reinforced concrete, and the floors are sloped for water drainage. Each vault has monitoring systems and sump pumps. Figure 3 shows an example of below grade vault disposal site.

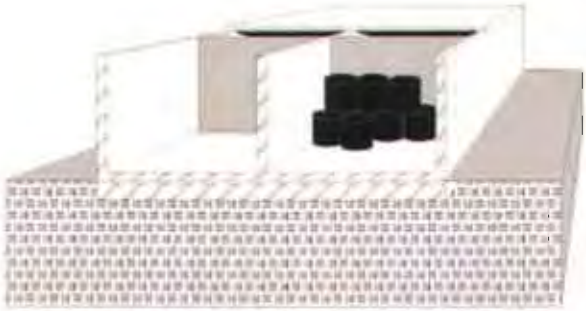

Figure 3. Example of a Simplified Below Grade Vault Site

(5) **Augured Holes** are another disposal option. A hole about 10 feet in diameter and 120 feet deep is dug. The bottom of the hole must be well above the water table. The walls of the hole are lined with metal or concrete. Waste containers are stacked in the hole. Any spaces between containers are filled with sand or clay. A cap usually made of concrete, plugs and seals the augured hole.

(6) **Earth Mounded Concrete Bunkers** combine features of above and below grade disposal. In this design, a trench is completely lined with concrete. Concrete wall panels are used to divide each trench into large compartments where containers of Class B and C waste are stacked. Spaces between containers are filled with concrete. Containers of Class A waste are stacked on top of the compartments. The Class A containers are situated above ground level and are covered with a cap of earth and clay. Grass may be planted on the cap to minimize wind damage and erosion. Figure 4 shows an example of earth mounded concrete bunker disposal site.

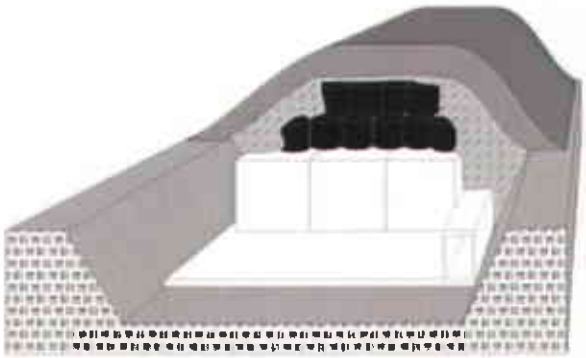

Figure 4. Example of a Simplified Earth Mounded Concrete Bunker Site

(Note: All disposal site figures are adapted from State of Ohio, RER-42, "What Disposal Methods Are Being Considered for Low-Level Radioactive Waste?")

(7) **Combination of Concrete Canister/Concrete Vault** disposal facility - concrete canisters containing the waste could be placed in an above grade or below grade vault.

2.0 RADIOACTIVE WASTE MANAGEMENT IN CHINA

Before the establishment of State Environmental Protection Administration of China (SEPA), radiation environment management was conducted by each nuclear facility operator in China, for example, the environmental protection division at each nuclear power plant was in charge of their own radioactive waste management under Ministry of Nuclear Industry's supervision. However, State Council established the SEPA in 1979 and consolidated radiation environment and radioactive waste management responsibility into one centralized management organization - the SEPA, which is responsible for nationwide radiation environment and radioactive waste management issues.

A division Under SEPA, the Nuclear Safety and Radiation Environment Management (originally the National Nuclear Safety Commission or NNSA, established by the State Council in 1984, but was merged as a division of SEPA in 1998), is responsible for setting national environmental protection policy and regulations for radioactive wastes and environmental radiation protection, as well as responsible for independent surveillance and management of the safety of Chinese civilian nuclear installations. Specific responsibilities of the Nuclear Safety and Radiation Environmental Management Division are:

- to develop guidelines, policies and regulations for nuclear safety, radiation environment and radioactive waste management;
- to participate in nuclear incident, radiation environmental incident emergency response;
- to uniformly supervise and manage nuclear facility safety and application of electromagnetic radiation and nuclear technology, and pollution control in radioactive mineral mining development;
- to provide safety supervision of nuclear material control and nuclear pressure retaining components; and,
- to implement international treaty and bilateral cooperation agreement.

The division has eight offices: radiation environment and comprehensive management office, first nuclear power office, second nuclear power office, nuclear reactor office, nuclear fuel office, radioactive waste office, radiation source and electromagnetic radiation management office, and nuclear equipment office.

In addition, Ministry of Health is in charge of worker health and safety associated with operation in nuclear facility.

2.1 Development of Radioactive Waste Management Regulations in China

Under the principle of "safety first, quality first" for developing nuclear energy in China, the State Council established the National Nuclear Safety Administration (NNSA) in 1984. In 1986, the State Council enacted the "Civilian Nuclear Facility Safety Supervision Management Rule" to assure safe construction and operation of civilian nuclear facility, to protect worker and public health, and the environment. The rule defines safety supervision management of civilian nuclear facilities including nuclear power plants (for electricity, heat and steam generation), reactors other than nuclear power plant reactor (research, experimental reactors and critical installations), nuclear fuel production, processing, and post treatment facilities, radioactive waste treatment and disposal facilities, and other nuclear facilities that are required strict supervision. The rule also establishes a licensing system for nuclear safety. License is required for nuclear power plant siting, construction, commissioning, operating and decommissioning.

In 1987, SEPA based on People's Republic of China (PRC's) Environmental Protection Act and promulgated "City (refers to province, autonomous region and municipality) Radioactive Waste Management Measures" to manage radioactive waste and used (spent or out-of-service) radioactive sources to protect public health and the environment. This measure requires the environmental protection bureau in each province, autonomous region and municipality to establish an organization, which will be responsible for the supervision of radioactive waste management and the monitoring of radiation environment in their jurisdiction. Each province, autonomous region and municipality environmental protection bureau is required to construct a storage facility to store radioactive wastes. The measure also defines radioactive waste as any artificially enhanced nuclides with a specific activity greater than $2*10^4$ Bq/kg (or $5*10^{-7}$ Ci/kg), naturally occurring radioactive nuclides, pollutant with a specific activity greater than $7.4*10^4$ Bq/kg (or $2*10^{-6}$ Ci/kg), or level of any surface contamination exceeding national radiation protection standard without decontamination process. It further defines city radioactive waste into three categories based on the length of half-life: short half-life (less

or equal to 60 days); intermediate half-life (greater than 60 days but less than or equal to 5.3 years); and, long half-life (greater than 5.3 years). The forms of city radioactive waste include contaminated metal and non-metal material, protection materials, contaminated equipment and tools, solidified low-level liquid radioactive waste, animal carcass or plants in research use, used sources, and scintillation liquid with radioactive nuclides (greater than 37 Bq/L or $1*10^{-9}$ Ci/L). The measure defines the responsibilities for radioactive waste generator, collector, shipper (including packaging, marking and manifest requirements) and storage and disposal facility operator. Finally, it defines a fee system for collection, transportation, storage and final disposal of radioactive waste.

Also, on June 15, 1987 State Council announced the "Nuclear Material Management Rules". The rule defines that radioactive material for military use is under the Department of Defense's jurisdiction; SEPA's NNSA (later became the Nuclear Safety and Radiation Environmental Management Division) is responsible for civilian use of nuclear material, and the Ministry of Nuclear Industry is responsible for licensing and managing nationwide nuclear material use.

Furthermore, in 1990, SEPA enacted "Radiation Environment Management Measures". It defines two level of management for radiation environment protection: national and provincial (including province, autonomous region and municipality) levels. In the national level, SEPA is responsible for setting radiation environment protection policy and developing rules, regulations and standards, and providing supervision on provincial level operation. Actual radiation environment protection is implemented at the provincial level, including review and approval of environmental impact assessment involving radioactive materials, review and approval of radiation pollution control facility and review and issuance of discharge or emission permits, implementation of monitoring and surveillance, emergency response to nuclear incident, fee collection for radioactive waste discharge or emission, centralized management of city radioactive wastes, resolution of radioactive incident dispute, and, training, performance review and public education. All radioactive wastes should be stored in a centralized storage facility. The facility is permitted and supervised by SEPA for its operation.

SEPA developed the "Environmental Policy for Intermediate and Low-Level Radioactive Waste Treatment" in 1992 to further enhance radioactive waste management practice, including:

- Expedite solidification process of radioactive liquid waste in the temporary storage facility by nuclear industry in the last thirty years. It is not permitted to store radioactive liquid waste on site at the nuclear facility. Other radioactive liquid waste generated from research and other applications should develop waste solidification plan and implement the process after obtaining approval from province.
- Limit low- and intermediate-level of solidified and solid radioactive wastes storage period. Particularly, the storage period for solidified and solid waste generated by nuclear power plant is five years. This storage period limitation will be further reduced in the future. All temporarily stored wastes, including nuclear industry and city radioactive wastes, should be shipped to the final disposal facility when the construction of the facility is completed.
- Construct regional low- and intermediate-level radioactive waste storage facility to handle regional waste disposal issue. SEPA will provide technical assistance in siting, construction and operation of the facility.

- Nuclear industry company is responsible for siting, construction and operation of regional low- and intermediate-level radioactive waste disposal facility.
- Central government will provide loans for the construction of the disposal facility. Nuclear power plant will set aside a fund for initial construction expense. The operation of the facility is a fee-based system and the user will be charged for using the service.

Recent incidents of lost spent sealed sources associated with injuries and potential public hazards have raised great concern from the central government. In 1991, incidents of lost sealed sources occurred in Inner Mongolia Agriculture and Husbandry College, and also in Shanxi and Henan Provinces. The Shanxi incident caused three deaths. As a result, SEPA announced an emergency notice of the "reinforcement of tracking and retrieval of spent sealed source" in 1993, requesting local authorities to develop and enforce sealed source management measures, to develop a database for tracking and identifying sealed source from production, use to final disposal. If the source in use does not meet safety requirement and the source owner can not correct the safety deficiencies in time, the public safety and health departments should revoke their permit and confiscate the source and store it in the city storage facility. The owner of the unused sources should store their sources in the city facility. The general public should be properly educated about the safe use of radiation. In case the source is missing, the owner should notify local authority and SEPA, and take proper action to investigate and retrieve the source.

Due to recurrence of lost sealed source incident, SEPA issued a notice in 1999 to reemphasize the importance of radiation safety and public health. The notice requests environmental protection authorities to strengthen the enforcement of "radiation environment protection measures" to investigate the users of radiation source and request that owners who are not already in the source owner database to report to the authority; to strengthen the enforcement of "city radioactive waste management measure" and start tracking all radioactive waste (including spent sealed sources) within their jurisdiction to ensure that all radioactive wastes are stored in the city storage facility, all un-used source to be stored prior to retrieval for use; to impose penalty to violators; and, to review facility decommission application to assure that no facility can be decommissioned without proper approval. Again, in 2004 SEPA held a "investigate radiation source and let public has a peace of mind" campaign and requested both national and local authorities to reinforce the radiation source management practice using uniform requirements, procedures and actions.

SEPA in 1996 defined the responsibilities for provincial and municipal environmental protection bureau in radiation environment protection as follows:

- Responsible for drafting local radiation environmental protection rules and regulations.
- Responsible for the review of environmental impact assessment of radiation facility or activity, such as production, use and sale of radioisotopes and sealed sources; production and use of x-ray equipment and accelerators; production and use of naturally occurring radioactive minerals including mill tailings; exploration of uranium, plutonium and mineral mines; uranium mining less than 50 tons capacity; all electromagnetic radiation equipment and facility excluding large-scale television broadcasting station.
- Responsible for the review of "three-simultaneous" for project construction and large-scale TV broadcasting station.

- Responsible for registration of radiation discharge source and discharge permits; radiation environment monitoring; centralized radioactive waste management; construction of radioactive waste storage facility; collection and storage of radioactive wastes; storage facility monitoring; supervision on nuclear facility decommissioning; participation in emergency response of a radiation incident and post-incident handling; radiation safety personnel training; and, assistance to the custom in the inspection of importation of radiation equipment, radioactive materials and radioactive wastes.

In 1996, Department of Transportation promulgated "Rules for Dangerous Goods Shipping in Waterways" and defined requirements for packaging, marking, shipping, loading and unloading, storage, delivery, fire protection and spill treatment of dangerous good including radioactive materials.

In 2003, China enacted the "PRC's Radioactive Pollution Control Act", which contains eight chapters and are summarized below:

- General Rules - define objectives and roles of various government agencies in the enforcement of radioactive pollution control.
- Supervision and Management of Radioactive Pollution Control - defines radiation environment monitoring requirements and responsible parties; responsibility of radiation source owners and users; training and qualification; radiation device marking and labeling; and, radiation standards.
- Radioactive Pollution Control at Nuclear Facilities - defines requirements for siting, construction, fuel loading, operation, decommissioning of nuclear facility, emergency response measures, and the responsibility of environmental monitoring surrounding the facility.
- Radioactive Pollution from the Application of Nuclear Technologies - defines production, sales and use of radioisotopic materials and licensing requirements, registration and tracking of radiation sources, facility and equipment inspection, and storage.
- Radioactive Pollution Control in Uranium and Radioactive Mineral Mining and Utilization - defines the responsibility and licensing requirements for uranium and radioactive mineral mining and pollution control, environmental monitoring, waste disposal and mine decommissioning.
- Radioactive Waste Management - defines the responsibility of owners or operators of radioactive materials to properly manage radioactive wastes, and to minimize waste generation, emission and discharge permit application and approval, prohibition of illegal dumping or disposal of radioactive wastes, high-level waste disposal by geologic disposal and low to intermediate level waste disposal by shallow ground disposal, prohibition of ocean dumping or dumping in any waterbody, siting and construction requirements for final disposal facility, and fee schedule for waste disposal.
- Legal Responsibility - defines responsibility for all parties involved in radioactive material production, sale, use and radioactive waste generation, and penalty for violators.
- Appendix lists definition of technical terminology and defines the Department of Defense to be in charge of radioactive materials use and radioactive waste

generation in military, and all workers are subject to radiation safety standards as described in the "PRC's Occupational Disease Prevention Act".

Furthermore, SEPA, Nuclear Industry Company and various nuclear research institutes issued numerous standards related to radiation exposure, analytical methods, technical requirements for treatment and disposal. For example, GB9132-88 "Regulations for Shallow Ground Disposal of Solid Low- and Intermediate-level Radioactive Wastes" defines technical requirements for shallow ground surface and subsurface (approximately 50 meters below surface) disposal for low and intermediate-level solid radioactive wastes. The disposal site should have engineering shield protection or barrier to prevent waste from dispersing or spreading into environment and post health hazards. The maximum exposure of radiation should not exceed 0.25 mSV. Following parameters should be considered in siting a disposal site: geology, water temperature, meteorology, social and economic conditions. Cost effectiveness analysis should also be performed. Site operator should submit application and obtain license for operation or for decommissioning.

2.2 Radioactive Waste Classification Scheme in China

China adopted the IAEA radioactive waste classification principles and developed its own classification schemes for radioactive wastes. There are four categories: (1) classification based on final treatment/disposal requirements; (2) classification based on management requirements before final treatment/disposal; and (3) qualitative classification.

There are two types of wastes according to the classification based on final treatment/disposal requirements: solid and liquid radioactive wastes. Solid radioactive wastes can be further divided into following categories: high-level, long half-life intermediate- and low-level waste, short half-life intermediate- and low-level waste, and the exempted waste. Table 9 shows the solid radioactive waste classification based on final treatment/disposal requirements.

Table 9. Solid Radioactive Waste Classification in China

Waste Category	Waste Characteristics	Treatment/Disposal Method
Exempted wastes	Specific radioactivity level equals or is less than the control level@	Not treated as radioactive waste
Intermediate- and low-level waste	Specific radioactivity level is greater than the control level, heat release rate is less than $2KW/m^3$	Near surface or geologic disposal
Short half-life waste	Specific radioactivity level of long half-life α radionuclides in single waste container is less than $4*10^6Bq/kg$; or average specific activity level of long half-life α radionuclides in multiple containers is less than $4*10^5Bq/kg$	Near surface or geologic disposal
Long half-life waste	Specific radioactivity level of long half-life α radionuclides is greater than the level listed above	Geologic disposal
High-level waste	Specific radioactivity level of long half-life α radionuclides is greater than the level listed above, and has a heat release rate of greater than $2KW/m^3$	Geologic disposal
(@: The control level is derived from that effective exposure dose for general public is less than 0.01mSv as shown in Table 10)		

Table 10. Control Level for Solid Waste Radionuclide Specific Radioactivity

Radionuclide Group	Radionuclides	Exempted Control Level (A_I in Bq/g)
High energy β-γ radiation	^{22}Na, ^{60}Co, ^{137}Cs	0.1-1.0
Other β-γ radiation	^{54}Mn, ^{106}Ru, ^{131}I	1.0-10^2
α radiation	^{129}Pu, ^{241}Am	0.1-1.0
Carbon	^{14}C	10^2-10^3
Short half-life β radiation	^{32}P, ^{35}S, ^{45}Ca	10^3-10^4

Note: When solid waste contains multiple nuclides, control level is calculated using the equation below:

$$\sum_i A_i / A_{I,i} \leq 1.0$$

where, A_i is radionuclide's specific radioactivity in the waste (in Bq/g) and $A_{I,i}$ is the control level (in Bq/g) for radionuclides.

Liquid radioactive waste can be categorized as the exempted waste and discharged into city sewer system directly if meeting control level requirements. In addition, any radioactive waste when its concentration, activity or specific activity level is equal or lower than the control level after cleaning or decontamination process, can apply for exemption.

Classification based on management requirements before final treatment/disposal can be categorized according to the different state of the waste - airborne, water-borne and solid. Tables 11, 12 and 13 show the classification of airborne, water-borne and solid radioactive wastes, respectively.

Table 11. Classification of Airborne Radioactive Waste

Class	Level	Radionuclide Concentration, C (Bq/m^3)
I	Low-level	$C \leq 4*10^7$
II	Intermediate-level	$C > 4*10^7$

Table 12. Classification of Water-borne Radioactive Waste

Class	Level	Radionuclide Concentration, C (Bq/L)
I	Lo-level	$C \leq 4*10^6$
II	Intermediate-level	$4*10^6 < C \leq 4*10^{10}$
III	High-level	$C > 4*10^{10}$

Table 13. Classification of Non-α Solid Radioactive Waste

Class	Level	Radionuclide Specific Activity, A (Bq/kg)			
		$T_{1/2}$≤60-day (1)	60-day<$T_{1/2}$≤5yr (2)	5a≤$T_{1/2}$<30yr (3)	$T_{1/2}$ >30 yr
I	Low	A≤4*10^6	A≤4*10^6	A≤4*10^6	A≤4*10^6
II	Intermediate	A>4*10^6	A>4*10^6	4*10^6<A≤4*10^{11}(or heat release rate is less than 2KW/m^3)	A>4*10^6(or heat release rate is less than 2KW/m^3)
III	High	-	-	A>4*10^{11} (or heat release rate is greater than 2KW/m^3)	A>4*10^{10} (or heat release rate is greater than 2KW/m^3)

(1) Includes ^{125}I ($T_{1/2}$=60.14d)
(2) Includes ^{60}Co ($T_{1/2}$-5.27yr)
(3) Includes ^{137}Cs ($T_{1/2}$=30.17yr)

Qualitative classification categorizes radioactive waste based on their characteristics: (1) from generation sources, such as mine tailing wastes, nuclear power plant waste, reprocessed spent fuel waste, decommissioned waste and city waste; (2) by treatment methodology, such as combustible waste and compactable waste; (3) by physical property, such as volatile waste, organic waste and biological waste.

2.3 Nuclear Industry in China

Although abundant in coal and hydroelectric power generation, China is determined to develop additional nuclear power capability to ensure the country can meet the power needs from rapid economic growth. Table 14 lists existing nuclear power projects in China.

Table 14. Description of Nuclear Power Projects in China

Station	Reactor Type	Capacity (MW)	Status	Operator	Reactor Supplier
Guangdong-1	PWR	984	Operating since 1994	GNP JVC	FRAM
Guangdong-2	PWR	983	Operating since 1994	GNP JVC	FRAM
Qinshan-1	PWR	300	Operating since 1994	QNPC	CNNC
Qinshan-2A	PWR	600	Operating since 2002	NPQ JVC	CNNC
Qinshan-2B	PWR	600	Start up in 2004	NPQ JVC	CNNC
Lingao-A	PWR	986	Operating in 2002	GNP JVC	FRAM
Lingao-B	PWR	986	Start up in 2003	GNP JVC	FRAM
Qinshan-3A	PHWR	728	Start up in 2002	TQNPC	AECL
Qinshan-3B	PHWR	728	Start up in 2003	TQNPC	AECL
Tianwan-1	WWER	1000	Start up in 2004	JNPC	AEE&ZAES
Tianwan-2	WWER	1000	Start up in 2005	JNPC	AEE&ZAES

Note: PWR: Pressurized Water Reactor; WWER: Water Cooled Water Moderated Power Reactor; PHWR: Pressurized Heavy Water Reactor. FRAM: Framatome, France. CNNC: China National Nuclear Corporation. AECL: Atomic Energy of Canada. AEE&ZAES: Russian Nuclear Company. Adapted from IAEA "Country Nuclear Power Profiles - People's Republic of China", 2001 and from World Nuclear Association "Nuclear Power in China", October 2004.

After all 11 units in operation from 2005, nuclear power in China can produce an electricity capacity of approximately 8,900 MW. The government plans to increase nuclear generating capacity to 36 GW by 2020. Table 15 lists the proposed nuclear power units in China.

Table 15. Proposed Nuclear Power Units in China

Proposed Plant	Province	Unit * Gross Capacity (MW)
Lingdong	Guangdong	2 * 1,000/1,500
Quinshan-2 (Units 3 & 4)	Zhejiang	2 * 600/1,000
Sanmen	Zhejiang	2 * 1,000
Yangjiang-1	Guangdong	2 * 1,000/1,500
Haiyang	Shandong	2 * 1,000
Huian	Fujian	2 * 1,000
Tianwan-2	Jiansu	2 * 1,000
Yangjiang-2	Guangdong	2 * 1,000/1,500
Yangjiang-3	Guangdong	2 * 1,000/1,500
Jinzhouwan	Liaoning	2 * 1,000
Jiuliang	Jiangsu	2 * 300
Hainan	Hainan	2 * 300
Filing	Chongqing	2 * 900
Total		23,000 to 27,000
(Adapted from World Nuclear Association "Nuclear Power in China", October 2004.)		

Based on World Nuclear Association's record, China's known uranium resources of 70,000 tons will be sufficient to fill the needs for the national nuclear program for the short-term. Production of approximately 1,000 tons/year that from heap leach operations at several mines in Xinjiang province supplies current needs. China also has five active operating uranium mines - Fuzhou, Chongyi, Yining, Lantian and Benxi, and one stand-by mine in Hengyang. The Lanzhou enrichment plant in Gansu province currently supplies Daya Bay plant. An additional uranium enrichment plant is located in Hanzhong, Shanxi province. Yibin of Shichuan province has a fuel fabrication plant producing fuel assemblies for Qinshan-1 plant and Daya Bay units. The other fuel assembly plant is located in Baotao.

China has developed a closed fuel cycle strategy for its nuclear power program. Therefore, the spent fuels from nuclear reactors will be handled by at-reactor storage, off-site storage, and reprocessing. The generation of spent fuel will increase when all the units are in operation. It is expected that by 2010 with a capacity of 20 GW and by 2020 with a capacity of 40 GW, the annual spent fuel will reach approximately 600 tons in 2010 and 1,000 tons in 2020, respectively. A centralized spent fuel storage facility has been constructed in Lanzhou Nuclear Fuel Complex in 1994. The facility has a storage capacity of 550 tons in 2001 and could be expanded with an additional capacity of 500 tons. Currently, a pilot-scale reprocessing plant was constructed and cold commissioning in 2002. A full scale commercial fuel reprocessing facility will be in operation in near future. In addition to commercial nuclear power plants, China has several experimental and research reactors. At present, a total of 10 research reactors ranging up to 15 MW and one 125 MW test reactor are operational in China.

From a radioactive waste management perspective, this development will ensure growth of waste amount in the near future and pose multiple challenges to the nation's regulatory

agencies. According to a waste generation rate of 833 m^3 per 1 GW electricity generation, China generated approximately 5,666 m^3 radioactive wastes and $3.9*10^5$ m^3 uranium mill tailing wastes in year 2000 by 10 nuclear power generation units. It is expected that from 2000 to 2010 with the completion of new nuclear power facilities, the annual radioactive waste generation by nuclear power facilities will reach $5*10^5$ m^3. If combined with other radioactive generation sources such as military, medical, scientific research and educational institution, the total annual radioactive waste generation amount will reach $7*10^5$ m^3.

2.4 China and IAEA

China first made unofficial inquiries about possible participation in the IAEA in 1978. China applied for membership with the IAEA in 1983, and became a member in January 1984. Since then, China has declared that it will apply IAEA safeguards on all of its nuclear exports. China also has signed a number of agreements with the IAEA, applying safeguards to nuclear exports to other countries such as Algeria, Chile, Ghana, Nigeria, Pakistan (2 agreements), and Syria. In 1988, China signed an agreement with the IAEA subjecting a number of facilities in China to IAEA safeguards, and also guaranteeing that China will require recipients of Chinese nuclear exports to accept IAEA safeguards.

Currently, China has two facilities under IAEA safeguards: (1) the Qinshan-1 nuclear power reactor and (2) the HWR-2 research reactor at the China Institute of Atomic Energy Institute, Beijing. In addition, the three-module centrifuge plant being built with Russian assistance at Hanzhong and the CANDU power reactors to be provided by Canada will also be under IAEA safeguards. In 1991, China further declared that it would report to the IAEA any export or import of nuclear materials and all exports of nuclear equipment. However, although China has placed all of its nuclear exports under IAEA safeguards, it does not require full-scope safeguards.

China signed an additional protocol with the IAEA in January 1999. The protocol stipulates that China will bring its civilian nuclear program under IAEA control. China also agreed to inform the IAEA of its nuclear cooperation, including nuclear imports and exports to non-nuclear weapon countries. The China Atomic Energy Authority is in charge of managing China's cooperation with the IAEA.

Since becoming a member state of IAEA, China has adopted many IAEA safety standards, including radioactive waste classification, management, technical requirements for treatment and disposal.

3.0 RADIOACTIVE WASTE MANAGEMENT IN TIANJIN

According to Tianjin City's 2003 environmental communiqué, the Tianjin City radiation environment was meeting requirements for both ionizing radiation indicator and electromagnetic radiation. There are 68 facilities that use sealed radiation source and meet "Basic Standards for Ionizing Radiation Protection and Radiation Source Safety". In addition, twelve facilities that use open isotopic source also meet management requirements.

Electromagnetic radiation monitoring results from 15 mobile communication stations, 56 miniature communication stations, Motorola 150 MHz group communication system and electrical distribution systems in small residential districts also meet electromagnetic radiation protection standards.

Tianjin EPB installed and operated an on-line real-time safety management system to monitor facilities in the city using radiation source. The second phase of the construction of City radioactive waste storage facility was completed.

3.1 Legal Framework of Radioactive Waste Management in Tianjin

Tianjin City Government promulgated "Tianjin City Radioactive Waste Management Measures" on June 1, 2004, which is one of the most important legal frameworks for radioactive waste management in the city. This legislation replaces the 1986 version of the measure. This measure contains twenty two articles and is summarized below:

- The measure is promulgated based on the requirements as listed in the "PRC's Radioactive Pollution Control Act" in 2003.
- This measure is applicable to all organizations that produce radioactive wastes from the use of radioisotopes and nuclear technologies.
- The City's environmental protection bureau is responsible for city-wide radioactive waste management.
- Public safety and other departments, according to their legal authorities, are responsible for safety and security protection of radioactive wastes.
- The measure applies to the following radioactive wastes: (1) materials, container, tools, equipment, and, animal carcass and plants that are contaminated with radioactive pollution; (2) spent or out-of-service sealed radiation sources; (3) organic scintillation liquid containing radionuclides; and, (4) other radioactive wastes.
- Radioactive waste generators should construct on-site radioactive waste temporary storage facility according to national requirements and standards. The temporary storage facility should be properly marked and staffed with trained personnel to prevent lost or theft of radioactive waste.
- Radioactive waste generator can store wastes with a half-life less than 60 days in the on-site temporary storage facility. The treated waste should be delivered to City-operated disposal facility for final disposal.
- Radioactive waste generator should deliver all other radioactive wastes (any waste with greater than 60-day half-life) directly to the city storage and disposal facility without any pretreatment.
- Any importation or exportation of radioactive waste into or from the city should meet national regulatory requirements.
- Spent sealed source should not be mixed with other radioactive waste. Radioactive waste is prohibited to mix with other solid waste and be abandoned, discarded or incinerated.
- Radioactive waste should meet the following requirements before being shipped to disposal facility: (1) radioactive waste should be dry and the content of ionizing liquid ratio should be less than 1%; (2) radioactive waste should be stable, and does not have volatile, combustible or explosive nature, and is not a strong oxidant and corrosive; (3) experimental plants with radioactivity should be dehydrated, dried or turned into ash; (4) experiment animal carcass should be solidified using cement, dried or tuned into ash, or treated to prevent the carcass

from rotting; (5) container surface contamination should meet national pollution level and radioactivity standards requirements; and, (6) the package of spent sealed source should be intact and the package surface contamination should meet national pollution level and radioactivity standards.

- Radioactive waste packaging should meet the following requirements: (1) use uniform waste containers, each container's volume should be less than 30 liters, and the total weight, including the waste, should not exceed 20 kg; and, (2) waste packaging should take half-life of radionuclides into consideration, for example, wastes with similar half-life should be packaged into the same waste container.

- Radioactive storage and disposal facility should inspect all received wastes and only accept wastes that are meeting requirements and prepare waste manifest document. The facility operator should reject the ones that are failed to meet requirement and request the generator to take proper corrective action. After the receipt of spent sealed source, the waste generator should submit waste manifest document to public security department to complete source delisting procedure.

- The storage and disposal facility should assign designated individual and specially designed vehicle for collection and transportation of radioactive waste. Waste transportation route should avoid water resource protection, scenic, natural preserve and other protective areas, and select proper shipping time and distance to travel through high population areas.

- The storage and disposal facility should examine worker's surface contamination after each shipment and only permit the worker to leave the facility when the worker's level of radioactive contamination meets national requirements. Tools and vehicles should also be examined for contamination. If contamination exists, tools and vehicles should be subject to decontamination process.

- Radioactive waste generator should pay a fee to use the storage and disposal facility. The fee schedule and fee utilization will be determined jointly by the City's Finance, Pricing and Environmental Protection Bureaus.

- Violators of this measure will be fined. Waste generator's temporary storage facility does not install proper marking and does not correct the deficiency in a fixed period of time will be fined up to a maximum of RMB10,000. The authority can suspend waste generator's operation if the generator does not ship waste with half-life greater than 60-day directly to city's storage facility, or conducts treatment on-site, or does not segregate spent source from other radioactive waste, or mixes radioactive waste with solid waste, or abandons, or dispose or incineration of radioactive waste, or not takes necessary corrective action, will be fined up to a maximum of RMB200,000.

- If waste generator refuses to pay disposal fee, if overdue, the Environmental Protection Bureau can impose 5% late fee daily, and a fine up to a maximum of RMB30,000.

- The violator after paying a fine is not relieved from their financial liability for expenses associated with clean up or decontamination.

3.2 Other Legal and Technical Requirements for Radioactive Waste Management in Tianjin

Based on the authority vested in them by the aforementioned measure, Tianjin Environmental Protection Bureau in July 2001 developed the "Tianjin City Radioactive Pollutant Reporting and Registration Handbook", requesting individual or organization directly or indirectly uses any radioactive materials, nuclear equipment, radioisotopes, sealed source, radiation device, radioactive mineral mining, and radioactive waste generator to report and register their radioactive pollutants with the Bureau regarding radioactive waste discharge or emission into the environment as part of the nationwide pollutant discharge or emission reporting, registration and modification system. The information reported and registered including organizational data, types and number of device used, and waste generation and discharge or emission estimation.

In 2003, the Institute of Radiation Environment Management under Tianjin EPB Solid Waste Management Division (currently a new division - Tianjin Nuclear and Radiation Safety Supervision Division, in parallel to the Solid Waste Management Office), has developed a City Radioactive Waste Storage Expansion Plan and begun the construction of a new storage and disposal facility at the location adjacent to the existing storage facility. The storage and disposal facility expansion project is nearly completed in 2004. The division also developed the following technical documents:

- Tianjin City Radiation Environmental Monitoring Program
- Procedures for the Collection and Storage of Radioactive Wastes
- Emergency Response Plan, and
- Supervision Station Emergency Response On-site Supervision Implementation Procedure

3.3 Civilian Radioactive Waste Management in Tianjin

In order to develop a program which will enhance or improve current civilian radioactive waste management system, it is necessary to fully understand generation source, waste quantity, transportation, storage and disposal practice currently in use in Tianjin.

3.3.1 Data Collection and Site Visits

From October 27 to November 7, 2003, site visits were conducted to understand current civilian radioactive waste management policy, enforcement and general practice in Tianjin City. Table 16 lists on-site activity schedule arranged by Tianjin EPB.

Table 16. On-site Activity Schedule (October 27 to November 7, 2003)

Date	Activity
October 27, 2003	Introduction of program and project personnel
October 28, 2003	▪ Introduction of US laws and regulations, management approaches, operation and procedures and other background on radioactive waste management. ▪ Introduction of China and Tianjin laws and regulations, management approaches, operation and procedures and other background on radioactive waste management. Discussion of Tianjin current situation and demands.
October 29, 2003	Visit Tianjin Medical University General Hospital - nuclear medicine application (i.e., medical diagnosis and treatment) and waste management practice.
October 30, 2003	▪ Visit Huang He Hospital - nuclear medicine application (medical diagnosis and treatment) and waste management practice. ▪ Visit Tianjin City Radioactive Waste Storage Facility
October 31, 2003	Visit DEPU Radiopharmaceutical Company - radioisotopic pharmaceuticals manufacturing/formulation facility and radioactive waste management
November 3 to 5, 2003	Group discussion
November 6, 2003	Preparation of initial findings and recommendations
November 7, 2003	Presentation of initial findings and recommendations

Information obtained during the site visit is summarized below:

- For liquid waste and decommission and construction wastes - Normally, liquid waste (for example, patient's urine from radiological treatment) is processed using a multi-media processing system. The effluent is sampled and released and the filter media is disposed of as radioactive solid waste. Currently, Tianjin EPB does not have any building material that has been contaminated with longer lived radionuclides. Normally, contaminated construction material is stored for sufficient time resulting in decay of the source radionuclide (usually about 6 months). If a facility needs to be decommissioned, Tianjin EPB would prepare a closure plan and obtain SEPA approval. Tianjin EPB uses a cradle to grave tracking system for generation of radioactive waste along with construction and decommissioning debris.

- Nuclear medicine and radioactive waste management - Tianjin Medical University General Hospital (Class 3) was visited to observe the storage and use controls of nuclear medicine and wastes. The Nuclear Medicine Department has two major departments; diagnostic, and treatment using radioimmunology and radionuclides (^{125}I and ^{131}I). The diagnostic process uses imaging involving ^{99}Tc. Typically, the ^{99}Tc source is 3-15 μCi and administered by injection. The patient is released after imaging. This process produces waste in the form of needles, syringes, and vials. This material is normally stored for 60 days, monitored to ensure sufficient decay, and then disposed of as medical waste. The treatment process uses ^{131}I of source strength between 3 and 10 μCi. The radioactive material is packaged by the manufacturer and delivered ready for use. No waste is associated with administering of the radionuclide. The patient relieves themselves in a special toilet, has reduced visitation times, and is kept in the hospital for an extended stay. The sewer system for the special toilet is separate from the main sewer system and is directed to a multi-media treatment system. The effluent is then directed to the main sewer system. The multi-media

treatment system consists of an ion exchange column and a hollow fiber tube. The patient's room is ventilated by a fan in the window but has no filtration. The ^{125}I source was not discussed. Personnel radiation safety is accomplished by using personnel monitoring dosimeters. The dosimeters are collected quarterly. There is a health examination required annually. Personal protective equipment for radiology department worker is a lead apron during the administering process. Exposure limits for the worker is 10 rem/yr and the general public is 1 rem/yr. Each worker in the department receives occupational health and health administration (OSHA) equivalent training, radiological training is provided by Tianjin EPB. The workers are then certified for working in this department. They also receive annual refresher training. The hospital has one monitoring device and reads in mr/hr (however, it is old and not well maintained). The ETC (emission computed tomography) room is where the I-131 is administered and diagnostic equipment is used (such as X-Ray, etc.). The ETC room is shielded using 4mm of lead on the walls and ceiling. The ETC room is located on the second floor and has no lead shielding on the floor, although the reinforced concrete is thick. The radioimmunoassay process does not employ radionuclides. Radioactive containers are shredded and stored separately. The shredder is dedicated to this application and not used for any other shredding. The hospital has three licenses: permit for radiological work, hospital license, and use of radionuclides for external and internal administration. There are ^{60}Co sources used in radiology, but this department was not visited.

- Nuclear medicine and radioactive waste management - Huang He Hospital (Class 2) was visited to understand both medical and radioactive waste management practices. Three different radioisotopes (^{125}I, ^{131}I and ^{99}Tc) are used during treatment and diagnosis. A separate toilet and waste treatment system are used for handling the radioactive wastes. This system is very similar to the one employed at the Class 3 hospital discussed above. The sewer waste from the toilet is collected in one of two tanks, held for 60 to 90 days then released into the sanitary sewer system. Radioactive and medical waste is handled separately and by different groups. Radiological waste is handled by the Preventive Medicine Group and is part of the Hazardous Waste Management Team. Any solid radiological waste is compacted (using an onsite compactor) then stored for transportation to the radiological waste storage facility. The radioactive storage area is separate from all other storage areas and is locked. Personnel monitoring for hospital workers was not discussed nor was the type of solid waste generated using radiological treatment and diagnostic methods. It is assumed that the type of waste would be consistent with the type of waste generated at the Class 3 hospital.

- Tianjin City Radiological Waste Storage Facility - This facility is located outside of Tianjin City and is the main facility for storage of all radioactive waste and material for the City. The facility is managed by Tianjin EPB, Nuclear and Radiation Safety Supervision Division. The compound currently has two facilities. One of the facilities (the older and smaller building) is at capacity. The new facility is being constructed and is currently going through the permitting process. These facilities are discussed in detail in later sections. Facility environmental monitoring is performed by pumping ground water into a pond that is stocked with fish (this is a technique currently used in Scandinavian countries). The fish are used as a biological monitor and periodically a few of the fish are caught, dissected and counted for radioactivity. This technique is excellent for monitoring the effects of any radioactivity escaping into the environment but is not effective for monitoring radiation exposure to nearby

inhabitants. Environmental monitoring for the facility consists of soil sampling, air sampling, water sampling, fish sampling (as outlined above) and vegetation sampling. The samples are now sent to the Environmental Monitoring Center, a laboratory run by SEPA, and the results are sent back to Tianjin EPB for interpretation. (Tianjin EPB currently has three different types of radiation monitoring equipment - radiation meter [sodium iodide - NaI], radiation meter [Geiger-Mueller], and a neutron detector. Tianjin EPB expressed their desire to build a radiological measurement laboratory on-site in the future.) The samples are stored for two years. Environmental monitoring for radiation exposure is not performed. A compactor and incinerator are also planned for the compound to expand the capability for waste treatment and minimization. The procedures for transferring radioactive materials from the generator to the storage facility begin at the generator's site. Tianjin EPB will be notified and a representative will be sent to the generators site. The Bureau's representative will inspect each container being offered for shipment and provide approval for receipt at the storage facility. The Bureau will then designate the transfer routes and placarding requirements of the vehicle. The container construction criteria used to transport radioactive material is specified by SEPA. The facility site visit showed that the facility is surrounded by cotton fields.

- DEPU radiopharmaceutical company - This is an US/Tianjin joint venture biomedical manufacturing company. One of the products manufactured is ^{125}I for medical uses. The company produces 2,000 to 3,000 boxes of ^{125}I per month. Each box contains 5 μCi of ^{125}I. Several weaknesses in application of sound radiological controls for handling, marking and storing the radioactive material were identified, such as not all radioactive material was properly marked, storage of liquid waste did not use liquid tight lids or seals, transfer of liquid between containers was carried out by hand and not using funnels or drip trays, evidence of spills were found on the floor near the storage location of the liquid waste container, the drum stacking procedures employed in the storage area were not adequate to ensure the drums were properly stacked (drums were observed in a leaning position and not properly braced to prevent falling). A wastewater processing system using activated carbon and resin train is used to treat rinse water from the packaging process. It is concluded that although the applicable regulations were well written and comprehensive, however, the translation of the regulations into a standard operating procedure (SOP) and adherence to the SOP were weak.

- Other observations - Review of the National Radiological Monitoring Plan (issued as a guideline by SEPA) indicated that the monitoring requirements were well-defined, but lack of actual monitoring methods. As described earlier, currently Tianjin EPB is not equipped to perform monitoring as required in the plan. In addition, it was learned that Tianjin EPB gathers radiological data and reports the data to the national agency, stores radioactive material and waste, provides technical guidance (i.e. interpreting national requirements and promulgate local policy and regulations), and provides laboratory service. The enforcement authority is at the national level - SEPA.

Additionally, the following documents were provided by the Tianjin EPB:

- Current Status of Radioactive Waste in Tianjin City
- Radioactive Source Distribution Statistics in Tianjin City

- Table of Radioactive Materials, Waste and Sources Collected by Tianjin EPB, Radiological Environmental Management Institute
- Radioactive Waste Storage Facility Expansion Plan
- Tianjin City Environmental Radiation Monitoring Program (tentative)
- Radioactive Waste Collection and Storage Procedures
- Radioactive Waste Storage Facility Emergency Response Handbook
- Tianjin City Nuclear and Radioactive Safety Monitoring Station Emergency Response On-Site Supervision Implementation Procedures
- Isotopic Radiation Source Management Procedures
- Tianjin City Radioactive Waste Management Rules
- Tianjin City Radioactive Waste Reporting and Registration Handbook
- Regulations for the Safe Transport of Radioactive Materials
- Standard of Safety for Low and Intermediate Level Solid Radioactive Waste Packages
- Regulations for Interim Storage of Low and Intermediate Level Solid Radioactive Waste Packages
- Basic Standards for Protection Against Ionizing Radiation and for the Safety of Radiation Sources
- Compilation of Environmental Radiation Monitoring Methods, Analytical Methods, and Management Standards
- Technical Criteria for Radiation Environmental Monitoring
- Rules for Inspecting Imported Waste Metals for Radioactive Contamination

These documents were reviewed to understand the current status of civilian radioactive waste management in Tianjin City and to determine the type and quantity of radiological monitoring equipment needed to allow Tianjin EPB to comply with the regulations. Three separate programs were identified that need to be supported with radiological monitoring equipment, they are: (1) radiation monitoring; (2) environmental radiation monitoring; and, (3) emergency radiological monitoring. Furthermore, Tianjin EPA expressed their interest in the following areas: (1) to develop a dynamic information management system for radioactive waste to track generation, location, etc. and display using Geographic Information System (GIS); (2) to develop radiological emergency response monitoring program; (3) to develop standard procedures for environmental monitoring program; and, (4) to develop or adopt technology to reuse or recycle radioactive materials to minimize or eliminate waste generation.

3.3.2 Civilian Radioactive Waste Generation Source, Quantity and Projected Growth

Currently, there are approximately 700 radioactive waste generators in Tianjin City, consisting of universities, medical schools, hospitals, research institutes, industries and mining. Eighty three generators use sealed radioactive sources with total activity strength

of $1.4*10^{16}$ Bq and radionuclides such as ^{60}Co, ^{137}Cs, ^{226}Ra, ^{241}Am, ^{90}Sr, ^{239}Pu, and ^{14}C. Sixty seven facilities use "open radioactive sources" (this term is used to represent a source that has accessible loose surface contamination) with an annual usage of $2.6*10^{12}$ Bq, and radionuclides such as ^{125}I, ^{131}I and ^{3}H. Three generators use a total of 46 ^{241}Am-Be neutron sources with activity strength of $1.06*10^{13}$ Bq. Other radiation sources include 131 industrial diagnostic x-rays, 541 medical x-rays, 52 computerized tomography (CT scan) machines, one x-ray knife, one gamma-ray knife and ten accelerators. Table 17 lists basic statistics of type of generator, distribution and sources of radioactive materials in Tianjin. Table 18 shows generators of open source and their annual usage. Types of source and applications of radioactive materials and device are listed in Table 19. In summary, from geographical distribution it shows the generators are concentrated in the urban center areas; open sources and radiation devices are used mostly by medical facilities; the majority of the sealed sources are used by industry, however, the largest quantity of sealed source usage is scientific research. Table 20 lists the types of radioactive waste stored in the existing facility.

Although the actual projection of future growth of radioactive waste generation in Tianjin is not available during this study, nevertheless, it is expected that the growth could be significant due to the rapid economic growth in the country and the increase in use of nuclear technologies in medicine, industry and research.

Table 17. Statistics of Generator, Source and Distribution of Radioactive Materials in Tianjin

Type	Nuclear Facility	Radiopharmaceuticals		Open Source Isotope	Sealed Source		Radiation Devices				
		Production /Sales	Sales		Sealed Source (includes neutron source)	Gamma Radiation Device	Accelerator	X and Gamma Ray Knifes	X-Rays	X-Rays Diagnostics	Scientific Instruments
Organization	1	6	4	66	83	3	7	3	600	96	27
Units	-	-	-	-	~800	3	11	3	1,400	200	40
Geographic Distribution											
Urban Center	1	2	4	56	49	2	7	3	285	10	11
Rural Areas	-	1	-	-	7	1	-	-	95	69	2
Tan-Han-Da Area	-	3	-	3	14	-	-	-	92	14	4
Five Hisens	-	-	-	7	13	-	1	-	128	3	-
Type of Generators											
Medical Facilities	-	-	-	56	18	-	3	3	500	-	-
Industries	-	-	-	3	44	-	2	-	68	94	3
Scientific Research and Universities	1	-	-	9	16	2	1	-	32	2	14
Electronic Instrumentation	-	-	-	3	-	-	-	-	-	-	-
Others	-	-	-	5	5	1	-	-	-	-	-

Note: Data provided by Tianjin EPB.

Table 18. Open Source Generator and Annual Usage

Generator	Type of Open Source	Annual Usage in Bq (Ci)	Percentage (%)
Medical facilities	^{131}I, ^{125}I, ^{3}H, ^{14}C, ^{32}P, ^{67}Ca, ^{99}Tc, ^{201}Tl	$1.55*10^{12}$ (42)	60.0
Industries	^{3}H, ^{45}Ca, ^{32}P, ^{63}Ni, ^{63}Cr, ^{86}Rb, U (natural), Th (natural)	$1.85*10^{11}$ (5)	7.1
Scientific research and universities	^{131}I, ^{147}Pm, ^{137}Cs, ^{14}C, ^{3}H	$3.7*10^{11}$ (10)	14.3
Electronic instrumentation	^{65}Zn, ^{131}Ba, ^{131}I, ^{198}Au, U (natural), Th (natural)	$3.7*10^{11}$ (10)	14.3
Others	^{3}H, ^{14}C	$1.1*10^{11}$ (3)	4.3
Note: Data provided by Tianjin EPB.			

Table 19. Types of Radioactive Source and Application in Tianjin

Source Type		Application	Type of Equipment or Radioactive Material Used
Medical application	Diagnosis	External radiological diagnosis	x-ray, CT, ECT, simulator, accelerator
		Diagnosis using isotopes internally	^{67}Ga, ^{99}Mo-Tc, ^{133}Xe, ^{131}I, ^{201}Tl
		Diagnosis using isotopes externally	^{125}I
	Treatment	External radiation	^{60}Co, x- and γ-ray knifes, accelerator, DSA
		Intracellular and body activity internal radiation therapy	^{192}Ir
		Open source therapy	^{131}I
Industrial application	Diagnosis	Material or component integrity inspection	x- and γ-rays, ^{192}Ir
		Thickness, liquid level, density detection	^{137}Cs, ^{241}Am, ^{60}Co
	Exploration	Geological exploration	^{226}Ra sealed source, Am-Be neutron source
	Radioactive tracer	Tracer and well exploration	^{137}Cs, Am-Be neutron source, ^{131}Ba open source
	Illumination	Illuminating coating	^{226}Ra, ^{147}Pm open source
	Industrial irradiation	Irradiation	^{60}Co sealed source and accelerator
Agricultural application	Irradiation	Breeding and agricultural products	^{60}Co
Scientific research	Experiment	Experimental animals	^{137}Cs, ^{3}H, ^{131}I
Material analysis		Radiological equipment	U, ^{226}Ra, ^{232}Th, ^{137}Cs
Radiopharmaceuticals		Radioimmunoassay reagent	24 different reagents
		Radiation source	^{60}Co sealed source
Consumer products		Smoke detector	^{241}Am sealed source
Note: ECT - emission computed tomography, normally administered along with radiopharmaceutical to the patient and images are taken by gamma camera. DSA: digital subtraction angiography using x-ray.			

Table 20. Types of Radioactive Waste in Tianjin City

Waste Types	Example	Composition	Nuclides
Materials with radioactive contamination (or called shredded waste)	Non-metal materials such as clothes, protective equipment, paper, cotton, fabrics, plastics and glasses	Represent 75% of total waste generated. Among them, 50-60% are combustible (cotton, paper), 40-50% are compactable (glass, plastics)	^{60}Co, ^{90}Sr, ^{137}Cs, ^{125}I, ^{131}I, ^{3}H, ^{32}P, ^{14}C and other short-life nuclides
Tools or equipment with radioactive contamination (or called waste tools or equipment)	Instrumentation, piping, toolbox, workbench, filters, and small amount of solidified radioactive waste	Represent 20% of total waste generated	^{60}Co, ^{90}Sr, ^{137}Cs, U, ^{232}Th, ^{3}H, ^{99}Tc
Experimental animal carcass and plants	Animal carcass and plants	Represent only 5% of total waste generated.	^{90}Sr, ^{125}I, ^{3}H and ^{147}Pm
Spent radiation sources	Mostly standard sources, stored in lead-shielded containers, or glass, wooden or metal containers	Maximum weight including lead shield is less than 3 tons.	Unit activity less than $3.7*10^{10}$ Bq, nuclides include ^{60}Co, ^{90}Sr, ^{226}Rd and neutron sources, also has small amount of ^{232}Th, ^{36}Cl, ^{65}Zn, ^{239}Pa, ^{106}Rn sources
Note: Data provided by Tianjin EPB.			

3.3.3 Civilian Radioactive Waste Collection, Transportation, Storage and Disposal in Tianjin

Based on national and local regulations, all radioactive wastes generated in Tianjin City are collected by the Tianjin EPB using specialized containers and transportation vehicles and stored in a designated storage facility operated by the City (refer to section 4.1). Tianjin city constructed and operated a radioactive waste storage facility since 1992. Currently, the storage facility has stored approximately 1,260 solid radioactive waste drums with a total weight of 15,946 Kg, 532 pieces of spent radioactive source with a total activity of $2.025*10^{12}$ Bq. Table 21 lists radioactive wastes stored at the facility from 1992 to 2003.

Table 21. Summary of 1992-2003 Radioactive Waste Storage in Tianjin

Date	Number of Radiation Source	Total Activity (Bq)	Number of Waste Drum	Total Weight (kg)
1992-1993	2	$1.11*10^{8}$	120	1,323
1994	5	$1.05*10^{10}$	68	720
1995	9	$1.92*10^{11}$	104	1,040
1996	27	$2.07*10^{11}$	72	858
1997	89	$3.48*10^{11}$	79	1,185
1998	112	$2.53*10^{11}$	121	1,815
1999	22	$4.83*10^{10}$	175	2,615
2000	49	$4.88*10^{10}$	136	2,040
2001	45	$2.78*10^{11}$	183	2,745
2002	116	$6.39*10^{11}$	107	1,605
2003 (partial)	56	n/a	93	n/a
Total	532	$2.03*10^{12}$	1,260	15,946
Note: Data provided by Tianjin EPB.				

In addition, the facility stores radioactive material for issue to generators when needed. An example of the storage service is in the use of sealed sources. Sealed sources are stored at the facility until needed, then transported to the end user. This alleviates the user from having to store the sealed source on site, develop a radioactive material storage area and develop a monitoring/inventory program. However, the facility plans not to accept any single piece of spent source with an activity level greater than 3 mCi in the future, which will be returned to the manufacturer.

The existing facility has a storage capacity of 80 m^3 for sealed sources and 500 m^3 for open sources. There are five separate storage areas: No. 1 area stores sealed source and solid radioactive waste; No. 2, 3 and 5 store solid radioactive waste; and, No. 4 area stores radioactive wastes including spent sealed sources from Beijing City. As of September 2001, the storage facility has stored 18.74 tons of solid waste stored consisting of nuclides such as ^{125}I (majority), ^{147}Pm, U, Th, ^{226}Ra, 314 pieces of spent sealed source (the majority is ^{137}Cs and ^{60}Co) with a total activity of $1.40*10^{12}$ Bq (or 38 Ci). Figure 5 shows the No. 4 storage area of the existing facility.

Figure 5. Area No. 4 of the Existing Tianjin Radioactive Waste Storage Facility

As discussed earlier, the existing storage facility is now at capacity. An expansion plan was submitted and the construction was underway to expand the storage capacity. The expanded storage facility is now completed and will be in use shortly. The capacity of the new facility is 1,000 m^3 and has adjustable storage capacities. This capacity is expected to store 30 years of radioactive waste and contain the waste for 100 years. The sealed sources are segregated from open sources. The facility is constructed with 1.5 m below grade surface using concrete for shielding, and is divided into 27 compartments with air ventilation and filtration system provided for each compartment. Figure 6 shows the inside of the new facility. The 27 compartments are divided into six storage areas: strong source area, weak source areas, No.1 waste area, No.2 waste area, No.3 waste area, and spare area. The new facility is not equipped to treat any waste at the present time, however, it is Tianjin EPB's desire to establish radioactive waste treatment capability in the near future, including pretreatment, drying, shredding or compaction, incineration (thermal treatment), solidification or stabilization processes. A landfill site will be developed in the new facility to dispose exempted radioactive wastes and wastes that meet land disposal requirement after a proper storage period.

Figure 6. Tianjin Radioactive Waste New Storage Facility

4.0 FEASIBILITY STUDY FOR IMPROVEMENT OF TIANJIN CIVILIAN RADIOACTIVE WASTE MANAGEMENT SYSTEM

The feasibility study for improvement of Tianjin civilian radioactive waste management system includes the following sections:

4.1 Analysis of Legal Framework and Organizational Structure of Radioactive Waste Management System in Tianjin

During the site visit a general overview of the United States federal regulatory structure was discussed. The relationship between federal, state and local authorities was presented along with the way laws and regulations are changed and affected. The driving force for regulatory change in the US is much different than that in China. The US reacts to public input and promotes public participation generating a certain synergy for change. Whereas in China, the impetus for change is based on need, technological availability, and financial viability.

The US utilizes a tiered approach to technical regulations. Starting at the federal level, Congress and the President will pass a technical specification into law, called a statute. The statute is then interpreted by the responsible agency (such as the DOT or the EPA) in a proposed regulation. The proposed regulation is published in the Federal Register in proposed form, reviewed by the public and published again in the Federal Register in final form. The proposed regulation is then added to the Code of Federal Regulations (CFR), of which there are 50 titles. The CFRs are then used by each state to develop a state specific regulation, which can be more stringent than the CFR, but not more lenient. Upon enactment of a new regulation, several companies offer specific training or advice on the requirement and how best to adhere to the requirements. It is the responsibility of the user (or generator) to know the regulations. If the user is found to be in violation of the regulations, a fine, imprisonment or both can be imposed. Regulatory adherence is checked by several enforcement entities (depending on the technical field). Most

regulatory agencies have an affiliated enforcement group responsible for field audits of users and identification of violations. The NRC manages the radioactive material and waste with the regulations contained in Code of Federal Regulations, Title 10.

China utilizes a much simpler approach to regulations. The regulations are being written at the national level with approval from the People's Congress (comparable to the US federal level) and then a local specific regulation is prepared by the local regulatory agency, sent to the local people's council for approval. Once it is approved, the regulation will be announced by the city government for implementation.

4.1.1 Legal Framework

The analysis of existing legal framework and organizational structure of radioactive waste management system in Tianjin reveals that the existing system is actually more than adequate. Although less sophisticated than the system in the US, China's national and local radioactive waste management systems are fairly complete after 40 years of development. One unique characteristics of the Chinese system is that it is a centralized, command and order type of management system, which promotes efficiency in terms of implementation and enforcement. Authority and responsibility of local government are clearly defined in the legislation.

4.1.2 Organizational Structure

As discussed in earlier sections, Tianjin EPB recently created the Nuclear and Radiation Safety Supervision Division (it is no longer a subdivision under the Solid Waste Division) to strengthen the City's abilities to meet radioactive waste management needs mandated by the national and city regulations. Therefore, the organizational structure is considered fairly adequate in terms of authority, personnel, resources and technologies.

4.1.3 Funding Mechanism

Due to unique natural of radioactive waste, the collection, transportation and storage services at local level are operated only by the local regulatory agency. As in Tianjin, the Nuclear and Radiation Safety Supervision Division in Tianjin EPB is responsible for providing such services. Although the radioactive waste management service provided by the City is a fee-based system, however, the fee rate is jointly determined by EPB and other city departments (i.e., Finance and Pricing Bureaus). Whether the fee schedule is actually reflecting operating cost is yet to be determined. At present time, there is no commercial company providing radioactive waste management service in Tianjin.

4.1.4 Management System

The existing management system contains a reporting and registration database for waste generator and source users. Although still a simple system, but the reporting and registration database (refer to section 4.2) does provide vital information needed for tracking waste and sources from generation to disposal.

In summary, the analysis of existing legal framework and organizational structure for Tianjin radioactive waste management system indicates that the current system seems to be adequate. However, the real challenge is the enforcement to ensure that generators and fee-based waste disposal service provider will comply with regulatory requirements. Since Tianjin EPB plays both enforcement and service provider roles at local level, it is

not clear how the compliance oversight on service provider can be implemented because of the current arrangement.

4.2 Development of a GIS-based Radioactive Source and Waste Management System

4.2.1 Improvement of Existing Database Structure

Currently, the Nuclear and Radiation Safety Supervision Division has a database to record inventory of radioactive material, source and waste. Information is provided by each of the generators concerning the radionuclide, level, physical form, activity and chemical constituent of any radioactive material offered for shipment and storage. This information is then entered into a database, such as Access, to track shipments and generators.

However, the existing database system can be enhanced by creating a new field to document the condition of the shipment upon arrival at the storage facility. This field could be structured to allow a sort by negative comments, indicating a generator may need further training on packaging requirements. The database would also be sorted to determine which generators perform most of the shipments, which radionuclides are shipped the most, etc., then, this information is used to profile generators and develop generator information for management planning on a quarterly or annual basis. The same sorted result may also be used to generate information on the quantities of certain physical forms of radioactive materials or waste to assist in performing a cost analysis for certain waste minimization techniques that could be employed.

4.2.2 GIS-based Radioactive Source and Waste Management System

A GIS-based system is a dynamic database and information system that serves as powerful decision-making and management application tool. In addition to tracking of radioactive source and waste from generation to storage or disposal, the data collected can also be combined with GIS for visualization and display of collected data for planning transportation route for radioactive material, source or waste, and to plan and monitor emergency response purposes. GIS is a system combining computer software, hardware and data, and personnel to manipulate, analyze and present information of a spatial location. A spatial location is normally a geographic location.

The key components of GIS software include (1) data key entry and query tools for entering and manipulating geographic information (i.e., address, administrative boundaries), (2) a database management system (DBMS) to for storing and data presentation, (3) tools that create intelligent digital maps you can analyze, query for more information, or print for presentation, and (4) an easy-to-use graphical user interface (GUI).

For a GIS-based radioactive waste management system, at least the following information should be included:

- A digitized map of administrative regions
- Topographic data
- River, lake and waterway system

- Road and street access (transportation)
- Demographic data (population) and sensitive population
- Types of radiation source and user location data. Radioactive material production, user and waste generator data including types of radionuclide, radioactivity level, physical form, chemical constituent of any radioactive material offered for shipment and storage, shipping and receiving conditions, and discharge or emission data
- Spill or release model and emergency response planning model

Each data set acts as a layer of spatial information that is added to a basic geographic map, the result is a GIS database and can be analyzed, interpreted and displayed.

Figure 7 depicts the conceptual database structure for a GIS-based radioactive waste management system.

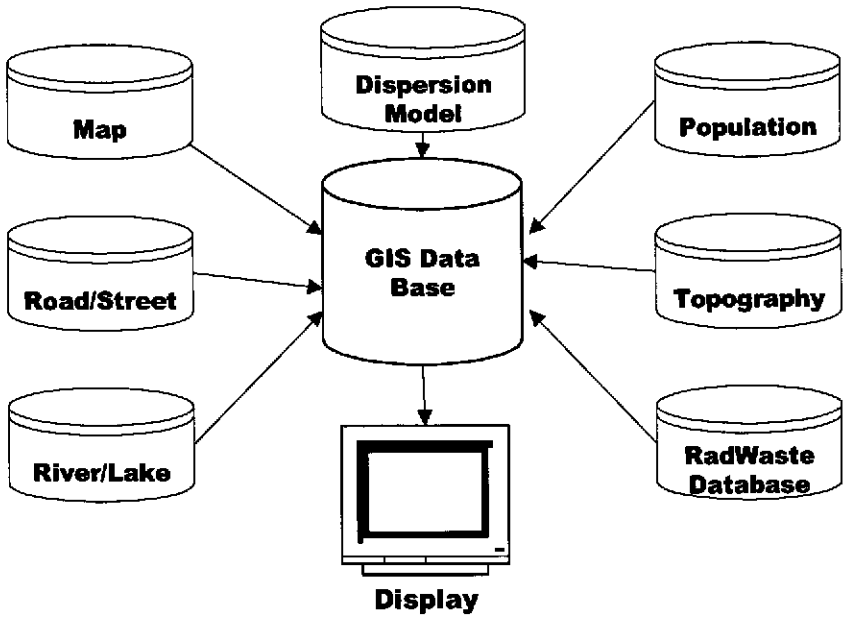

Figure 7. Database Structure for a GIS-based Radioactive Waste Management System

Basic software requirements include ARC/GIS software (http://www.esri.com), database management software (i.e., Oracle or Microsoft Access), statistics software (i.e., SAS), and accidental release (air release - HOTSPOT, PLUME, FIRE, RESUSPENSION models) and emergency response model. ARC/GIS software is a collection of software products used to create, import, edit, query, map, analyze, and publish geographic information. There are four products in the ARC/GIS software bundles: (1) ARC/Reader is a map viewer to view and print all maps and data types. It also has some simple tools to explore and query maps, (2) ARC/View provides extensive mapping, data use, and analysis along with simple editing and geo-processing capabilities, (3) ARC/Editor includes advanced editing for shapefiles and geo-databases in addition to the full functionality of ARC/View, and (4) ARC/Info extends the functionality of both ARC/View and ARC/Editor with advanced geo-processing.

Furthermore, the display can be presented in an interactive Internet GIS environment using software program such as ARC/IMS for public viewing to promote general public's participation and information distribution.

In fact, Tianjin City Urban Planning and Land Management Bureau has developed a Tianjin Urban Planning and Land Information System (TUPLIS) in 1995 to support city planning decision and land management applications. The TUPLIS incorporates various datasets from different departments and create a central repository of geodata for authorities to share citywide via the Internet. It is recommended that the proposed GIS-based radioactive management system be built on the TUPLIS platform to fully utilize the well-established structure and available data to eliminate the redundancy and to expedite the system development process.

4.3 Development of Alternative Radioactive Waste Collection, Transportation, Storage, Treatment and Monitoring

At national level, SEPA plans to build four radioactive waste final disposal facilities around the nation, however, when to construct these facilities and the actual location are not clear. Currently, Tianjin City radioactive storage facility does not perform any treatment or final disposal, although treatment technologies such as compaction or incineration for volume reduction and landfill disposal are considered in the near future. Evaluation of the radioactive waste collection, transportation, storage and monitoring methods were conducted during the site visit. The radioactive waste collection, transportation, and storage process was found to be adequate and required no immediate improvement. The following discussion will focus on required radioactive waste treatment technology and monitoring improvement.

4.3.1 Training

Similar to other waste management strategy, the ultimate goal for radioactive waste management is waste minimization - to reduce waste generation at the source (source reduction). The foremost of all waste minimization approaches is training. Training of the generators in the proper methods of handling radioactive materials will help alleviate the generation of unnecessary radioactive waste. These techniques include proper handling/packaging to minimize spills, and limiting the items taken into a controlled area (this decreases the number of items disposed of as potentially contaminated). As discussed in the earlier section, some operating procedural deficiencies (i.e, improper handling of radioactive materials) were identified during the site visit of a radiopharmaceutical facility. Additional radioactive waste could be generated as a result of these deficiencies. If workers are properly trained and monitored by both internal and external audits, the generation of radioactive waste can be minimized.

4.3.2 Material Substitution - the Use of Non-isotopic Materials

The recent development of fluorescence-based technique in biomedical research and medical diagnosis is an alternative technology that does not use radioactive material for the required purpose. For example, ^{32}P- and ^{125}I-labeled isotopes were commonly used radiographic technique in the early molecular biology research. Currently, many fluorescence- or dye-based molecular probes are commercial available to replace radiography (http://www.probes.com). Medical and research communities are encouraged to use newly developed molecular probes, which do not contain any radioactive material, and therefore completely eliminate the generation of radioactive wastes.

4.3.3 Waste Treatment

Waste treatment technologies are considered for the newly expanded Tianjin Radioactive Waste Storage Facility - including compaction, shredding/cutting, incineration/pyrolysis and solidification/stabilization. US vendor information and cost estimates are listed below. It should be noted that the following cost estimation is for capital equipment only, and based on FOB (free-on-board) at a US manufacturer's location. Other costs such as delivery, import tariff, site preparation, installation, training, and operation and maintenance/repair costs are not included but should be considered in the overall budgetary planning.

4.3.3.1 Compaction

Volume of radioactive waste can be reduced by compaction to reduce transportation and storage costs. Compaction is conducted by pressing waste in a rigid container using a mechanical ram. Normally an anti-springback device is used to hold the compressed material in place.

They ranged from simple, manual compaction to air- or hydraulic-power system (or called super-compactor with a much higher volume reduction ratio of 100:1, depending on the volume reduction ratio required. List of US waste compactor vendor is presented in Table 22. Figures 8 and 9 show a typical drum compactor and a box compactor, respectively. Figure 10 is an example of Teflon anti-springback disk (Figures are adapted from US Army Corps of Engineers, "Guidance for Low-Level Radioactive Waste (LLRW) and Mixed Waste (MW) Treatment and Handling, June 1997). Drum compactor normally employs 10 to 30 tons to force compaction. Box compactor use forces of approximately 250 tons of force for compaction. Supercompactors use forces ranged from 1,000 to 5,000 tons.

Table 22. Waste Compactor Vendor List

Company Name	Street Address	City	State	Zip Code	Phone and Fax Numbers	Web Address
Safe Storage, Inc.	2301 Bert Drive	Hollister	CA	95023	**Toll Free:** (800) 344-6539 **Phone:** (831) 637-5955 **Fax:** (831) 637-7405	www.safestorage.com
Glossar Manufacturing, Co.	1 Douglas Street	McKeesport	PA	15134	N/A	
Lift Pak	4273 Will Rogers Parkway	Oklahoma City	OK	73108	**Phone:** (405) 947-5100	
INET Corp.	8450 Central Avenue	Newark	CA	94560	**Phone:** (510) 797-9600 **Fax:** (510) 754-7066	
Newstripe, Inc	1700 Jasper St., Unit F	Aurora	CO	80011	**Toll Free:** (800) 624-6706 **Phone:** (303) 364-7786 **Fax:** (303) 364-7796	www.newstripe.com

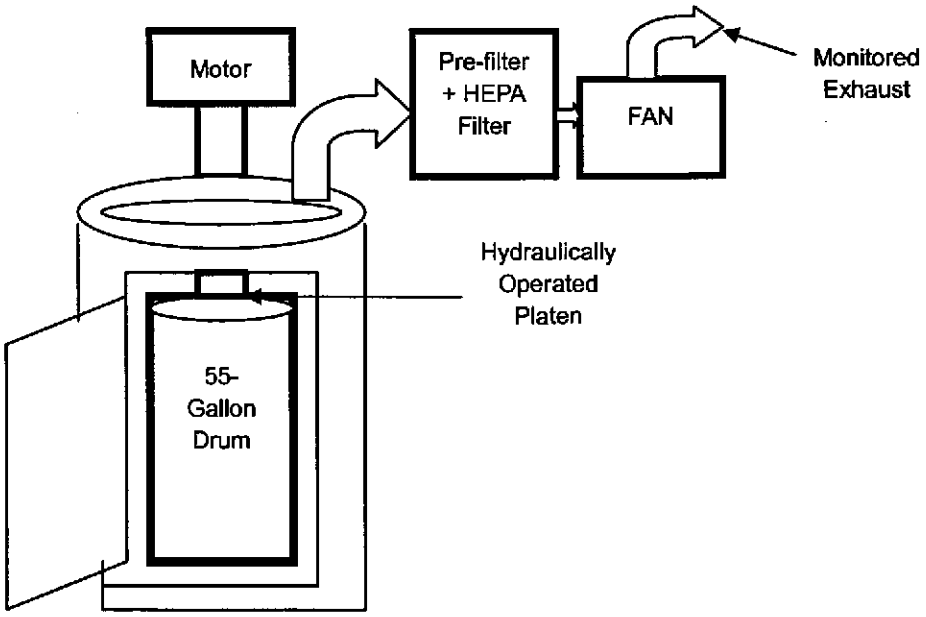

Figure 8. A Conventional Compactor

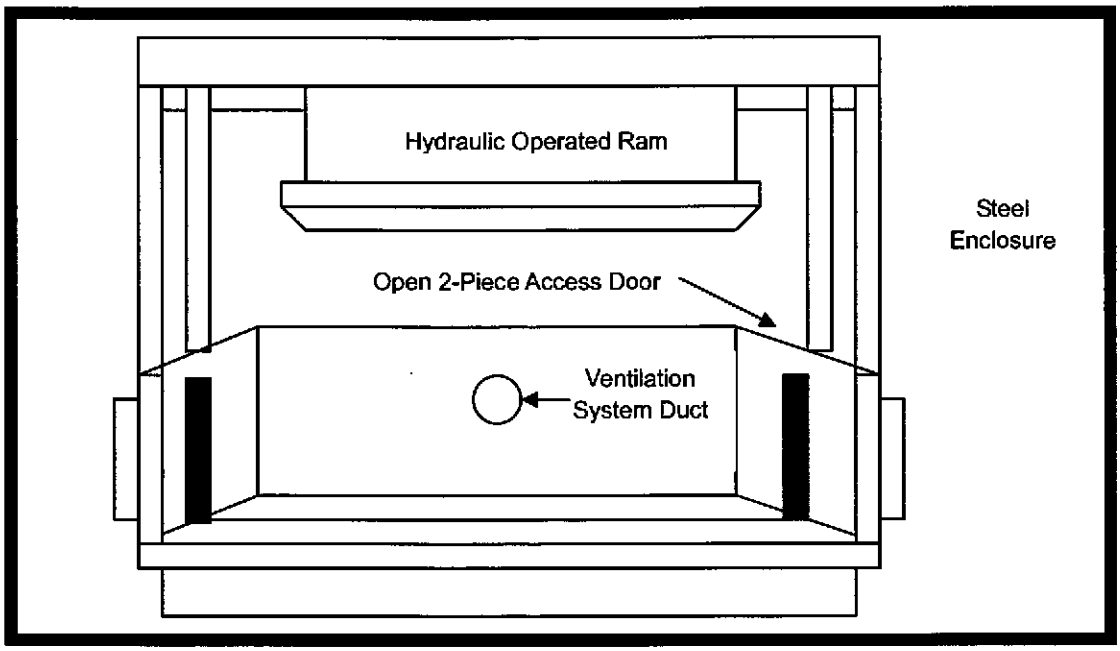

Figure 9. A Typical Box Compactor

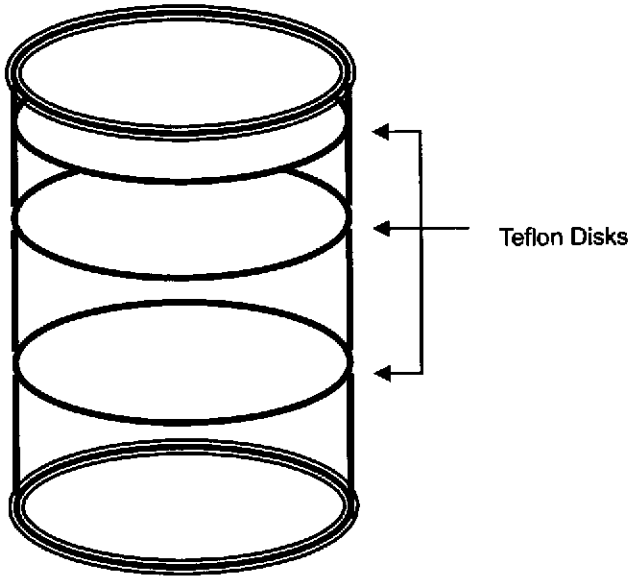

Figure 10. Anti-springback Teflon Disk

When using compaction for volume reduction, waste compatibility is the utmost concern. Dry material such as plastics, paper, absorbent materials, and cloth are compatible in conventional compactors. Metal parts such as pipes, valves, conduits, woods, and other like items are compatible in super-compactors. It is important for operator to segregate waste before compaction to prevent potential puncturing of the container. Also, a ventilation system equipped with high efficiency particulate air (HEPA) filter is normally installed to the compactor to capture any suspended particulate during compaction. The HEPA filters are treated the same as radioactive waste.

The selection of compactor type for the storage facility depends on waste compatibility, space and power requirement, the expected throughput (i.e., how many drums or containers to be compacted on a daily basis), degree of automation, and desired volume reduction ratio. Capital costs (equipment only) of a drum compactor ranged from US$3,000-5,000 for a simple manual or air-powered system (without air ventilation/filtration) to US$50,000 to US$160,000 for a complex system with a hydraulic ram. Estimated costs for a box compactor ranged from US$250,000 to US$500,000.

Based on the Tianjin Radioactive Waste Storage Facility expansion plan, one compaction system is required with a 100 tons pressure system, a reduction ratio of 10 to 1 and a throughput of 2 m^3/hour. A box compactor system will meet this requirement and the estimated capital equipment costs range from US$250,000 to US$500,000.

4.3.3.2 Crushing

Similar to compaction, cutting, crushing and shredding are used to reduce waste size for space saving in transportation and storage and eventually reducing the overall disposal cost. Tianjin Radioactive Waste Storage plans to install a crushing system to crush friable wastes such as glass, concrete, ceramics to achieve volume reduction. Crushing equipment can be used in conjunction with volume reduction equipment to further increase reduction ratio. A mill, grinder or crushing machine using conventional design can be used. As in compaction, waste must be properly sorted before crushing to ensure the smooth operation and avoid any potential hazard such as explosion. Table 23 lists examples of US manufacturers of glass crushing machine. The cost of capital equipment varies depending on the size of the system. It is approximately US$6,000 for a small unit to crush 15 glass bottles each batch and up to US$600,000 for a large automated system with 20 to 60 tons/hr capacity. For a 40 kg/hr system required by Tianjin EPA the capital equipment will cost approximately US$50,000. Figures 11 and 12 are examples of glass crushing machine.

Table 23. US Waste Crusher Vendor List

Company Name	Street Address	City	State	Zip Code	Toll Free	Phone	Fax	Web Address
American Pulverizer	5540 West Park Ave.	St. Louis,	MO	63110		(314) 781-6100	(314) 781-9209	www.ampulverizer.com/
Andela Products,	493 State Route 28	Richfield Springs	NY	13439		(315) 858-0055	(315) 858-2669	www.andelaproducts.com/
CS Bell Co.	P.O. Box 291, 170 W. Davis St.	Tiffin	OH	44883	(888) 958-6381	(419) 448-0791	(419) 448-1203	www.csbellco.com/
Glass Aggregate Mfg.	P.O. BOX 464	Faribault	MN	55021		(507) 334-6437	(507) 334-6438	www.glassagg.com/
Getz Recycle, Inc.	2800 West Lincoln St.	Phoenix	AZ	85005	(888) 234-7600		(602) 272-5668	www.getzrecycle.com/
Miller Manufacturing, Co.	2032 Divanian Dr.	Turlock	CA	95382		(209) 632-3846,	(209) 632-1369	www.millermfg.us/
Stedman Machine Co.	129 Franklin St. PO Box 299	Aurora	IN	47001	(800) 262-5401	(812) 926-0038	(812) 926-3482	www.stedman-machine.com/
William Patent Crusher	2701 North Broadway	St. Louis	MO	63102		(314) 621-3348	(314) 436-2639	www.williamscrusher.com/

Figure 11. A HMG 05P Glass Crusher (C.S. Bell Co.)

Figure 12. A H-100V Glass Crusher (Glass Aggregate System)

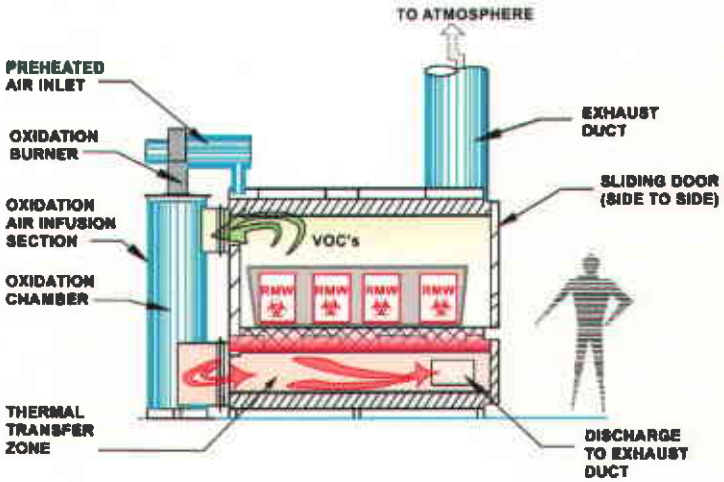

Figure 13. Typical Design of a Pyrolysis Unit

4.3.3.3 Thermal Treatment - Incineration and Pyrolysis

Incineration for low-level radioactive waste is no different from incineration for hazardous or municipal wastes; the additional requirement is the installation of radiation shield, air filtration and proper handling of ashes by solidification or vitrification. Incineration can reduce waste volume as well as destruct organic wastes, however, incinerator will require sophisticated air pollution control system and it can be complex and costly. Incineration is a continuous operation. Advantages of incineration include that the technology can treat various combustible wastes - solid and liquid, and the volume reduction ratio can reach as high as 100 to 1 ratio depending on the type of materials. Capital equipment of a typical 1million Btu/hr hearth incinerator unit will cost approximately US$250,000 not including any instrument control and pollution control unit. A treatment capacity of 50 kg/h, auto de-ashing and auto-ignition incinerator is required for the Tianjin EPB's storage facility. The cost of initial capital equipment could be in the range of US$250,000 to 500,000 depending on the sophistication of instrument control.

If exhaust gas from incineration is a public concern, pyrolysis could be a good alternative. Pyrolysis has similar mechanism as incineration except it is operated at a lower temperature in absence of oxygen (actually oxygen depleting or oxygen-starving environment). Normally pyrolysis has less particulate emission than incineration; therefore, exhaust gas treatment may not be required. Pyrolysis unit is a batch operation. Generally each batch may take up to 8 to 10 hours to complete. However, it is not suitable for pressurized container and heavy metals. Figure 13 shows the design a typical pyrolysis unit. Volatile organics are vaporized during pyrolysis and combusted in an oxidation burner (afterburner) Figures 14 is an actual commercial pyrolysis unit in operation.

Figure 14. A Commercial Pyrolysis Unit in Operation.

Figures 15 to 17 illustrate the radioactive waste before and after pyrolysis treatment. (Figures are provided by Mr. Lee Boyland, November 2003)

Figure 15. Radioactive Waste before Pyrolytic Treatment.

Figure 16. Radioactive Waste after Pyrolytic Treatment.

Figure 17. Volume Reduction of Radioactive Waste after Pyrolytic Treatment.

4.3.3.4 Cement Solidification/Stabilization

Using cement as a matrix material to solidify or immortalize radioactive waste is a widely used technology. There are five types of Portland cement - Types I to V. Type I cement is a general purpose cement. Type II cement is a slow-setting, sulfate-resistant cement and produces only a moderate amount of heat during setting. Type III cement is fast-setting, with high compressive strength, but generates significant heat during setting. Type IV is a slow-setting cement with low heat generation. Type V cement is highly resistant to sulfate and is generally used in marine environment. The selection of cement is highly dependent upon the waste being processed.

The mixing equipment is rather inexpensive. A common cement mixing unit with reinforcement on radiation shielding will be sufficient. However, it should be careful in selecting waste constituents for cement solidification. Table 24 lists the waste constituents that may not compatible with cement solidification and potential problem constituents that may be avoided by good housekeeping or pretreatment.

Table 24. List of Waste Constituents That May Cause Problem with Cement Solidification

Potential Problem Constituents Which May be Expected in the Waste Stream	
Inorganic constituents	Berates, phosphates, lead salts, zinc salts, ammonia and ammonium salts, ferric salts, oxidizing agents (i.e., permanganates, chromates, chromates), nitrates, sulfates
Organic constituents - aqueous solutions	Organic acids (formic acid, chelates, oxalic acid, citric acid, picolinic acid, EDTA, NTA), decon solutions, soaps and detergents
Organic constituents - oily wastes	Benzene, toluene, hexane, miscellaneous hydrocarbons, vegetable oil additives
Potential Problem Constituents That May Be Avoided By Good Housekeeping or Pretreatment	
Generic problem constituents	Oil and grease, aromatic oils, organic solvents, dry-cleaning solvents, industrial cleaners, paint thinners, decon solutions, soap and detergents
Specific problem constituents - organics	Acetone, methyl ethyl ketone, trichloroethane, tricholortrifluoroethane, xylene, dichlorobenzene
Specific problem constituents - inorganics	Sodium hyperchorite
(Adapted from US Army Corp. of Engineers - Guidance for Low-Level Radioactive Waste and Mixed Waste Treatment and Handling, EM1110-1-4002, June 1997)	

4.3.4 Environmental Monitoring at the Waste Storage Facility

Placing environmental thermoluminescent dosimeters (TLDs) around the radiological storage facility would be a valuable addition to the environmental monitoring currently being conducted. The TLDs could be placed at varying distances from the facility in a circular array. The TLDs would be collected and read on a monthly basis. This allows a real time assessment of the radiation dose being received by the general public in the vicinity of the storage facility. In addition, the doses measured by the TLDs will allow analysis of radiation trends near the facility. This is also an inexpensive method for real time environmental radiation assessment.

4.4 Development of Radiation Measurement Laboratory and Equipment Required for Emergency Response

4.4.1 Radiation Measurement Laboratory

The need for a radioactive measurement laboratory was expressed during the site visit. The radiological storage facility was built with the anticipation of housing a radiological measurement laboratory and appears to be well planned. Generally, a radioactive measurement laboratory produces analysis of environmental samples of various media such as air, soil, water, plant life, animal life and aquatic life. The instruments used in these measurements include gamma spectroscopy system, alpha/beta swipe counter, beta scintillation detector and alpha spectroscopy system.

The gamma spectroscopy system is normally coupled with a personal computer to aid in gamma energy analysis by comparing the measured peaks to the energy peaks listed in a commercially supplied library. Another important component of the gamma spectroscopy system is the counting area (referred to as a cave). The cave is normally a lead shield with a copper sheath on the inside surrounding the detector (inserted from the bottom of the cave). The top of the cave is movable allowing the samples to be placed on a fixed position inside the lead shielded cave. This produces a known geometry with a very low background allowing assessment of very small amounts of gamma radioactivity. The

other important component to this system is the calibration standard. The calibration standard should approximate the size, media and density of the sample to be counted. Calibration standards are commercially available, however, the development of the calibration standard will depend on many variables such as radioisotope(s) of concern, media of sample to be counted (such as water, soil, sediment, tissue, etc.), and size of samples. In most radioactive measurement laboratories, several calibration standards will be used to allow a variety of assessments.

The alpha/beta swipe counter is used to assess air samples (collected on filter paper as air is passed through the filter) and loose surface contamination measurements (collected by rubbing a filter paper on a surface of concern) obtained during the periodic radiological surveys of facilities or from the site of an accidental release of radioactivity.

The beta scintillation detector and alpha spectroscopy system are optional. Both these counting techniques sometimes require sophisticated separation techniques involving wet chemistry to prepare samples for counting. This type of analysis is only necessary when the radioisotope(s) of concern involve pure beta or alpha emitters. Most radionuclides emit a gamma ray during the decay process, but a few of the radionuclides such as Strontium (beta particle), Plutonium (alpha particle) and Uranium (weak gammas along with both beta particles and alpha particles) are best analyzed using the beta scintillation counting technique or alpha spectroscopy.

4.4.2 Radiological Monitoring Equipment

The radiation environment monitoring program and monitoring plan were reviewed to determine the type and quantity of radiological monitoring equipment needed to allow Tianjin EPB to comply with these regulations. Three separate programs were identified that need to be supported with radiological monitoring equipment: (1) radiation monitoring, (2) environmental radiation monitoring, and (3) emergency radiological monitoring.

The equipment necessary for supporting the programs identified above can be either combined or separate equipment provided to support each program independently. The equipment for each program is listed below:

4.4.2.1 Radiation Monitoring

Radiation monitoring program would provide for the basic radiation monitoring of storage areas, radioactive shipments and radioactive storage areas. Radiological equipment to support this program are:

(1) Beta/gamma detector

(2) Radiation monitor

(3) Air sampler with removable filter

(4) Beta/gamma swipe counter

(5) Alpha swipe counter

4.4.2.2 Environmental Radiation Monitoring

Environmental radiation monitoring program would provide for the radiological monitoring of the environment surrounding the storage facility and allow supporting analysis of environmental samples from other districts. Radiological equipment to support this program are:

(1) Thermoluminescent dosimeters (TLDs)

(2) TLD reader

(3) Gamma spectroscopy system

(4) Radiation monitor

(5) Air sampler with removable filter

(6) Beta/gamma swipe counter

(7) Alpha swipe counter

4.4.2.3 Emergency Radiation Monitoring

Emergency radiation monitoring program would provide the radiological monitoring equipment to allow radiological assessment of an accident. Radiological equipment to support this program are:

(1) Portable gamma spectroscopy system

(2) Beta/gamma detector

(3) Radiation monitor

(4) Portable air sampler

(5) Alpha detector

A description of the radiological equipment listed above is provided below:

Beta/gamma detector: This instrument is used to detect beta and gamma contamination and is portable. Using the detector to frisk surfaces will provide data on the total amount of beta/gamma radioactive contamination on the surface. Obtaining a swipe of the surface and then measuring the swipe with the detector will provide data on the removable amount of beta/gamma radioactive contamination. By subtracting the removable radioactive contamination from the total beta/gamma radioactive contamination provides the amount of fixed beta/gamma radioactive contamination on the surface. This type of detector reports measurements in Bq (bequerels) or counts per minute.

Radiation monitor: This instrument is used to determine the dose rate of a particular radioactive source and is portable. This type of detector reports measurements in Sv (sieverts) per hour or rem per hour.

Alpha detector: This instrument is used to detect alpha contamination and is portable. Using this detector to frisk surfaces will provide data on the total amount of radioactive alpha contamination on the surface. Obtaining a swipe of the surface and then measuring the swipe with the detector will provide data on the removable amount of alpha

radioactive contamination. By subtracting the removable alpha radioactive contamination from the total alpha radioactive contamination provides the amount of fixed alpha radioactive contamination on the surface. This type of detector reports measurements in Bq or counts per minute.

Air sampler: This instrument is an air pump used to draw ambient air through a filter paper at a constant rate to measure airborne contamination in a given volume of air. The air sampler is portable. The filter paper is removable and is measured with either an alpha detector or a beta/gamma detector.

Beta/gamma swipe counter: This instrument allows multiple swipes to be measured automatically, saving time and manual labor. This instrument is a laboratory instrument. A carousel or cassette is loaded with the swipes that need to be measured and the swipe counter will measure the contamination on the swipe, record the measurement and automatically change to measure another swipe.

Alpha swipe counter: This instrument allows multiple swipes to be measured automatically, saving time and manual labor. A carousel or cassette is loaded with the swipes that need to be measured and the swipe counter will measure the contamination on the swipe, record the measurement and automatically change to measure another swipe. This instrument is a laboratory instrument.

Thermoluminescent dosimeter (TLD): This device measures radiation dose. It is useful in environmental monitoring because it is small, rugged and may be deployed for long periods. The TLD would be placed in locations around storage areas, transfer routes, etc. to determine the exposure to the general public. The TLD could be in place for a month or longer, removed, read and placed back in the field.

TLD reader: This instrument is what is used to read the TLD. Basically the TLD reader measures the intensity of the light given off when the TLD crystal is energized. The intensity of the light is directly proportional to the exposure the device was subjected to in the field. The results are reported in sieverts or rem. This instrument is not portable.

Gamma spectroscopy system: The system is typically made up of a detector (normally a high purity germanium detector), photo multiplier tube, cooler (also called a dower and are either electrical or contain liquid nitrogen), scaler, counting cave and personal computer (PC). This system can be used to analyze any item or sample. Properly calibrated the system can identify the radioisotope(s) emitting gamma rays and the intensity of the particular radioisotope. This system is particularly useful in identifying unknown radioisotopes or determining the contribution of several radioisotopes to a particular measurement. The PC is used to analyze the various energy peaks identified by the detector and compare them to the library contained in the software. This instrument is a laboratory instrument.

Portable gamma spectroscopy system: This system is portable and properly calibrated will identify the radioisotope(s) emitting gamma rays and intensity of the particular radioisotope. This instrument has limitations due to unknown geometry of the source material, but approximations can still be made. This system is very useful when performing an investigation of a spill, assessing radioactive contamination clean-up actions or analysis of radioactivity of unknown origin.

A list of suppliers for the aforementioned equipment is provided in Table 25. Type of

equipment carried by the vendor is listed in Table 26. Estimate unit cost for each type of instrument is listed in Table 27.

Table 25. Radiological Measurement Instrument Vendor List

Company Name	Street Address	City	State	Zip Code	Toll Free	Phone	Fax	Web Address
Alpha Spectra	715 Arrowest Court	Grand Junction	CO	81505	(800) 231-2545	(970) 243-4477	(970) 244-6947	www.alphaspectra.com
Bartlett Service, Inc.	60 Industrial Park Rd	Plymouth	MA	02362		(508) 830-3616	(508) 830-3616	www.barlettinc.com
Berkley Nucleonics, Corp	3060 Kerner Blvd.	San Rafael	CA	94901		(415) 453-9955		www.berkeynucleonics.com
Canberra Industries	800 Research Parkway	Meriden	CT	06450		(203) 235-1347		www.canberra.com
Exploranium Nuclear Systems (A division of SAIC)	207 E. Ohio St., Ste. 262	Chicago	IL	60611		(630) 922-9483		www.exploranium.com or www.saic.com/product
Gamma Products, Inc.	7730 West 114th Place	Palos Hills	IL	60645		(708) 974-4100		www.gammaproducts.com
Health Physics Instruments (now part of Far West Technology)	330 S. Kellog Ave. Ste D	Goleta	CA	93117		(805) 964-3162		www.fwt.com
Ludlum Measurements Inc.	P.O. Box 810	Sweetwater	TX	79556		(915) 235-4672		www.ludlums.com
ORTEC	801 South Illinois Ave.	Oak Ridge	TN	37831		(865) 425-4411		www.ortec-online.com
Princeton Gamma-Tech, Inc.	1026 Rte 518	Rocky Hill	NJ	08553	(800) 229-7484	(609) 924-7310		www.pgt.com
Protean Instrument Corp.	231 Sam Rayburn Parkway	Lenoir City	TN	37771		(865) 717-3456		www.proteaninstrument.com
Syncor Radiation Management Systems	6045 Cochran Rd	Cleveland	OH	44139		(44) 248-9300		
Thermo-Eberline	P.O. Box 2108	Santa Fe	NM	87504		(505) 428-3535		www.thermo.com

Table 26. Example of Radiological Measurement Instrument Vendors and Their Products

Company Name	Radiological Measurement Instrument
Alpha Spectra	Scintillation detectors, other radiological detectors
Bartlett Service, Inc.	Integrated radiological measurement services, floor remote monitoring system
Berkley Nucleonics, Corp	Portable radiological measurement equipment
Canberra Industries	Laboratory and portable radiological measurement equipment, alpha, gamma spectrometer, alpha and beta counting system, dosimeter, emergency instrumentation
Exploranium Nuclear Systems (A division of SAIC)	Various radiological measurement detectors, multiple detector system for field deployment, portable instrument and dosimeter
Gamma Products, Inc.	Bench top alpha and beta counting system
Health Physics Instruments (now part of Far West Technology)	Chemical dosimeter, radiological detectors, instrument for radiation safety
Ludlum Measurements Inc.	Portable and survey meters, alpha, beta, gamma and neutron detectors, Geiger-Mueller counter
ORTEC	Portable and laboratory radiological measurement equipment
Princeton Gamma-Tech, Inc.	Microanalysis for x-ray and gamma ray spectroscopy, nuclear spectroscopy and detectors
Protean Instrument Corp.	Automatic high throughput alpha and beta radiation measurement instrument, radiochemistry, laboratory and bench-top instrument, smear/swipe counting instrument
Syncor Radiation Management Systems	Radiation management system
Thermo-Eberline	Various counter, alpha and tritium air monitor, area monitors, dosimeter and TLC reader

Table 27. Example of Cost for Radiological Measurement Instrument

Equipment	Estimated Cost Per Unit in US$
Gamma Spectroscopy System, including PC and Software	200,000
Portable Gamma Spectroscopy System	100,000
Alpha, Beta and Gamma Swipe Counter	75,000
Beta and Gamma Detector	25,000
Alpha Detector	25,000
Radiation Monitor	10,000
Air Sampler	5,000
TLDs	100
Note: Unit price does not take into account of bulk quality discount.	

4.4.3 Recycle or Reuse of Spent Radiation Source and Radionuclide

Many radiation sources (i.e., sealed source) are discontinued to service due to the specific activity of the source has been reduced to a level that is no longer effective for a certain application. However, the source may still contain certain level of radioactivity. Like reuse and recycle program for industrial wastes, the reuse or recycle of radioactive materials to minimize or eliminate waste generation is theoretically possible. However, in reality the system will involve the establishment of a complicated exchange platform to match waste generated and potential users, source reuse tracking and monitoring system, audits, and recordkeeping. In the US, currently there is no active recycle or reuse program of spent radiation sources.

Although some attempts were made to recycle radionuclide used in smoke detectors (Americium-241) or luminous dial (tritium), but the concentration is very low and the chemical process used would potential generate more mixed waste to make the recover and reuse not cost-effective. No new recycle/reuse or beneficial use of low level radioactive waste is currently known or anticipated.

It is recommended that if Tianjin EPB desires to pursue the spent source exchange program, an oversight organization should be established to track every single piece of sealed source from original owner to the new owner, and final disposal of the source to assure that the requirements for safe handling, transportation and use are followed.

4.4.4 Economic and Financial Analysis of the Improved Radioactive Waste Storage Facility

As described earlier, the Tianjin Radioactive Waste Storage Facility is owned and operated by the Tianjin EPB and the charging fee for radioactive waste storage and disposal service is jointly determined by City Finance and Pricing Bureaus and EPB. City Pricing Bureau normally set the fee not solely based on market demand, but also local consumer affordability, because the operation of such a facility is considered as part of government service to the general public.

The economic and financial analysis presented below is primarily for assessing the financial feasibility of the proposed facility expansion with an "order-of-magnitude" engineering cost approach and an uncertainty ranging from +30 to 50%. Figure 18 depicts major financial considerations for the economic analysis of a civilian radioactive waste storage facility. These key financial considerations included but might not be limited to expansion costs such as costs associated with equipment purchase and facility construction.

- Operating and maintenance costs such as variable consumables (e.g., utilities, water, fuel, containers), labor, overhead, administrative, and amortization of start-up costs.
- Financing such as interest expense and payments, mandatory debt repayments, and working capital needs.
- Return on investment such as tax to government or dividend to investors.
- Other considerations, including:
  - Rate and potential economic impacts.

✓ Market-based rates or rates established by local government pricing bureau.

- Budgetary concerns.
  - ✓ If charge fee is based on a per-radioactivity of waste bed rate ($/radioactivity), there may be budgetary impacts from increase of waste amounts due to incorporation of other non-radioactive waste.
- Other financial concerns, such as:
  - ✓ Funding capability of storage facility (allocate separate budget or obtain other financial sources) to sustain civilian radioactive waste storage/disposal costs.
  - ✓ Regulatory cost imposed by local oversight agencies.
  - ✓ On-going research and development (R&D) for radioactive waste disposal technologies, which could be part of the radioactive waste charge to improve handling, collection, transportation, and treatment/disposal of radioactive waste.
  - ✓ Impacts from alternative radioactive waste treatment and disposal technologies, or substitution by non-radioactive materials.
  - ✓ Promulgation of waste reduce-reuse-recycle (3R) will cause a significant reduction of waste quantity, negatively affecting the designed storage capacity.
  - ✓ Preparation of disaster contingency plan and the needs for alternative or standby emergency treatment system.

Figure 18. Major Financial Elements to be Considered for the Economic Analysis of a Civilian Radioactive Waste Storage Facility

TIANJIN ENVIRONMENTAL PROTECTION BUREAU

ECONOMIC CONSIDERATIONS - FEASIBILITY OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT SYSTEM

START UP COSTS

Facility Construction

Equipment & Supplies (Pyrolysis, Vehicles, Containers, etc.)

FINANCING

Interest Expense & Payments

Mandatory Debt Repayments

CIVILIAN RADIOACTIVE WASTE STORAGE FACILITY

OPERATING & MAINTENANCE

Variable Consumable Costs (Fuels, Electricity, Water, Containers, etc.)

Labor

Overhead & Administrative

Amortization of Start-Up Costs

RETURN ON INVESTMENT

Tax to Government

Dividend to Investors

OTHER CONSIDERATIONS

Working Capital Needs

Market-Based Rates, Regulated by Pricing Authority

Funding Capabilities of Storage Facility

Regulatory Oversight Costs By EPB

On-Going Research & Development

Alternative Waste Disposal Methodologies

Reduce-Recycle-Reuse

Disaster Contingency Plan

Budgetary Concerns

- ✓ Per radioactivity of waste

4.4.4.1 Key Technical and Operational Assumptions

The proposed civilian low radioactive waste storage facility is an expansion of the existing facility. The expanded facility will require the following handling/treatment equipment: - radioactive source or waste collection and transport, mechanical and thermal treatment, final disposal, and radioactivity measurement and monitoring.

Collection and Transport - Additional containers and vehicles will be required for the collection and transport of radioactive sources or wastes from user or generator sites to the storage facility. It is estimated that a total of additional 15 vehicles and 1,000 containers will be required. Assuming each vehicle travels 200 km of linear travel distance per day, vehicle mileage is 10 km/liter diesel, using 3 days collection per week schedule, and, each vehicle will be decontaminated at RMB100 per vehicle after each use.

Treatment Technology - Two treatment processes are proposed for the facility - mechanical treatment and thermal treatment, to reduce radioactive waste volume.

- **Mechanical Treatment** - Use mechanical force to reduce waste volume prior to storage. Two types of mechanical treatment equipment will be required - a 2 m^3/hr throughput, 100 tons pressure, and 10:1 volume reduction ratio compactor and a 40 kg/hr throughput crusher.
- **Thermal Treatment** - Use thermal process to reduce waste volume prior to storage, or after storage prior to final disposal. In this analysis, pyrolysis treatment is selected for its unique operation principle and less air pollution control requirements, particularly the concern of radioactive particulate matter emissions. A pyrolysis unit with a capacity of 230 kg/load or 1.94 m^3 per load is proposed with air pollution control devices and auxiliary equipment. The operation is scheduled for 3 days per week, 2 loads per day, which is coincided with the collection schedule as described earlier.

Final Disposal - After the stored radioactive wastes reach the safety level for disposal, the waste will be disposed at the on-site landfill.

Radioactivity Measurement and Monitoring - In addition, the storage facility will be equipped with radiation measurement and monitoring equipment to provide measurement services and monitor potential radiation in the following areas:

- Radiation Measurement Laboratory
- Routine Radiation Measurement
- Environmental Radiation Monitoring
- Radiation Emergency Response Monitoring

4.4.4.2 Key Financial Assumptions

The following assumptions are made in the economic and financial analysis:

- Land required for expansion is provided by the City at no additional cost to the

facility.

- Facility construction cost and annual operating cost are provided by TJEPB. Materials and labor are provided by local source.
- Major pretreatment and thermal treatment equipment will be purchased from US source and installed by US personnel.
- Cost analysis will be performed based on the total service year of the equipment (i.e., 10 years). After the cost of capital equipment is paid off or depreciation is completed, the following year cash flow will be identical except for inflation adjustment.
- Cost analysis is based on the assumption that Tianjin Municipal Government will provide land required for the expansion of the storage facility, and 30% of the total capital investment and operating or working capital (normally, working capital is 10-15% of total capital investment). The remaining 70% of the total investment will come from a 15-year bank loan with an annual interest rate of 6.5%.
- Equipment and labor cost in engineering cost estimation will be based on 2005 dollars. If cost adjustment is needed, it will be performed by multiplying consumer price index values in different years (i.e., ratio of x year index/y year index), using US Dept. of Labor inflation calculator (http://www.bls.gov/cpi/home.htm#data). For example, $100 in 1990 is equivalent to $148.74 in 2005, or $100 in 2003 is equivalent to $106 in 2005.

4.4.4.2.1 Capital Cost Estimation

Capital cost refers to costs associated with facility and hardware construction, equipment procurement and installation, and start-up operation. Due to the unique nature of radioactive waste, the treatment process is to properly and securely store the radioactive waste until natural decay that renders the waste harmless to public health and the environment. Finally, the waste can be disposed of in a secured landfill. Therefore, the major capital investment is a well-constructed storage facility, which provides sufficient storage capacity, safety and security. Table 28 shows cost estimates for the improved storage facility provided by the Tianjin EPB. The total capital cost is $981,444, inclusive of both direct and indirect expenditures, but exclusive of land which is provided by the City at no cost to the facility. The facility is estimated to have a service life of 30 years.

Other capital costs include collection containers and vehicles, mechanical treatment (i.e., physical treatment such as compactor and crusher to reduce waste volume) and thermal treatment equipment (i.e., thermal treatment such as pyrolysis to reduce waste volume). In addition, the proposed facility will be equipped with various measuring and monitoring equipment to provide routine radiological measurement services and monitoring in an event, such as an accidental spill.

Table 28. Capital Costs for Tianjin Civilian Radioactive Waste Storage Facility

Capital Costs for Facility Construction		
Cost Item	(in $US, 1$US=8.27RMB)	Cost (in $)
Direct Cost	Facility Construction	906,892
Indirect Cost	Engineering Design	60,459
	Construction Supervision	12,092
	Land	Provided by the City
	Radiation Monitoring	2,000
Total Facility Cost		981,444
Service Life	30 years	

(Note: Data of facility construction costs provided by TJEPB)

Table 29 lists the estimated capital cost of $549,135 for purchasing 1,000 radioactive source and waste collection containers and 15 transportation vehicles. These equipment are expected to have a service life of 10 years.

Table 29. Capital Costs for Collection and Transport of Tianjin Civilian Radioactive Wastes

Cost Item		**Vehicles**	**Containers**
Direct Cost (in $US, 1$US=8.27RMB)			
Purchased Equipment (PE)	Unit Price	36,276	5
	Units Required	15	1,000
Purchased Equipment		544,135	5,000
Total Purchased Equipment		549,135	
Service Life 10 years			

Table 30 lists estimated costs of $1,045,100 for purchasing capital equipment required for Tianjin civilian radiation measurement and monitoring laboratory. The expected service life of the equipment is 10 years.

Table 30. Capital Costs for Tianjin Civilian Radiation Measurement and Monitoring Laboratory

Laboratory and Field Measurement Equipment									
Cost Item		**Radiation Laboratory**		**Radiation Monitoring**		**Environmental Monitoring**		**Emergency Response**	
Direct Cost (in $US)	Unit Cost (in $)	Unit Required	Cost	Unit Required	Cost	Unit Required	Cost	Unit Required	Cost
Gamma Spectroscopy System, including PC and Software	200,000	1	200,000	-	-	1	200,000	-	-
Portable Gamma Spectroscopy System	100,000	-	-	-	-	-	-	1	100,000
Alpha, Beta and Gamma Swipe Counter	75,000	1	75,000	2	150,000	2	150,000	-	-
Beta and Gamma Detector	25,000	1	25,000	1	25,000	-	-	1	25,000
Alpha Detector	25,000	1	25,000	-	-	-	-	1	25,000
Radiation Monitor	10,000	-	-	1	10,000	1	10,000	1	10,000
Air Sampler	5,000	-	-	1	5,000	1	5,000	1	5,000
TLDs	100	-	-			1	100	-	-
Subtotal Equipment Cost			325,000		190,000		365,100		165,000
Total Equipment Cost	1,045,100								
Service Life 10 years									

The estimated capital cost for mechanical pretreatment equipment, namely compactor and crusher, including 3% of tax and 5% of freight charges and the total is $472,000 as shown in Table 31. The estimated service life of the equipment is 10 years. The estimated capital cost for a pyrolysis unit is $1,108,000 based on vendor's proposal and listed in Table 32, including equipment, 5% freight, 3% tax and installation costs. The expected service life is 10 years.

Capital costs for facility expansion, collection and transportation, pretreatment and treatment equipment can be summarized below:

- Facility expansion - $981,444 based on information provided by Tianjin EPB.
- Collection and transport - $549,135.
- Instrumentation for laboratory and monitoring team: $1,045,100
- Mechanical pretreatment: $413,000 for a compactor and $59,000 for a crusher.
- Thermal treatment (a pyrolysis unit): $1,108,000.

4.4.4.2.2 Annual Cost

Total annual costs are expenses incurred every year over the life of an improved civilian radioactive waste storage facility, which includes both direct and indirect costs. These costs can be offset by revenue or income from service provided in the cash flow analysis. Total annual costs are developed based on the following assumptions:

- Depreciation for facility occurs over a 30-year period.
- Depreciation for major equipment and accessories occurs over a 10-year period.
- Depreciation for collection containers and transportation vehicles occurs over a 10-year period.
- Residual value for fixed assets is estimated at 10%.
- Average local labor cost is RMB$30,000 or US$3,600/year including benefits.
- Management labor cost is estimated as 15% of total labor costs.

Direct costs can be further separated into variables and semi-variables. Variables costs are costs directly associated with the operation of the storage facility, such as utilities (electricity, fuel and water, etc.), and waste disposal. Semi-variables include operating and maintenance labors, maintenance and other consumable materials, and overhead. Indirect costs include capital equipment depreciation, taxes or permit fees (property tax, vehicle, air and waste discharge permits), and insurance and administrative charges.

Table 31. Capital Costs, Tianjin Civilian Radioactive Waste Mechanical Treatment Equipment

		Mechanical Treatment	
Cost Item (in $US)		**Compactor**	**Crusher**
Specifications		($2m^3$/hr, 100 tons pressure, 10:1 volume red. ratio)	(40 kg/hr)
Direct Cost			
Site Preparation		As required	As required
Facilities, buildings		As required	As required
	Purchased Equipment (PE)		
	Equipment	350,000	50,000
	Taxes (3%)	10,500	1,500
	Freight	17,500	2,500
Total PE		378,000	54,000
Total Installation		35,000	5,000
Capital Investment		413,000	59,000
Total Capital Investment		472,000	
Service Life	10 years		

Table 32. Capital Costs for Tianjin Civilian Radioactive Waste Thermal Treatment Equipment

		Thermal Treatment
Cost Item		**Pyrolysis Unit**
Direct Cost		
	Site Preparation	As required
	Facilities, buildings	As required
	Purchased Equipment (PE)	
	Treatment Device + Auxiliary Equipment (Wet Quench, Pack Column Scrubber, Sub-cooling Section, Wet Electrostatic Precipitator, Activated Carbon Column, and Induced Draft Blower)	975,000
	Taxes (3%)	29,250
	Freight	48,750
Total PE		1,053,000
Total Installation		55,000
Total Capital Investment		1,108,000
Service Life	10 years	

(Data Source :Honua Technologies Preliminary Proposal)

Annualized cost for the storage facility will be provided by the Central Government appropriation fund of RMB 300,000 or equivalent to US$36,276.

Annualized cost estimation for facility operation is based on the following assumptions:

- Operator costs for facility, collection and transportation and treatment equipment are based on actual manpower required and labor cost as described earlier.
- Operator costs for laboratory are based on two staff per laboratory and labor costs as described earlier.
- Maintenance labors are estimated as 10% of the total purchased equipment cost.
- Employee tax is estimated as 15% of operator labor costs.
- Administrative charges, property tax and insurance is estimated as 4% of total equipment costs.
- Overhead cost is estimated as 60% of all labor and material costs.

As shown in Table 33, annualized cost for collection and transport of Tianjin civilian radioactive wastes is estimated as $286,541. In which, annual cost for vehicle decontamination is estimated as 15 vehicles*[(RMB100/vehicle)/8.27]*52 wks/yr*3 times/wk = $28,295; and, annual cost for vehicle fuel is estimated as {[(15 vehicles*200 km/day*52 wks/yr*3 days/wk)/10 km/liter]*RMB4/liter}/8.27 = $22,636.

Table 33. Annualized Costs for Collection and Transport of Tianjin Civilian Radioactive Wastes

Radioactive Source and Waste Collection and Transport			
Annualized Costs		**$US**	
	Operator	54,414	(10% of capital cost)
	Decontamination	28,295	
	Fuels	22,636	
	Maintenance	54,914	(10% of capital cost)
	Overhead, Tax, Insurance	126,282	
Total Annualized Costs		286,541	

Table 34 shows annualized cost for radiation measurement and monitoring laboratory. Labor cost is estimated as two technical staff for each laboratory and the total is $7,255*4 = $29,020 for all laboratories and emergency response team. Maintenance cost is estimated as 10% of equipment cost, which is $104,510. Overhead, insurance and tax is estimated using the assumptions above and the total is $150,029. The grand total of annualized cost for radiation measurement and monitoring is $259,806.

Table 34. Annualized Costs for Tianjin Civilian Radiation Measurement and Monitoring Laboratory

Laboratory and Field Measurement Equipment				
Cost Item (in $US)	**Radiation Laboratory**	**Radiation Monitoring**	**Environmental Monitoring**	**Emergency Response**
Total Equipment Cost	325,000	190,000	365,100	165,000
Annualized Costs (Labor and Maintenance)				
Labor	7,255	7,255	7,255	7,255
Maintenance (10% Equipment /yr)	32,500	19,000	36,510	16,500
Overhead, Insurance and Tax	37,941	24,441	41,951	45,696
Total Annualized Cost	259,806			

Table 35 lists annualized operating and maintenance cost for the mechanical treatment, using assumptions discussed earlier, and the total is $100,696.

Table 35. Annualized Costs for Tianjin Civilian Radioactive Waste Mechanical Treatment Equipment

Mechanical Treatment			
Cost Item (In $US)		**Compactor**	**Crusher**
Total Capital Investment		413,000	59,000
Annualized Costs			
Labor		3,628	3,628
Maintenance (10% of Total PE/year)		37,800	5,400
Overhead, Insurance, Tax		41,921	8,321
Annualized Costs		83,348	17,348
Total Annualized Costs	100,696		

Annualized cost for operating and maintenance of a thermal treatment (i.e., pyrolysis) unit is listed in Table 36. It is assumed that the unit will be operated on 3-days per week schedule. Operator labor cost is estimated based on 3 operators, each operator works 8-hr shit and 2 shifts per day, and the total is $21,765. Supervisor labor is estimated as 15% of total operator labor and the total is $3,265. Maintenance labor is estimated as 2 hours per shift and the total is $907. Maintenance material is estimated as 100% of maintenance labor, which is $907. Other items such as activated carbon, chemicals, electricity and fuels are estimated using the following formula.

For activated carbon cost: 1 kg-hr*52 wk-yr*3 days-wk*24 hr-day*$1/kg = $3,744

For sodium bicarbonate or sodium hydroxide cost: 5 kg-hr*52 wk-yr*3 days-wk*24 hr-day*$0.5/kg = $9,360

For fuel cost: 1{[(540000 kcal-hr*52 wks*3 day-wk*24 hr-day)*3.96832 Btu/kcal] / 1031Btu-cf / 35.3cf-m3} *RMB2.5-m3 /8.27 = $66,640

For electricity cost: 100kw-hr*($0.61/8.27)*52*3*24 = $27,616

A total annualized cost for consumables and utilities (i.e., fuel and electricity) is estimated as $107,360.

Indirect cost, such as administrative charges, property tax and insurance, and overhead using assumptions described earlier, and is estimated as ($22,160+$11,080+$11,080+$664,800) = $709,120.

Total annualized cost for operating a pyrolysis unit is estimated as $846,589, and the details are listed in Table 36.

Table 36. Annualized Costs for Tianjin Civilian Radioactive Waste Thermal Treatment Equipment

Annual Cost (based on 3 days/week operation schedule)		
	Thermal Treatment	
Cost Item		**Pyrolysis Unit**
Direct Cost, DC		
	Operating labor	21,765
	Supervisor labor	3,265
	Operating materials	3,265
	Maintenance labor	907
	Maintenance material	907
	Cost for Fuel, Utilities, Chemicals, Activated Carbon, etc.	107,360
Indirect Annual Costs, IC		
	Administrative charges	22,160
	Property tax	11,080
	Insurance	11,080
	Overhead	664,800
	Total Annual Cost DC + IC	846,589

(Data Source: Honua Technologies Preliminary Proposal)

Annual ash volume is estimated to be 2 loads-day*1.94m^3-load*52 weeks-yr*3 run-week*(1-0.9) [or 90% volume reduction] = 60.53 m^3, and the unit disposal fee is $300/m^3. Annual cost for final disposition of ash and residue at an on-site facility is estimated as $18,158.

Annualized costs for facility operation, collection and transportation, pretreatment and treatment, and final disposal can be summarized below:

- Annualized cost for facility operation is $36,276.
- Annualized cost for collection and transport is $165,917.
- Annualized cost for instrumentation is $259,806.
- Annualized cost for mechanical treatment is $83,348 and $17,348 for compactor and crusher, respectively.
- Annualized cost for thermal treatment is $846,589.

- Annualized cost for final disposal is $18,158.

4.4.4.3 Economic Analysis

Using capital investment and annualized cost estimates, an economic analysis was conducted for the improved civilian radioactive waste storage facility to assess whether the selected technology is economically feasible for implementation.

Normally, an economic analysis begins with an estimate of capital and auxiliary equipment cost based on the proposed technologies, capacity, and engineering specifications; followed by calculating depreciation values based on years of equipment service life and annualized cost estimates that take into account of both direct (i.e., utility, consumables) and indirect (i.e., administrative and overhead charges) operating costs.

It should be pointed out that the existing fee schedule for storing radioactive waste is based on half-life, specific activity, weight, volume, and collection/transport fee (Table 37). And, the fee schedule for storing radioactive source is based on radioactivity of the source (Table 38). The format of existing fee schedule is adopted for projection of future annual revenue based on fee per unit (i.e., $/radioactivity or $/Bq$10^{10}$) calculation for the following economic and financial analyses.

Table 37. Tianjin Civilian Radioactive Waste Collection and Storage Fee Schedule

Effective on Oct. 4, 1992

Class	Half-life ($T^{1/2}$)	Specific activity (Bq/kg)	Waste weight (kg)	Fee (RMB)	Waste volume (liter)	Fee (RMB)
A-I	less or equal to 60 days	less or equal to $2*10^6$	1	30	1	20
A-II	less or equal to 60 days	greater than $2*10^6$	1	35	1	23
B-I	between 60 days and 5.3 years	less or equal to $2*10^6$	1	45	1	30
B-II	between 60 days and 5.3 years	greater than $2*10^6$	1	50	1	33
C-I	greater than 5.3 year	less or equal to $2*10^6$	1	55	1	36
C-II	greater than 5.3 year	greater than $2*10^6$	1	60	1	40

Data source: TJEPB

Note:

1. Fee schedule is developed based on half-life, specific activity, weight, volume, and collection/transport fee
2. If waste weight is less than 40 kg, fee is charged based on waste volume.
3. Waste collection bag and container will be provided by TJEPB with a nominal fee.

Table 38. Fee Schedule for Radioactive Source Storage (not including transport fee)

Effective on Jan. 1, 1994		
Activity	**Unit**	**Fee (RMB)**
5 Ci - 10 Ci	pc.	6,000
10 Ci - 50 Ci	pc.	7,000
50 Ci - 100 Ci	pc.	8,500
100 Ci - 200 Ci	pc.	17,000
200 Ci - 300 Ci	pc.	25,000
300 Ci - 400 Ci	pc.	35,000
400 Ci - 500 Ci	pc.	45,000
500 Ci - 600 Ci	pc.	53,000
600 Ci - 800 Ci	pc.	70,000
800 Ci - 1000 Ci	pc.	85,000
1000 Ci - 1500 Ci	pc.	110,000
1500 Ci - 2000 Ci	pc.	130,000
2000 Ci - 3000 Ci	pc.	160,000

Economic analysis then proceeds to evaluate feasibility and profitability of the proposed improved storage facility, including annual revenue estimation and preparation of income statement, balance sheet, statement of cash flow, and finally cash flow analysis and calculation of internal rate of return. The following summarizes the essential components of the economic analyses.

- Total capital investment consists of costs associated with facility expansion or improvement, equipment procurement, and land lease as well as capitalized interest. Equipment procurement cost includes purchase price and installation or testing costs required to prepare the equipment for operation. The land used for facility expansion is assumed to be provided by the Tianjin Municipal Government at no cost to the project. Capitalized interest is interest charge incurred during the initial startup period before operation.

- Annualized costs are routine costs incurred annually throughout the life span of the equipment or technology. Annualized costs can be expressed as:

  Total Annualized Costs = Direct Annualized Costs + Indirect Annualized Costs

  Where, direct annualized costs include consumables, fuel, utilities and maintenance; and, indirect annualized costs consist of administrative charges, insurance, overhead and tax.

- Depreciation is the annual value deduction of depreciable capital investment in service. Normally, land is not considered as depreciable in tax codes. In the following economic analysis, a 10% residual value of fixed assets and the straight-line depreciation method are used. Annual depreciation can be expressed as:

  Annual Depreciation = Capital Investment x (1-10% Residual Value)/Year of Equipment Service Life Span

- Every piece of equipment is assumed to have an average of 10-year service life period. However, the facility has a 30-year service life. The residual value is written off at the end of the 10-year period and a new set of equipment will be procured at the 11th year. All costs include a 3% annual inflation rate based on the

2005 equipment value.

- It is assumed that 70% of capital costs will be raised through a 15-year loan with an annual interest rate of 6.5%. Hence, capitalized interest charge will be factored in during an 8-month initial period. Capitalized interest will be calculated using the following formula:

  Capitalized Interest = Principle x Interest Rate x Number of Periods

- Annualized cost analysis is performed using the following assumptions:
  - All costs are adjusted for an annual inflation rate of 3%.
  - Sales tax is calculated at 5% of annual income and other value-added tax is estimated at 11.55% of the sale tax.
  - Income tax is estimated at 33% and could be adjusted according to actual.
  - Annual operational incomes are revenue from providing storage of radioactive source and storage and treatment of radioactive wastes. The estimated annual operational incomes is calculated based on pre-determined profitability ratio and annualized operating costs. No unit cost is provided.
  - Labor costs include fringe benefits.
  - Fixed expenses is the sum of costs required for facility maintenance, vehicle insurance and registration, equipment maintenance, and depreciation, insurance and property tax.
  - Variable expense is the difference between total annual expense and fixed expense.
- Balance sheet is prepared based on the following assumptions:
  - Assuming one month of inventory supplies for consumable and maintenance materials.
  - Appropriated earning is defined as 15% of net income as required by the laws of PRC's for future growth and welfare.
- Cash flow analysis is performed based on the following assumptions:
  - Cash Sales = Annual Sales/12 x 11 (e.g., collect 11 months of cash sales and one month of account receivable).
  - Annual operating cost does not include non-cash expenses, such as depreciation and gain or loss from disposing fixed assets.

Key findings from economic analysis are discussed in the following sections:

4.4.4.3.1 Revenue Projection

Based on the information provided by TJEPB, it is projected that there will be a decline in radioactive waste generation due to new substituted material available fro radioactive medicinal treatment and diagnosis, but there will be an increase or growth in the use of sealed radioactive sources because of its wide industrial and medical applications. Therefore, a linear extrapolation of radioactive waste generated from 1992 to 2003 was

employed to project future decline of waste at annual of negative rate of 10% in radioactivity using 2003 as baseline year; and, future growth of source use at an annual rate of $3.4*10^{10}$ Bq, from 2005 to 2020. The average charge rate for radioactive waste is $\$0.75/10^{10}$ Bq and $\$3.9/10^{10}$ Bq per month for radioactive source, respectively. Table 39 shows the projected radioactive waste generation, source and projected revenues, for years 1, 5, 10, 11 and 15.

Table 39. Tianjin Civilian Radioactive Waste Treatment and Storage Facility Revenue Projections

No. of Year	1	5	10	11	15
Year	**2006**	**2010**	**2015**	**2016**	**2020**
Radioactive Waste Treatment					
Activity ($Bq*10^{10}$)	41.92	27.51	16.24	14.62	9.59
Annual Activity Change ($Bq*10^{10}$)	n/a	-3.06	-1.80	-1.62	-1.07
Revenue In US$1000 (Charge rate: $0.75/ $Bq*10^{10}$)	$31	$21	$13	$11	$7
Radioactive Waste Treatment					
No. of Source	126	162	208	217	254
Annual Change Number of Source	9	9	9	9	9
Activity ($Bq*10^{10}$)	46.47	60.09	77.03	80.42	94.00
Annual Activity Change ($Bq*10^{10}$)	n/a	34	34	34	34
Revenue In US$1000 (Charge rate: $3.9/ $Bq*10^{10}$-Month)	$2,175	$2,810	$3,604	$3,764	$4,399
Total Projected Revenue	$2,206	$2,831	$3,617	$3,775	$4,406

Note:

1. Radioactive waste generation data for 1992 through 2003 is provided by TJEPB.
2. Radioactive material is classified into two types - one is radioactive waste, the other is radioactive source.
3. Radioactive waste is projected to decrease 10% per year using 2003 as the baseline year.
4. Radioactive source is projected to increase using linear regression method. First number of radioactive source is projected and the average radioactivity for each source is multiplied by an average of 10mCi or 3.7+e09 Bq per source

4.4.4.3.2 Depreciation

Table 40 shows total investment costs, depreciation and net book value for years 1, 5, 10, 11, 15 and 20. It should be noted that at year 11, the residual value, which is estimated at 10% of the original cost, is written off and a new set of equipment will be installed to replace the existing ones.

Table 40. Depreciation Schedule, Tianjin Civilian Radioactive Waste Storage Facility

Value (x US$1000)						
	Year					
Item	**1**	**5**	**10**	**11**	**15**	**20**
Total Cost	$4,282	$4,282	$4,282	$5,277	$5,277	$5,277
Total Depreciation	$325	$325	$325	$414	$414	$414
Total Net Book Value	$3,956	$2,655	$1,028	$4,560	$2,488	$831

4.4.4.3.3 Annual Cost Analysis and Income Statement

Results of annual cost analyses for years 1, 5, 10, 11 and 15 are summarized in Table 41. The time is set to match the assume 15-year bank loan. As discussed earlier, due to the complexity of cost structure of fee schedule for radioactive source storage and radioactive waste storage and treatment, the annual income is estimated based on predetermined unit revenue per radioactivity ($Bq10^{10}$).

Table 41. Annual Cost Analysis, Tianjin Civilian Radioactive Waste Storage Facility

Value (x US$1000)					
	Year				
Item	**1**	**5**	**10**	**11**	**15**
Total Annual Income	$2,206	$2,831	$3,617	$3,775	$4,406
Total Annual Expense	$2,187	$2,370	$2,614	$3,087	$3,002
Net Annual Income	$13	$309	$672	$461	$941
Profitability (%)	1	11	19	12	21

Table 42 lists income statement for Tianjin civilian radioactive waste storage facility.

Table 42. Income Statement – Tianjin Civilian Radioactive Waste Storage Facility

Value (x US$1000)					
	Year				
Item	**1**	**5**	**10**	**11**	**15**
Total Income	$2,206	$2,831	$3,617	$3,775	$4,406
Total Cost of Sales/Service	$1,973	2,200	$2,517	$3,003	$2,968
Gross Profit	$233	$631	$1,100	$772	$1,438
Total Operating Expense	$22	$25	$29	$30	$34
Total Income from Operation	$210	$606	$1,071	$742	$1,405
Other Expense (Loan Interest)	$190	$145	$67	$54	$0
Income before Tax	$20	$461	$1,003	$688	$1,405
Income Tax	$7	$152	$331	$227	$464
Net Income for the Year	$13	$309	$672	$461	$941

4.4.4.3.4 Balance Sheet

Table 43 summarizes the balance sheet results for years 1, 5, 10, 11 and 15. It should be noted that the following cost items are included in the Balance Sheet calculations but can be modified if necessary.

- Note receivable in current asset.
- Construction in progress in property, plant and equipment.
- Intangible asset, such as land acquisition and permit, amortization and other intangibles.
- Note payable, accrued interest, income tax payable, accrued wages and salaries and deposits received from customers under current liability.

4.4.4.3.5 Cash-flow Analysis

Cash flow is the net difference of direct investments, loans and revenue collected, and expenditures made during the lifecycle of an operation. Cash flows are typically segregated into financing, investing and operating. Financing cash flows are the direct investment or repayment of monies to and from investors. Investing cash flows are expenditures to acquire and install technology that will ultimately generate revenue and profits. Operating cash flows represent the excess or deficit revenue received over operating expense paid. A summary of cash flow analysis is presented in Table 44.

Table 43. Balance Sheet, Tianjin Civilian Radioactive Waste Storage Facility

Year	1	5	10	11	15
Assets (x US $1000)					
Current Assets					
Cash	$54	$1,392	$4,398	$1,121	$5,281
Accounts Receivable	$184	$236	$301	$315	$367
Note Receivable	-	-	-	-	-
Inventory			-	-	
Material	$3	$3	4	$4	$4
Total Current Assets	$241	$1,631	$4,703	$1,440	$5,652
Long-Term Investment					
Property, Plant and Equipment					
Construction in Progress	-	-	-	-	-
Acquisition Cost	$4,282	$4,282	$4,281	$5,277	$5,277
Accumulated Depreciation	($325)	($1,623)	($3,247)	($718)	($2,375)
Total Property, Plant and Equipment	$3,957	$2,658	$1,035	$4,560	$2,902
Intangible Asset					
Land Lease-Permit	-	-	-	-	-
Amortization	-	-	-	-	-
Other Intangible	-	-	-	-	-
Total Intangible Assets					
Total Assets	$4,198	$4,289	$5,738	$5,999	$8,554
Liability and Stockholders' Equity					
Current Liability					
Account Payable	$3	$3	$4	$4	$4
Note Payable	-	-	-	-	-
Accrued Interest	-	-	-	-	-
Income Tax Payable	-	-	-	-	-
Accrued Wages, Salaries	-	-	-	-	-
Deposits Received from Customers	-	-	-	-	-
Total Current Liabilities	$3	$3	$4	$4	$4
Long-Term Debt	$2,935	$2,235	$1,035	$835	$0
Total Liabilities	$2,938	$2,238	$1,039	$839	$4
Stockholder's Equity					
Capital Stock	$1,247	$1,247	$1,247	$1,247	$1,247
Additional Paid-in Capital					
Retained Earnings					
Appropriated Earnings	$2	$121	$518	$587	$1,096
Un-appropriated Earnings	$11	$684	$2,935	$3,327	$6,208
Total Retained Earnings	$13	$805	$3,453	$3,914	$7,304
Total Liabilities and Stockholders' Equity	**$4,198**	**$4,289**	**$5,738**	**$5,999**	**$8,554**

Table 44. Summary of Cash Flow Analysis

Item	Year 0	Year 5	Year 10	Year 11	Year 15
Year	**2005**	**2010**	**2015**	**2016**	**2020**
Cash Flow (x1000 US$)					
Cash Sales	0	$2,595	$3,316	$3,316	$4,039
Cash Collection from Receivable	-	$223	$288	$301	$354
Proceeds from Sale of Fixed Asset	-	-	-	-	-
Total Cash Flow	0	$2,818	$3,604	$3,617	$4,393
Cash Outflow				-	
Start-up Investment	$4,282	-	-	-	-
Plant & Equipment Replacement	-	-		$4,266	-
Annual Operation Cost Payment	-	$1,568	$1,836	$1,894	$2,140
Interest Payment	-	$145	$67	$54	$0
Income Tax Payment	-	$152	$331	$227	$464
Loan Principal Repayment	-	$200	$200	$200	$85
Total Cash Outflow	$4,282	$2,065	$2,434	$6,641	$2,689
Annual Net Cash Inflow	($4,282)	$753	$1,169	($3,024)	$!,704
Accumulated Cash Flow	($4,282)	$2,960	$7,785	$4,760	$10,631

Note: The cash flow assumes no proceeds from disposal of fixed assets.

The project revenues are derived from providing radioactive source and waste treatment services. It is expected that the majority of the sales will be collected in cash and only one month of sales will remain in receivable at the end of the year. A unit charge of $0.75 per activity unit (Bq*10^{10}) and $3.9 per activity unit per month (Bq*10^{10}-month) and an average annual profitability of 11%, it is anticipated that the project will produce sufficient cash flow to fund the operation and service the loan repayment at the same time.

4.4.4.3.6 Financial Internal Rate of Return

The financial internal rate of return or IRR is the discount rate that results in a net present value of zero for a series of future cash flows. It is a discounted cash flow approach to valuation and investing just as net present value (NPV).

Both IRR and NPV are widely used to decide which investments to undertake and which investment not to take. IRR is the flip side of NPV and is based on the same principles and the same math. NPV shows the value of a stream of future cash flow discounted back to the present by some percentage that represents the minimum desired rate of return, often a company's cost of capital. IRR, on the other hand, computes a break-even rate of return. It shows the discount rate below which an investment results in a positive NPV and above which an investment results in a negative NPV. It is the break-even discount rate, the rate at which the value of cash outflows equals the value of cash inflows.

Net present value of an investment is the difference between the sum of the discounted cash flow which is expected from the investment and the amount which is initially invested. It is a traditional valuation method used in the discounted cash flow measurement methodology.

Net Present Value = Expected Cash Flow from an Investment- Cost of Capital (or called Discounted for Cost of Capital) - Initial Investment

Whereas, Expected Cash Flow from an Investment- Cost of Capital = Present Value

In summary, IRR measures the return to equity on the money it invested. The IRR is calculated to be approximately 12 % at the end of 15-year period.

4.4.4.4 Analysis of Investment Risk

Investment risk for the improved civilian radioactive waste storage facility may include the followings:

- Construction and sponsor risks
- Operation and technology risk
- Economic, inflation, and environmental risks
- Country, political and foreign exchange rate risks.

These risks are discussed further below.

4.4.4.4.1 Construction and Sponsor Risks

The key construction risks for Tianjin civilian radioactive waste storage facility are non-completion, late completion, and cost over-run. These risks will greatly impact the facility operation, profitability, and investment return. The following measures can be used to mitigate non-completion, late completion risks, or cost over-run.

- Allocate construction risks, to the extent possible, to the contractors by negotiating a turn-key fixed price project, with carefully designed and legal binding milestone payment schedules, payment withhold provisions, and other penalties (i.e., bid bonds or performance bonds) associated with non-completion, late completion, and cost over-run situations. An award fee may also be built into the contract to reward the contractor for early and successful completion of milestone deliverables of the overall project schedule.
- Require contractors and/or vendors to commit equity or potentially secured assets to ensure its genuine interest in successfully completing the project.
- Utilize third party/parties to perform independent engineering evaluation and construction management as part of the due diligence processes to detect early problems.

Since the construction of the facility expansion project is provided by the state-owned construction company and financially sponsored by the government, therefore, the construction and sponsor risks are relatively low. In fact, the facility has already completed the construction during the course of this feasibility study.

4.4.4.4.2 Operation and Technology Risks

Operation and technology risks include the types of technology selected and the availability of qualified personnel. As discussed earlier, due to the unique nature of radioactive source and waste, the focus of the operation will be to provide a properly secured and monitored storage facility operated by qualified staff. Therefore, the main

issue is how to provide a carefully planned management scheme to ensure that radioactive sources and wastes are collected, transported, and stored according to industry best management practices and regulatory requirements. Technology selected for waste volume reduction by mechanical and thermal methods are well developed and in use for many years by the industry, and the associated risks are considered to be relatively low.

4.4.4.4.3 Economic, Inflation and Environmental Risks

Economic risk is an early benchmark used to assess the potential success of a project, more specifically, is to assess that revenue is sufficient to offset operating costs and loan obligations, so the operation can be self-sustained.

Under current arrangement, government budget appropriation provides expansion and operating costs; and, revenue received from services rendered is turned over to the government. Therefore, economic risk is very low. This arrangement is not expected to change in the foreseeable future due to unique nature of radioactive sources and wastes and the service is still considered as part of social services provided by the government.

However, if market-based approach is adopted for radioactive source and waste management, the facility operator should carefully review and analyze all assumptions used for economic analysis to determine whether the revenue projection is reasonable and the likelihood for the project to generate adequate cash flow to meet its obligations.

Another economic risk is inflation. Since the project expenditures, receipts, and loans are all in the same currency, there is relatively low inflation risk.

There are also growing concerns of environmental impacts by new project in PRC. Proper project planning and environmental impact assessment prior to the construction of the facility will be required. The facility expansion project already completed environmental impact assessment prior to actual construction; therefore, there is no environmental risk.

4.4.4.5 Summary of Financial Analysis

The overall cost estimate of the improved civilian radioactive waste storage facility is presented in Table 45 and the results of the financial analysis are also summarized below.

- Loan amount is $3,035,000 (70% of initial investment of $4,155,680) and capitalized interest of $126,060.
- Loan maturity year is 2020 (15 years from loan origination in the year of 2005)
- Loan interest is 6.5%.
- Internal rate of return is calculated at 12%.
- Annual revenue is calculated at $3,303,640 to sustain the operation.

Table 45. Estimate of Total Investment for Tianjin Civilian Radioactive Waste Storage Facility

Total Investment	(In 000 USD)
Investment Item	**Value**
Facility	981.44
Collection & Transportation	549.14
Laboratory & Field Equipment	1,045.10
Mechanical Equipment	472.00
Thermal Treatment Equipment	1,108.00
Capitalized Interest	126.05
Total Investment	4,281.73

5.0 CONCLUSIONS AND RECOMMENDATIONS

Specific recommendations for the improvement of Tianjin radioactive waste management system are listed below:

- ✓ An overview of the existing national and city regulations in China reveals that although the legislation process is different from the U.S., however, the current legal framework is adequate for Tianjin City and the focus should be on the enforcement. Since the City is the only radioactive waste management provider, presumably the State Environmental Protection Administration (SEPA) is responsible for the oversight function. Although Tianjin City radioactive waste management system is a fee-based system, however, the fee rate is jointly determined by City's Finance, Pricing and Environmental Protection Bureaus. In addition to the fact that radioactive waste management is still considered as a public service provided by the government, the fee rate development process will also take into account of local affordability, therefore, the final fee rate may not actually reflect the true operating cost.

- ✓ One area to enhance the management of radioactive materials and sealed source is to strengthen the current registration and report system by expanding the database structure to document shipment condition. This will enable the regulatory agency to identify which generator might need further training on packaging and shipping requirements, and, to generate information on physical forms of radioactive material or waste to assist in performing a cost analysis for each waste minimization techniques that could be employed.

- ✓ A Geographic Information System (GIS) based radioactive waste management system is a useful tool for decision-making process, information display, and distribution. It is recommended that a GIS-based radioactive waste management system to be developed based on the existing GIS system - Tianjin Urban Planning and Land Information System (TUPLIS) platform, which was established by the City's Urban Planning and Land Management Bureau. The GIS-based system should include the following elements: geographic information (digitized maps, topographic data, river, lake and water body system, road and street access, demographic data and sensitive population), radioactive material and waste database including information (types of radionuclides, source and user data, activity level, physical forms, chemical constituents, shipping and storage, and discharge or emission), and spill or accidental release

and emergency response models. In addition to computer hardware, basic software requirements include ARC/GIS software (ARC/Reader for map viewing and display, ARC/View for mapping and data analysis, ARC/Editor for data editing, and ARC/Info for data processing), database software, statistics software, accidental release software and emergency response software. Additionally, ARC/IMS software can be used for interactive Internet-based GIS for public viewing, participation and information distribution.

- ✓ Although the current legal framework and technical guidelines for radioactive waste management are fairly complete, however, the actual implementation and enforcement need to be further strengthened. The utmost waste management strategy is waste minimization at the source or source reduction, therefore, the emphasis is on the training in the proper handling of radioactive waste. This will help alleviate the generation of unnecessary radioactive waste. Periodic refreshing course and training coupled with proper internal and external audits will significantly reduce waste generation. Another option is material substitution, with recent development of new biomedical diagnostic technology, radioisotope-based molecular probes now can be substituted with fluorescent, non-radioactive probes, and completely eliminate the generation of radioactive waste.

- ✓ The facility requires radioactive waste pretreatment technologies such as volume and size reduction by compaction and crushing, and incineration or pyrolysis. Box compactor and crushing machine are commercially available. Capital equipment cost for a compactor ranges from US$3,000 for a simple manual system to US$500,000 for an automated, high throughput system. However, caution must be exercised when compacting radioactive waste. Carefully select type of radioactive waste (i.e., waste contains similar half-life radionuclides), and avoid incompatible material (i.e., wastes containing sharps) from rupturing the container or causing hazardous chemical reactions (i.e., chemically incompatible wastes). Capital equipment cost for a crushing machine for friable waste with a capacity of 40 kg/hr is approximately US$50,000. Thermal treatment by incineration or pyrolysis can achieve a higher waste volume reduction ratio. Considerations for designing an incinerator or pyrolysis unit for radioactive waste include type and half-life of radionuclide in the waste and type of wastes. These information are essential for the engineering design of exhaust gas and residue or ash treatment. The capital equipment of an incinerator with a capacity of 50 kg/hr is in the range of US$250,000 to 500,000, depending on the degree of sophistication of instrumentation and control. Pyrolysis is a good alternative to replace incineration if air pollution control of exhaust gas becomes cost prohibitive and difficult to manage. However, pyrolysis is a batch operation and normally will take 8 to 10 hour to complete one batch cycle. Wastes containing pressurized container and heavy metals are not suitable for pyrolysis.

- ✓ The facility also requires a cement-based solidification/stabilization of treated waste such as ash from incineration. Cement mixer is a rather inexpensive equipment and readily available. However, it should be reinforced with proper radiation shielding and have proper decontamination procedures. Furthermore, caution should be exercised to identify chemical constituents, particularly waste organic solvents, in the waste prior to cement solidification/stabilization to avoid potential degradation of solidified product.

- ✓ A radiation measurement laboratory will greatly enhance the facility's capability in the radiation measurement. In addition to wet chemistry laboratory normally required for sample preparation before measurement, the proposed laboratory

should be equipped with the following instrument: (1) a gamma spectroscopy system including necessary computer hardware (a personal computer) and spectrum library software, (2) an alpha/beta swipe counter, (3) a beta scintillation counter, and (4) an alpha spectroscopy system, and necessary accessories such as calibration standard and sampling devices. The overall cost estimate for a laboratory equipped with one of each instrument listed is in the range of US$350,000.

- ✓ Measurement instrument required for basic monitoring of premise of the storage facility, shipments and the storage vault areas include: (1) a beta/gamma detector, (2) a radiation monitor, (3) air samplers with removable filters, (4) a beta/gamma swipe counter, and (5) an alpha swipe counter. Instrument cost is estimated in the range of US$200,000.

- ✓ Measurement instrument required for environmental radiation monitoring include: (1) thermoluminescent dosimeters (TLDs), (2) TLD reader, (3) a gamma spectroscopy system, (4) a radiation monitor, (5) air samplers with removable filters, (6) a beta/gamma swipe counter, and (7) an alpha swipe counter. Instrument cost is estimated in the range of US$400,000.

- ✓ Portable instrument required for emergency response radiation monitoring include: (1) a portable gamma spectroscopy system, (2) portable alpha, beta and gamma detectors, (3) a radiation monitor, (4) portable air samplers. Instrument cost is estimated in the range of US$150,000.

It should be noted that the list of instrument recommended may be redundant due to the fact that the consideration is primarily based on the facility's functional needs. However, the total number of recommended instrument may be reduced if the instrument can be shared by various groups through proper scheduling and management. Furthermore, the purchase of instrument can be implemented in multiple phases to ease the financial burden.

- ✓ Although recycle and reuse of radiation source and radionuclides is technically feasible, it has not been implemented in the U.S. due to the difficulty in matching of technical specifications of used sources or materials for different applications and overall tracking and management requirement. It is recommended that if Tianjin EPB decides to pursue this venue, an oversight organization should be established to tracking every single piece of sealed source from original owner to the new owner, to the final disposal facility to assure that the requirements for safe handling, transportation and use are carefully followed.

6.0 PROJECT IMPLEMENTATION AND ACTION PLAN

This section presents the implementation schedule and action plan for the improvement of Tianjin civilian radioactive waste management system. Figure 19 illustrates the proposed implementation schedule based on assumptions discussed in earlier section.

Figure 19. Proposed Implementation Schedule

ID	Task Name	Start	Finish
1	Prepare Business and Operational Plan	2006/7/3	2006/8/2
2	Develop Budget Scheme and Prioritize Equipment Procurement Schedule	2006/8/3	2006/8/18
3	Submit for Approval and Allocate Funds	2006/8/21	2006/10/18
4	Prepare Bidding Document including Technical Spec., Contract Requirements and Bidder Qualification	2006/8/3	2006/10/13
5	Announce International and Local Tenders	2007/1/1	2007/1/19
6	Receive and Review Proposals	2007/1/22	2007/2/19
7	Select Qualified Vendors, Contract Negotiation and Award	2007/2/20	2007/3/20
8	Deliver and Install Equipment, Test Run, and Final Acceptance Test	2007/3/21	2008/6/30
9	Project Close-out	2008/8/1	2008/8/1
10	Warranty	2008/8/1	2010/7/30

A total of ten tasks included in the implementation schedule, the action plan is:

1. Prepare business and operational plan. The plan will include both technical operational requirements and business (i.e., budget and financial) requirements. It is expected to take approximately one month to prepare using information provided in this feasibility study.

2. Develop budget scheme and prioritize equipment procurement schedule. Budget scheme will include the discussion of potential funding sources – central government allocated budgets, state-run development bank guarantee loans and private bank investment; and, the appropriation scheme. In addition, it may be necessary to prioritize equipment procurement schedule to ease financial burden. Equipment procurement can be implemented in a multiple-phase approach. First phase is to purchase essential equipment such as portable monitoring equipment and personal monitors for emergency response team and radiological laboratory equipment for measurement, and collection containers and transportation vehicles. Radioactive waste handling and treatment can be purchased in the following phases since the new facility has been constructed and in operation and provides ample space for temporary storage. This task is estimated to take two weeks to complete.

3. Submit for approval and allocate funds. The plan will be submitted to the Tianjin Municipal Government, and then Central Government for review and approval. Once the plan is approved, the government will provide instructions on fund allocation – either from Central Government annual budget or state-run development bank guarantee loans, or in some cases, private bank investments. It is expected that the governmental approval process will take at least three months to complete.

4. Prepare bidding document. In fact, the preparation of bidding documents, including technical specifications, contract requirements and bidder qualifications, can be started simultaneously with the development of budget scheme and procurement priority as described in Task 2. This will save the time required for implementation. Details of candidate U.S. equipment vendors are listed in the previous sections, including monitoring/measurement and treatment equipment vendors. It is expected that the majority of monitoring/measurement and treatment equipment will be purchase from U.S. suppliers, except for transportation vehicles which could be purchased locally. The preparation of bidding document is expected to take two and half months to complete.

5. Announce international and local tenders. Once the tender paperwork is prepared and funds are allocated. The bidding process then can begin. The announcement of tender will follow local and central government international and local tender procedures. The announcement time is estimated to be two weeks.

6. Receive and review proposals. After tender announcement, the bidders will submit their proposals in response to the bidding requirements. One month time is allocated for reviewing and selecting qualified vendors. The proposed equipment and technical specifications as described in the bidder's proposal will be carefully cross checked with the technical specification as listed in the tender document. Bidder's qualification such as relevant experience, equipment provided and cost information will be taken into consideration during the selection process. If necessary, references will be requested and contacted to verify the validity.

7. Select qualified vendor and contract negotiation. As soon as qualified vendors are selected. Contract negotiation will begin to negotiate best offer in price quoted, to verify deliverables and delivery and installation schedule. Also, acceptance criteria

and procedures, and training will be discussed and finalized, and then the contract is awarded and signed. It is expected to take one month to complete this task.

8. Deliver and install equipment, test run and final acceptance. Depending on types of equipment or machinery, the delivery, installation, trial run and acceptance test may vary widely. Therefore, the time allocated for this task is estimated for fifteen months. This includes technical training of technical staff to use and operate various equipments purchased.

9. Project close-out. It is expected to close out the project in approximately two year period and all accounts payable are paid in full.

10. Warranty. As soon as the equipment is accepted and the warranty period will begin. Depending on types of equipment, warranty period can range from one year to several years. This will also mark the beginning of operation and maintenance phase of the facility.

7.0 OTHER ISSUES

Two technical issues were discussed briefly during initial data collection activity, although these issues are beyond the scope of this feasibility study. A brief discussion of these two issues is presented below.

7.1 Electric and Magnetic Field Experience in US

Electric and magnetic field (EMF) can be produced through the generation, transmission, and use of electric power. Naturally, it raises concern about potential human health impact from exposure to EMF. EMF exposure exists in the home and workplace as a result of the use of all types of electrical equipment and building wirings, and nearby power transmission lines. Unfortunately, health effect of EMF is not very straightforward. Electric field strength is measured in volts per meter (V/m) or kilovolts per meter (kV/m). Magnetic field intensity is measured in units of gauss (G) or tesla (T). One tesla equals to 10,000 gauss.

In 1992, US Congress authorized the Electric and Magnetic Fields Research and Public Information Dissemination Program (EMFRAPID) under the Energy Policy Act. The Congress instructed the National Institution of Environmental Health Sciences (NIEHS) of the National Institute of Health (NIH) and the DOE to direct and manage a program of research and analysis aimed at providing scientific evidence to determine whether exposure to extremely low frequency EMF (ELF-EMF) is a potential risk to human health. The participants include federal agencies such as NIEHS, DOE, DOD, DOT, EPA, Federal Energy Regulatory Commission, National Institute of Standards and Technology (NIST), OSHA and Rural Electrification Administration, and, non-governmental organizations such as Edison Electric Institute, American Public Power Association, National Rural Electrical Cooperative Association, National Electrical Manufacturers Association, National Association of Realtors, Empire States Electric Energy Research Company and Electric Power Research Institute. A final report was prepared by NIEHS/DOE in 1999 after six years of study. This study had three components: health effect research, information compilation and public outreach, and health assessment. The study concluded that scientific evidence suggesting that ELF-EMF exposures pose any health risk is weak. However, epidemiological studies demonstrate a fairly consistent pattern of a small, increased risk with increasing exposure. On the contrary, the

mechanistic studies and the animal toxicology literature fail to demonstrate any consistent pattern across studies although sporadic findings of biological effect have been reported. Therefore, NIEHS concluded that ELF-EMF exposure cannot be recognized as entirely safe because of weak scientific evidence that exposure may pose a childhood leukemia hazard. As a result, NIEHS' recommendation is that the conclusion of this report is insufficient to warrant aggressive regulatory concern. Nevertheless, NIEHS recommends that passive regulatory action is needed such as a continued emphasis on educating the public and the regulated community (i.e., power plants, electrical appliance manufacturers) on means aiming at reducing EMF exposure, for example, utility to locate a power distribution and transmission lines to reduce public exposure and appliance manufacture to voluntarily design a low EMF product (NIEHS Report on Health Effects from Exposure to Power-line Frequency Electric and Magnetic Fields - Prepared in Response to the 1992 Energy Policy Act, May 1999, NIH Publication No. 99-4493).

At state level, California Department of Health Services (DHS) started a five-year program in 1996 to assess possible EMF public health risk and offer guidance to school administrators and other decision makers. The California Electric and Magnetic Fields Program is a research, education and technical assistance program concerned with the potential health effects of EMF from power lines, appliances and other uses of electricity (http://www.dhs.ca,gov/ps.deodc/ehib/emf/). The study result was similar to the NIEHS' report, because there was no conclusive evidence; therefore, no law was enacted to limit EMF exposure.

In the US, presently there are no federal standards limiting occupational exposure to EMFs. Although there is no mandatory limits of EMF exposure, some states have adopted regulations governing power transmission line-generated magnetic field at the edge of the "rights-of-way" (rights-of-way or ROW is the area immediately surrounding power lines left clear for access for maintenance and repair) because of concern about the risk of electric shock from strong electric fields present in the area. Table 46 lists examples of transmission line EMF standards and guidelines adopted by states for utility "rights-of-way"

Table 46. Transmission Line EMF Standards Adopted by Various States

State	Electric Field		Magnetic Field
	on ROW	Edge of ROW	Edge of ROW
Florida	8 kV/m (for lines of 69-230 kV) 10 kV/m (for 500kV lines)	2 kV/m	150 mG (for lines of 69-230 kV) 200 mG (for 500kV lines) 250 mG (for 500 kV on certain existing ROW)
Minnesota	8 kV/m		
Montana	7 kV/m	1 kV/m	
New Jersey		3 kV/m	
New York	11.8 kV/m 11 kV/m (max. for highway crossing) 7kVM (max. for private road crossing)	1.6 kV/m	200 mG (max load)
Oregon	9 kV/m		
Data source: NIEHS and DOE			

The Department of Education requires minimum distances between new schools and the edge of transmission line rights-of-way. The setback guidelines are: 100 feet for

50-133kV lines, 150 feet for 200-230 kV lines, and 350 feet for 500-550 kV lines. The California Public Utility Commission recommended that the public owned utilities to adopt "no and low cost EMF avoidance measures" in construction of new and upgraded utility projects. This means that 4% of the total project cost is allocated to mitigation measures if these measures will reduce magnetic field strength by at least 15%.

The Federal Communication Commission (FCC) has set radiofrequency radiation exposure limits for FCC-licensees and grantees to protect workers and publics from EMF exposure of radiofrequency transmission and broadcasting towers. These limits are summarized in Table 47.

Table 47. EMF Exposure Limits set by FCC

Basic Restrictions for Time Varying Electric and Magnetic Field up to 300 GHz						
Exposure Category	**Frequency Range**	**Current Density for Head and Trunk (mA/m^2)**	**Whole Body Average SAR (W/kg)**	**Spatial Peak SAR in the Head and Trunk (W/kg)**	**Spatial Peak SAR in Limbs (W/kg)**	**Power Density (W/m^2)**
Occupational	0.3 MHz - 6 GHz	n/a	0.4	8	20	-
General Public	0.3 MHz - 6 GHz	n/a	0.08	1.6	4	-

Reference Levels for Time Varying Electric and Magnetic Field up to 300 GHz					
Exposure Category	**Frequency Range**	**E-Field Strength (kV/m)**	**H-Field Strength (A/m)**	**Equivalent Plane Wave Power Density (W/m^2)**	**Average Time (min)**
Occupational	0.3-3.0 MHz	0.614	1.63	1000	6
	3.0-30 MHz	1.842/f	4.89/f	9000/f*2	6
	30-300 MHz	0.0614	0.163	10	6
	300-1500 MHz	n/a	n/a	f/30	6
	1.5-100 GHz	n/a	n./a	50	6
General Public	0.3-1.34 MHz	0.614	1.63	1000	30
	1.34-30 MHz	0.824/f	2.19/f	1800/f*2	30
	30-300 MHz	0.0275	0.073	2	30
	300-1500 MHz	n/a	n/a	f/150	30
	1.5-100 GHz	n/a	n/a	10	30

SAR: Specific absorption rate. E-field: electric field. H-field: magnetic field. F: frequency in MHz. n/a: not available. Data from FCC-OET Bulletin 65, 1997.

7.2 Coal Ash and Radionuclide Emissions

China has coal reserves of about 126 billion short tons, and potential reserves of as much as 4 trillion short tons. Almost four-fifths of China's coal reserves is moderately low sulfur bituminous coal, with 15% as lignite and 6% as anthracite. Most of the reserves, including almost all of the highest-quality coal, are located in the northeastern part of the country. Due to production of coal in China is less than consumption, China becomes a major coal exporter in the world (http://www.eia.doe.gov/emeu/international/coal.html).

Currently, coal accounts for about two-thirds of China's total domestic energy usage. Coal is responsible for fueling 70-80% of power generation, 75% of energy used in industry, and even 80% of household energy. Although it is expected that coal's share of China's

energy consumption will decline in the coming years, the overall demand for coal is expected to increase by 20 million short tons annually over the next five years. In addition, China plans to increase coal production by about 17% within five years (2001-2005). Much of this coal will be used for generation of electricity. Summary of coal production and consumption in China from 1990 to 2001 is shown in Table 48.

Table 48. Coal Production and Consumption in China, 1990-2001 (in millions of short tons)

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Production	1,190.4	1,198.7	1,228.6	1,303.5	1,403.5	1,537.0	1,545.3	1,507.1	1,429.0	1,364.9	1,314.4	1,459.0
Anthracite	234.6	239.8	243.6	251.0	270.5	296.9	321.2	274.7	267.0	237.8	236.6	262.6
Bituminous	905.6	909.5	932.9	989.3	1,066.0	1,169.9	1,162.7	1,167.4	1,102.8	1,067.6	1,025.3	1,138.0
Lignite	50.2	49.4	52.1	63.2	67.0	70.2	61.3	65.0	59.3	59.6	52.6	58.4
Consumption	1,124.1	1,164.9	1,199.5	1,275.6	1,389.8	1,497.5	1,516.7	1,450.4	1,392.0	1,342.7	1,282.3	1,382.6
(Data are adapted from USDOE/EIA)												

Coal use for electricity generation in China is projected to grow by 4.1 percent a year, from 10.7 quadrillion Btu in 2001 to 28.2 quadrillion Btu in 2025. At the beginning of 2001, China had 232 GW (gigawatts) of coal-fired generating capacity, and additional 171 GW of coal-fired capacity is projected by 2025.

Since all fossil fuels, including coal, contain trace amount of naturally occurring radionuclides - primarily ^{238}U, ^{232}Th, ^{40}K and their decay products ^{220}Rd and ^{222}Rd - in the mineral deposits. During the combustion, radionuclides are entrained or concentrated in fly or bottom ash of a combustor. If fly ash not captured by pollution control device, it is emitted as particulates into the atmospheric environment. Gaseous radionuclides (I.e., radon) are also emitted into the atmosphere. The quantities of naturally occurring radionuclides vary depending on types of fuel and its geographic location. However, coal typically contains the greatest total quantity per unit mass (http://www.epa.gov/radiation/tenorm/sources.htm). Table 49 shows various radiation levels of coal ash.

Table 49. Coal Ash and Radiation Level in the US

Coal Ash	Radiation Level [pCi/g]		
	low	average	high
Bottom Ash	1.6	3.5-4.6	7.7
Fly Ash	2	5.8	9.7
Data are adapted from USEPA radiation.			

The result of a DOE's study of radionuclide emissions from coal-fired power plant showed that the detectable radionuclide activity level in feed coal ranged from 0.02 to 7.3 pCi/g. Average emission factors on a mass basis ranged from $3.9*10^{9}$ lb/10^{12} Btu for ^{210}Po

to 312 lb/10^{12} Btu for ^{238}U. Most of the other radionuclides had average emission factors ranged from 10^4 to 10^7 lb/10^{12} Btu. Average emission factors on an activity basis for the reported radionuclides ranged from $1.4*10^8$ pCi/10^{12} Btu for ^{226}Ra, to $7.2*10^{10}$ pCi/10^{12} Btu for ^{210}Pb. Most of the average emission factors on an activity basis were in the range of 10^8 to 10^9 pCi/10^{12} Btu (USDOE: A Comprehensive Assessment of Toxic Emissions from Coal-Fired Power Plans: Phase I Results from the US DOE Study, September 1996).

Considering China's energy demand is heavily relying on coal combustion and the amount of coal consumed each year, this could result in a significant amount of radionuclide emissions. In addition to direct emission, coal fly ash has been used for construction materials in building structures and roads and highways. It is recommended that research programs be established to assess potential hazards to human exposure and environmental hazard by radionuclide emission from coal combustion and in construction material.

APPENDIX A

ECONOMIC ANALYSES

- FACILITY CONSTRUCTION AND ANNUALIZED COST
- CAPITAL AND ANNUALIZED COSTS FOR TRANSPORT VEHICLES, COLLECTION CONTAINERS AND CONSUMABLES
- CAPITAL COSTS FOR LABORATORY AND FIELD MEASUREMENT EQUIPMENT
- CAPITAL COSTS OF PRIMARY AND AUXILIARY EQUIPMENT FOR MECHANICAL TREATMENT (FORMULA)
- CAPITAL COSTS OF PRIMARY AND AUXILIARY EQUIPMENT FOR MECHANICAL TREATMENT (CALCULATIONS)
- CAPITAL COSTS OF PRIMARY AND AUXILIARY EQUIPMENT FOR THERMAL TREATMENT (FORMULA)
- CAPITAL COSTS OF PRIMARY AND AUXILIARY EQUIPMENT FOR THERMAL TREATMENT (CALCULATIONS)
- ANNUAL COSTS OF PYROLYSIS UNIT AND AUXILIARY EQUIPMENT (FORMULA)
- ANNUAL COSTS OF PYROLYSIS UNIT AND AUXILIARY EQUIPMENT (CALCULATIONS)
- ANNUAL COSTS OF FINAL ASH AND RESIDUE WASTE DISPOSAL
- INVESTMENT SUMMARY
- DEPRECIATION SCHEDULE
- ANNUAL COST ANALYSIS
- RADIOACTIVE WASTE AND SOURCE GROWTH PROJECTION
- REVENUE PROJECTION
- INCOME STATEMENT
- PROJECT BALANCE SHEET
- CASH FLOW ANALYSIS AND INTERNAL RATE OF RETURN
- STATEMENT OF CASH FLOW ANALYSIS

Facility Construction and Annualized Cost

Tianjin Civilian Radioactive Waste Storage Facility
Capital Equipment

Cost Item		
Direct Cost	(in $US, 1$US=8.27RMB)	Cost (in $)
	Facility Construction	906,892
	Engineering Design	60,459
	Construction Supervision	12,092
	Land	Provided by the city
	Radiation Monitoring	2,000
	Total Facility Cost	981,444
	Annualized Costs (labor, maintenance, monitoring and evaluation)	36,276
Service Life	30 years	

(Note: Data from averaging facility construction costs provided by TJEPB)

Capital and Annualized Costs for Transport Vehicles, Collection Containers and Consumables

Cost Item			Vehicles	Containers
Direct Cost	(in $US, 1$US=8.27RMB)			
	Purchased Equipment (PE)	Unit Price	36,276	5
		Units Required	15	1,000
		Purchased Equipment	544,135	5,000
		Total Purchased Equipment	549,135	
		Annualized Costs		
		Operator	54,414	
		Decontamination	28,295	
		Fuels	22,636	
		Maintenance (10% of PE)	54,914	
		Overhead	96,155	
		Insurance and Tax	30,127	126,282
		Total Annualized Costs	286,541	

Service Life 10 years

Decontamination Cost

15 vehicles*[(RMB100/vehicle)/8.27]*52 wks/yr*3 times/wk

Fuel Cost:

{[(15 vehicles*200km/day*52wks/yr*3days/wk)/10km/liter]*RMB4/liter}/8.27

Capital Costs for Laboratory and Field Monitoring Equipment

Cost Item		Radiation Laboratory		Radiation Monitoring		Environmental Monitoring		Emergency Response		Total
Direct Cost (in $US)	Unit Cost (in $)	Unit Required	Cost	Unit Required	Cost	Unit Required	Cost	Unit Required	Cost	
Gamma Spectroscopy System, including PC and Software	200,000	1	200,000			1	200000			400,000
Portable Gamma Spectroscopy System	100,000							1	100000	100,000
Alpha, Beta and Gamma Swipe Counter	75,000	1	75,000	2	150000	2	150000			375,000
Beta and Gamma Detector	25,000	1	25,000	1	25000			1	25000	75,000
Alpha Detector	25,000	1	25,000					1	25000	50,000
Radiation Monitor	10,000			1	10000	1	10000	1	10000	30000
Air Sampler	5,000			1	5000	1	5000	1	5000	15000
TLDs	100					1	100			100
Subtotal Equipment Cost			325,000		190,000		365,100		165,000	1,045,100
Total Equipment Cost	1,045,100									
Labor		2	7,255	2	7,255	2	7,255	2	7,255	29,021
Maintenance (10% of Equipment/year)			32,500		19,000		36,510		16,500	104,510
Overhead			23,853		15,753		26,259		14,253	80,118
Insurance, Tax			14,088		8,688		15,692		7,688	46,157
Annualized Costs (labor and maintenance)			77,696		50,696		85,716		45,696	259,806
Total Annualized Costs	259,806									

Service Life 10 years

Capital Costs of Primary and Auxiliary Equipment for Thermal Treatment (Formula)

Tianjin Civilian Radioactive Waste Storage Facility
Capital and Auxiliary Equipment
Thermal Treatment

Cost Item			Pyrolysis
Direct Cost			
	Site Preparation		As required
	Facilities, buildings		As required
	Purchased Equipment (PE)		
		Treatment Device + Auxiliary Equipment (Wet Quench, Pack Column Scrubber, Sub-cooling Section, Wet Electrostatic Precipitator, Activated Carbon Column, and Induced Draft Blower)	X
		Taxes	0.03*X
		Freight	0.05*X
		Total PE	1.08*X
	Installation		Y
		Total Installation	Y

Service Life 10 years

(Data Source:Honua Technologies Preliminary Proposal)

Capital Costs of Primary and Auxiliary Equipment of Mechnical Treatment
(Calculations)

Mechanical Treatment Cost Item			Compactor	Crusher
Specifications			($2m^3$/hr, 100 tons pressure, 10:1 volume red. ratio)	(40 kg/hr)
Direct Cost				
	Site Preparation		As required	As required
	Facilities, buildings		As required	As required
	Purchased Equipment (PE)			
		Equipment	350,000	50,000
		Taxes	10,500	1,500
		Freight	17,500	2,500
		Total PE	378,000	54,000
	Installation		35,000	5,000
		Total Installation	35,000	5,000
	Total Capital Investment		413,000	59,000
	Annualized Costs			
		Labor	3,628	3,628
		Maintenance (10% of Total PE/year)	37,800	5,400
		Overhead	24,857	5,417
		Insurance, Tax	17,064	2,904
	Total Annualized Costs	(labor and maintenar	83,348	17,348
Service Life	10 years			

Capital Costs of Primary and Auxiliary Equipment for Thermal Treatment (Calculations)

Thermal Treatment			
Cost Item			**Pyrolysis Unit**
Direct Cost			
	Site Preparation		As required
	Facilities, buildings		As required
	Purchased Equipment (PE)		
		Treatment Device + Auxiliary Equipment (Wet Quench, Pack Column Scrubber, Sub-cooling Section, Wet Electrostatic Precipitator, Activated Carbon Column, and Induced Draft Blower)	975,000
		Taxes	29,250
		Freight	48,750
		Total PE	1,053,000
	Installation		55,000
		Total Installation	55,000
	Total Capital Investment		1,108,000
Service Life	10 years		
(Data Source:Honua Technologies Preliminary Proposal)			

Annual Costs of Pyrolysis Unit and Auxiliary Equipment (Formula)

Tianjin Civilian Radioactive Waste Storage Facility
Annual Cost

Cost Item	Pyrolysis Unit
Direct Cost, DC	
Operating labor	Operator 8 hours per shift, 2 shifts per day, 3 operators
Supervisor labor	15% of total operator
Operating materials	Application specific
Maintenance labor	Labor 1 to 2 hours per shift
Maintenance material	100% maintenance labor
Cost for Fuel, Utilities, Chemicals, Activated Carbon, etc.	(consumption rate/hr*unit cost*365*24)
Indirect Annual Costs, IC	
Administrative charges	2% of Total Capital Investment
Property tax	1% of Total Capital Investment
Insurance	1% of Total Capital Investment
Overhead	60% of total labor and material costs
Total Annual Cost DC + IC	

(Data Source:Honua Technologies Preliminary Proposal)

Annual Costs of Pyrolysis Unit and Auxiliary Equipment (Calculations)

nual Cost (based on 3 days/week operation schedule)
Thermal Treatment

Cost Item		Pyrolysis Unit
Direct Cost, DC		
	Operating labor	21,765
	Supervisor labor	3,265
	Operating materials	3,265
	Maintenance labor	907
	Maintenance material	907
	Cost for Fuel, Utilities, Chemicals, Activated Carbon, etc.	107,360

Indirect Annual Costs, IC		
	Administrative charges	22,160
	Property tax	11,080
	Insurance	11,080
	Overhead	664,800

Total Annual Cost DC + IC	846,589

(Data Source:Honua Technologies Preliminary Proposal)

Annual Cost	Formula	$
Activated carbon	1 kg-hr*52 wk-yr*3 days-wk*24 hr-day*$1/kg	3,744
Sodium Bicarbonate or Sodium Hydroxide	5 kg-hr*52 wk-yr*3 days-wk*24 hr-day*$0.5/kg	9,360
Fuel	{[(540000 kcal-hr*52 wks*3 day-wk*24 hr-day)*3.96832 Btu/kcal]/1031Btu-cf/35.3cf-m^3}*RMB2.5-m^3/8.27	66,640
Electricity	100kw-hr*($0.61/8.27)*52*3*24	27,616
Subtotal		107,360

Annual Costs of Final Ash and Residue Waste Disposal

Final Waste Disposal (on-site ash and residue disposal)

Cost Item			
Direct Cost	(in $US, 1$US=8.27RMB)		
	Waste ash disposal fee (landfill)	Unit Price (cubic meter)	300
	Annualized Costs		18,158
			60.53

(Data source: TJEPB)

Annual ash volume: [(Waste volume in m^3/yr) * (1-0.90) or 90% volume reduction]

2 loads-day*1.94m^3-load*52weeks-yr*3 run-week*(1-0.9)

Investment Summary

Tianjin Radioactive Waste Facility

(In $1,000 USD)

Investment Item	Value
Facility	981.44
Collection & Transportation	549.14
Laboratory & Field Equipment	1,045.10
Mechanical Equipment	472.00
Thermal Treatment Equipment	1,108.00
Capitalized Interest	126.05
Total Investment	4,281.73

(In $1,000 USD)

Investment Item	Value	Interst Allocation	Total
Facility	981.44	29.77	1,011.21
Collection & Transportation	549.14	16.66	565.79
Laboratory & Field Equipment	1,045.10	31.70	1,076.80
Mechanical Equipment	472.00	14.32	486.32
Thermal Treatment Equipment	1,108.00	33.61	1,141.61
Capitalized Interest	126.05		
Total Investment	4,281.73	126.05	4,281.73

Depreciation Schedule

Tianjin Radioactive Waste Facility

(In $1,000 USD)

	Item	Life Span	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20	
	Year		2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	
1	Facility																						
	Acquistion Cost	30	981.44	981.44	981.44	981.44	981.44	981.44	981.44	981.44	981.44	981.44	981.44	981.44	981.44	981.44	981.44	981.44	981.44	981.44	981.44	981.44	
	Capitalized Interest		29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	
	Replacement & Improvement																						
	Facility Subtotal:		1,011.21	1,011.21	1,011.21	1,011.21	1,011.21	1,011.21	1,011.21	1,011.21	1,011.21	1,011.21	1,011.21	1,011.21	1,011.21	1,011.21	1,011.21	1,011.21	1,011.21	1,011.21	1,011.21	1,011.21	
	Straight Line Depreciation																						
	Depreciation - Acqusition Cost		29.44	29.44	29.44	29.44	29.44	29.44	29.44	29.44	29.44	29.44	29.44	29.44	29.44	29.44	29.44	29.44	29.44	29.44	29.44	29.44	
	Depreciation - Capitalized Interest		0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	
	Depreciation - Replacement & Improvement																						
	Depreciation Subtotal		30.34	30.34	30.34	30.34	30.34	30.34	30.34	30.34	30.34	30.34	30.34	30.34	30.34	30.34	30.34	30.34	30.34	30.34	30.34	30.34	
	Net Book Value - Facility		980.88	950.54	920.20	889.87	859.53	829.20	798.86	768.52	738.19	707.85	677.51	647.18	616.84	586.50	556.17	525.83	495.49	465.16	434.82	404.49	
2	Collection & Transportation																						
	Acquistion Cost	10	549.14	549.14	549.14	549.14	549.14	549.14	549.14	549.14	549.14	549.14											
	Capitalized Interest		16.66	16.66	16.66	16.66	16.66	16.66	16.66	16.66	16.66	16.66											
	Replacement & Improvement												737.99	737.99	737.99	737.99	737.99	737.99	737.99	737.99	737.99	737.99	
	Equipment Subtotal:		565.79	565.79	565.79	565.79	565.79	565.79	565.79	565.79	565.79	565.79	737.99	737.99	737.99	737.99	737.99	737.99	737.99	737.99	737.99	737.99	
	Straight Line Depreciation																						
	Depreciation - Acqusition Cost		49.42	49.42	49.42	49.42	49.42	49.42	49.42	49.42	49.42	49.42											
	Depreciation - Capitalized Interest		1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50											
	Depreciation - Replacement & Improvement												66.42	66.42	66.42	66.42	66.42	66.42	66.42	66.42	66.42	66.42	
	Depreciation Subtotal		50.92	50.92	50.92	50.92	50.92	50.92	50.92	50.92	50.92	50.92	66.42	66.42	66.42	66.42	66.42	66.42	66.42	66.42	66.42	66.42	
	Net Book Value - Equipment		514.87	463.95	413.03	362.11	311.19	260.26	209.34	158.42	107.50	56.58	671.57	605.16	538.74	472.32	405.90	339.48	273.06	206.64	140.22	73.80	56.58
3	Laboratory & Field Equipment																						
	Acquistion Cost	10	1,045.10	1,045.10	1,045.10	1,045.10	1,045.10	1,045.10	1,045.10	1,045.10	1,045.10	1,045.10											
	Capitalized Interest		31.70	31.70	31.70	31.70	31.70	31.70	31.70	31.70	31.70	31.70											
	Replacement & Improvement												1,404.53	1,404.53	1,404.53	1,404.53	1,404.53	1,404.53	1,404.53	1,404.53	1,404.53	1,404.53	
	Vehicle Subtotal:		1,076.80	1,076.80	1,076.80	1,076.80	1,076.80	1,076.80	1,076.80	1,076.80	1,076.80	1,076.80	1,404.53	1,404.53	1,404.53	1,404.53	1,404.53	1,404.53	1,404.53	1,404.53	1,404.53	1,404.53	
	Straight Line Depreciation																						
	Depreciation - Acqusition Cost		94.06	94.06	94.06	94.06	94.06	94.06	94.06	94.06	94.06	94.06											
	Depreciation - Capitalized Interest		2.85	2.85	2.85	2.85	2.85	2.85	2.85	2.85	2.85	2.85											
	Depreciation - Replacement & Improvement												126.41	126.41	126.41	126.41	126.41	126.41	126.41	126.41	126.41	126.41	
	Depreciation Subtotal		96.91	96.91	96.91	96.91	96.91	96.91	96.91	96.91	96.91	96.91	126.41	126.41	126.41	126.41	126.41	126.41	126.41	126.41	126.41	126.41	
	Net Book Value - Vehicle		979.89	882.98	786.06	689.15	592.24	495.33	398.42	301.50	204.59	107.68	1,278.12	1,151.72	1,025.31	898.90	772.49	646.08	519.68	393.27	266.86	140.45	107.68
4	Mechanical Treatment Equipment	10																					
	Acquistion Cost		472.00	472.00	472.00	472.00	472.00	472.00	472.00	472.00	472.00	472.00											
	Capitalized Interest		14.32	14.32	14.32	14.32	14.32	14.32	14.32	14.32	14.32	14.32											

Depreciation Schedule

Tianjin Radioactive Waste Facility

(In $1,000 USD)

	Item	Life Span	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20	
	Year		2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	
	Replacement & Improvement												634.33	634.33	634.33	634.33	634.33	634.33	634.33	634.33	634.33	634.33	
	Container Subtotal:		486.32	486.32	486.32	486.32	486.32	486.32	486.32	486.32	486.32	486.32	634.33	634.33	634.33	634.33	634.33	634.33	634.33	634.33	634.33	634.33	
	Straight Line Depreciation																						
	Depreciation - Acqusition Cost		42.48	42.48	42.48	42.48	42.48	42.48	42.48	42.48	42.48	42.48											
	Depreciation - Capitalized Interest		1.29	1.29	1.29	1.29	1.29	1.29	1.29	1.29	1.29	1.29											
	Depreciation - Replacement & Improvement												57.09	57.09	57.09	57.09	57.09	57.09	57.09	57.09	57.09	57.09	
	Depreciation Subtotal		43.77	43.77	43.77	43.77	43.77	43.77	43.77	43.77	43.77	43.77	57.09	57.09	57.09	57.09	57.09	57.09	57.09	57.09	57.09	57.09	
	Net Book Value - Container		442.55	398.78	355.01	311.24	267.47	223.71	179.94	136.17	92.40	48.63	577.24	520.15	463.06	405.97	348.88	291.79	234.70	177.61	120.52	63.43	48.63
5	Thermal Treatment Equipment																						
	Acquistion Cost	10	1,108.00	1,108.00	1,108.00	1,108.00	1,108.00	1,108.00	1,108.00	1,108.00	1,108.00	1,108.00											
	Capitalized Interest		33.61	33.61	33.61	33.61	33.61	33.61	33.61	33.61	33.61	33.61											
	Replacement & Improvement												1,489.06	1,489.06	1,489.06	1,489.06	1,489.06	1,489.06	1,489.06	1,489.06	1,489.06	1,489.06	
	Plant Subtotal:		1,141.61	1,141.61	1,141.61	1,141.61	1,141.61	1,141.61	1,141.61	1,141.61	1,141.61	1,141.61	1,489.06	1,489.06	1,489.06	1,489.06	1,489.06	1,489.06	1,489.06	1,489.06	1,489.06	1,489.06	
	Straight Line Depreciation																						
	Depreciation - Acqusition Cost		99.72	99.72	99.72	99.72	99.72	99.72	99.72	99.72	99.72	99.72											
	Depreciation - Capitalized Interest		3.02	3.02	3.02	3.02	3.02	3.02	3.02	3.02	3.02	3.02											
	Depreciation - Replacement & Improvement												134.02	134.02	134.02	134.02	134.02	134.02	134.02	134.02	134.02	134.02	
	Depreciation Subtotal		102.74	102.74	102.74	102.74	102.74	102.74	102.74	102.74	102.74	102.74	134.02	134.02	134.02	134.02	134.02	134.02	134.02	134.02	134.02	134.02	
	Net Book Value - Plant		1,038.86	936.12	833.37	730.63	627.89	525.14	422.40	319.65	216.91	114.16	1,355.05	1,221.03	1,087.02	953.00	818.98	684.97	550.95	416.94	282.92	148.91	114.16
	Total Cost		4,281.73	4,281.73	4,281.73	4,281.73	4,281.73	4,281.73	4,281.73	4,281.73	4,281.73	4,281.73	5,277.13	5,277.13	5,277.13	5,277.13	5,277.13	5,277.13	5,277.13	5,277.13	5,277.13	5,277.13	
	Total Depreciation		324.68	324.68	324.68	324.68	324.68	324.68	324.68	324.68	324.68	324.68	414.27	414.27	414.27	414.27	414.27	414.27	414.27	414.27	414.27	414.27	
	Total Net Book Value		3,957.05	3,632.37	3,307.68	2,983.00	2,658.32	2,333.63	2,008.95	1,684.27	1,359.59	1,034.90	4,559.50	4,145.23	3,730.96	3,316.69	2,902.42	2,488.15	2,073.88	1,659.62	1,245.35	831.08	327.052
													4,265.92										1,034.90
																							707.85

Note

1 Residual value for fixed assets: 10%

2 Depreciation formula: Capital investment * 90% / Life Span. Straightline Depreciation

3 Life span: An asset's servie life

4 For assets with 10-year life span, new set of equipments is required at 11th year, and cost include 3% annual inflate rate based on 2005 equipment value

5 Capitalized Interest is charge on bank loan at 6.5% annual interest rate during 8-month construction period

6 Loan: $3035.03E3 (70% of initial investment $4155.68+Capitalized Interest $126.06E3)

7 Capitalized Interest=Principal*Interest Rate*Number of Periods $126.05

8 Loan repayment: 15 Years

Annual Cost Analysis

Tianjin Radioactive Waste Facility

(In $1,000 USD)

	Item	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Total	Per Year
	Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020		
1	Income																	
	Operational Income	2,206.23	2,361.97	2,518.03	2,674.37	2,830.96	2,987.79	3,144.82	3,302.04	3,459.42	3,616.95	3,774.62	3,932.41	4,090.31	4,248.31	4,406.40	47,348.42	3,382.03
	Other Income		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Total Income	2,206.23	2,361.97	2,518.03	2,674.37	2,830.96	2,987.79	3,144.82	3,302.04	3,459.42	3,616.95	3,774.62	3,932.41	4,090.31	4,248.31	4,406.40	49,554.65	3,303.64
2	Cost Analysis																	
	Waste Collection & Transportation Exp																	
	Labor	54.41	56.05	57.73	59.46	61.24	63.08	64.97	66.92	68.93	71.00	73.13	75.32	77.58	79.91	82.31	1,012.03	67.47
	Fules	22.64	23.32	24.01	24.74	25.48	26.24	27.03	27.84	28.67	29.53	30.42	31.33	32.27	33.24	34.24	421.01	28.07
	Decontamination	28.30	29.14	30.02	30.92	31.85	32.80	33.79	34.80	35.84	36.92	38.03	39.17	40.34	41.55	42.80	526.26	35.08
	Collection & Transportation Subtotal:	105.34	108.50	111.76	115.11	118.57	122.12	125.79	129.56	133.45	137.45	141.57	145.82	150.20	154.70	159.34	1,959.30	130.62
	Thermal Treatment																	
	Labor	25.03	25.78	26.55	27.35	28.17	29.02	29.89	30.78	31.71	32.66	33.64	34.65	35.69	36.76	37.86	465.54	31.04
	Material	3.26	3.36	3.46	3.57	3.67	3.78	3.90	4.02	4.14	4.26	4.39	4.52	4.65	4.79	4.94	60.72	4.05
	Utility	27.62	28.44	29.30	30.18	31.08	32.01	32.97	33.96	34.98	36.03	37.11	38.23	39.37	40.55	41.77	513.63	34.24
	Fuel, Chemicals etc	79.74	82.14	84.60	87.14	89.75	92.45	95.22	98.08	101.02	104.05	107.17	110.38	113.70	117.11	120.62	1,483.16	98.88
	Thermal Treatment Subtotal:	135.66	139.73	143.92	148.23	152.68	157.26	161.98	166.84	171.84	177.00	182.31	187.78	193.41	199.21	205.19	2,523.04	168.20
	Mechanical Treatment Labor	7.26	7.47	7.70	7.93	8.17	8.41	8.66	8.92	9.19	9.47	9.75	10.04	10.34	10.65	10.97	134.94	9.00
	Lab & Field labor	29.02	29.89	30.79	31.71	32.66	33.64	34.65	35.69	36.76	37.87	39.00	40.17	41.38	42.62	43.90	539.75	35.98
	Final Disposal Expense	18.16	18.70	19.26	19.84	20.44	21.05	21.68	22.33	23.00	23.69	24.40	25.14	25.89	26.67	27.47	337.73	22.52
	Operating & Maint. Expense																	
	Fixed Expense																	
	Thermal Equipment Insurance	11.08	11.41	11.75	12.11	12.47	12.84	13.23	13.63	14.04	14.46	14.89	15.34	15.80	16.27	16.76	206.08	13.74
	Thermal Equipment Property Tax	11.08	11.41	11.75	12.11	12.47	12.84	13.23	13.63	14.04	14.46	14.89	15.34	15.80	16.27	16.76	206.08	13.74
	Facility Maint.	36.28	37.36	38.48	39.64	40.83	42.05	43.32	44.61	45.95	47.33	48.75	50.21	51.72	53.27	54.87	674.69	44.98
	Vehicle Insurance & Registration Fee	30.13	31.03	31.96	32.92	33.91	34.93	35.97	37.05	38.16	39.31	40.49	41.70	42.95	44.24	45.57	560.34	37.36
	Mechanical Treatment Insurance & Tax	19.97	20.57	21.18	21.82	22.47	23.15	23.84	24.56	25.30	26.05	26.84	27.64	28.47	29.32	30.20	371.39	24.76
	Lab & Field Equipment Insurance & Tax	46.16	47.54	48.97	50.44	51.95	53.51	55.11	56.77	58.47	60.22	62.03	63.89	65.81	67.78	69.82	858.47	57.23
	Depreciation Expense	324.68	324.68	324.68	324.68	324.68	324.68	324.68	324.68	324.68	324.68	414.27	414.27	414.27	414.27	414.27	5,318.18	354.55
	Variable Expense																	
	Thermal Equipment Maint. Labor	0.91	0.93	0.96	0.99	1.02	1.05	1.08	1.12	1.15	1.18	1.22	1.26	1.29	1.33	1.37	16.87	1.12
	Thermal Equipment Maint. Material	0.91	0.93	0.96	0.99	1.02	1.05	1.08	1.12	1.15	1.18	1.22	1.26	1.29	1.33	1.37	16.87	1.12
	Other Thermal Treatment Overhead	664.80	684.74	705.29	726.44	748.24	770.69	793.81	817.62	842.15	867.41	893.44	920.24	947.85	976.28	1,005.57	12,364.56	824.30
	Vehicle Maintenance	54.91	56.56	58.26	60.01	61.81	63.66	65.57	67.54	69.56	71.65	73.80	76.01	78.29	80.64	83.06	1,021.33	68.09
	Other Vehicle Operation Overhead	96.15	99.04	102.01	105.07	108.22	111.47	114.81	118.26	121.81	125.46	129.22	133.10	137.09	141.21	145.44	1,788.38	119.23
	Mechanical Treatment Equipment Maint.	43.20	44.50	45.83	47.21	48.62	50.08	51.58	53.13	54.72	56.37	58.06	59.80	61.59	63.44	65.34	803.47	53.56
	Other Mechanical Treatment Overhead	30.27	31.18	32.12	33.08	34.07	35.09	36.15	37.23	38.35	39.50	40.68	41.91	43.16	44.46	45.79	563.05	37.54
	Lab & Field Equipment Maint.	104.51	107.65	110.87	114.20	117.63	121.16	124.79	128.53	132.39	136.36	140.45	144.67	149.01	153.48	158.08	1,943.77	129.58
	Other Labor & Field Overhead	80.12	82.52	85.00	87.55	90.17	92.88	95.67	98.54	101.49	104.54	107.67	110.90	114.23	117.66	121.19	1,490.11	99.34
	Tax and Licenses	123.05	131.74	140.44	149.16	157.90	166.64	175.40	184.17	192.95	201.74	210.53	219.33	228.14	236.95	245.77	2,763.91	184.26
	(Gain)/Loss on disposal of Fixed Assets.											327.05						
	Overhead Subtotal	1,678.21	1,723.81	1,770.53	1,818.42	1,867.49	1,917.78	1,969.33	2,022.18	2,076.36	2,131.91	2,605.50	2,336.86	2,396.77	2,458.21	2,521.24		
	General Administrative Expense	22.16	22.82	23.51	24.21	24.94	25.69	26.46	27.25	28.07	28.91	29.78	30.67	31.59	32.54	33.52	412.15	27.48
	Operating & Maint. Expense Subtotal:	1,700.37	1,746.63	1,794.04	1,842.63	1,892.43	1,943.47	1,995.79	2,049.43	2,104.43	2,160.82	2,635.28	2,367.54	2,428.36	2,490.75	2,554.75	31,706.74	2,113.78

Annual Cost Analysis

Tianjin Radioactive Waste Facility

(In $1,000 USD)

	Item	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Total	Per Year
	Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020		
	Other Expense																	
	Interest Expense	190.78	181.03	171.28	158.28	145.28	129.03	112.78	96.53	80.28	67.28	54.28	38.03	21.78	5.53	0.00	1,452.13	96.81
3	Total Annual O&M Expense	2,186.58	2,231.96	2,278.75	2,323.74	2,370.22	2,414.99	2,461.33	2,509.31	2,558.95	2,613.57	3,086.60	2,814.51	2,871.36	2,930.13	3,001.63	38,653.62	2,576.91
	Income Before Tax	19.65	130.01	239.28	350.63	460.75	572.80	683.49	792.73	900.47	1,003.38	688.03	1,117.90	1,218.96	1,318.18	1,404.78	10,901.03	726.74
	Income Tax	6.48	42.90	78.96	115.71	152.05	189.02	225.55	261.60	297.15	331.12	227.05	368.91	402.26	435.00	463.58	3,597.34	239.82
4	Net Income	13.17	87.11	160.32	234.92	308.70	383.78	457.93	531.13	603.31	672.27	460.98	748.99	816.70	883.18	941.20	7,303.69	486.91
	Profitability	1%	4%	6%	9%	11%	13%	15%	16%	17%	19%	12%	19%	20%	21%	21%		11%
5	Principal Repayment	100.00	150.00	150.00	200.00	200.00	250.00	250.00	250.00	250.00	200.00	200.00	250.00	250.00	250.00	85.03	3,035.03	202.34
6	Interest Payment	190.78	181.03	171.28	158.28	145.28	129.03	112.78	96.53	80.28	67.28	54.28	38.03	21.78	5.53	0.00	1,452.13	96.81
7	Principal Balance at beginning of the year	3,035.03	2,935.03	2,785.03	2,635.03	2,435.03	2,235.03	1,985.03	1,735.03	1,485.03	1,235.03	1,035.03	835.03	585.03	335.03	85.03	25,375.45	1,691.70
8	Principal Balance at the end of the year	2,935.03	2,785.03	2,635.03	2,435.03	2,235.03	1,985.03	1,735.03	1,485.03	1,235.03	1,035.03	835.03	585.03	335.03	85.03	0.00		
9	Fixed Expense	479.37	484.01	488.79	493.72	498.79	504.01	509.39	514.93	520.64	526.52	622.16	628.39	634.82	641.43	648.25	8,195.22	546.35
10	Variable Expense	1,707.21	1,747.94	1,789.95	1,830.02	1,871.43	1,910.98	1,951.95	1,994.38	2,038.32	2,087.05	2,464.44	2,186.12	2,236.54	2,288.70	2,353.38	30,458.40	2,030.56

Note

1 Sales tax is calculated at 5% of annual income and other value-added tax is estimated at 11.55% of sale tax.
2 Income Tax is estimated at 33% and could be adjusted according to actual.
3 All labors are from local source and labor cost includes fringe benefits.
4 All costs, except depreciation, interest expense, and (gain)/loss on FA disposal, include 3% inflation escalator every year.
5 Loan: $3035.03 (70% of initial investment $4155.68+Capitalized Interest $126.06)
6 Capitalized Interest is charge on bank loan at 6.5% annual interest rate during 8-month construction period
7 Principal & Interest payment can't be determined until revenue is estimated.
8 Loan repayment: 15 Years

Radioactive Waste and Source Growth Projection

Tianjin Civilian Radioactive Waste Generation Data							
Date	Number of Radiation Source	Total Activity (Bq)	Number of Waste Drum	Total Weight (kg)	Ave. Wt./drum (kg)	Ave. Activity/Source (Bq)	Ave. Activity/Drum (Bg)
1992-1993	2	1.11E+08	120	1,323	11	5.55E+07	9.25E+05
1994	5	1.05E+10	68	720	11	2.10E+09	1.54E+08
1995	9	1.92E+11	104	1,040	10	2.13E+10	1.85E+09
1996	27	2.07E+11	72	858	12	7.67E+09	2.88E+09
1997	89	3.48E+11	79	1,185	15	3.91E+09	4.41E+09
1998	112	2.53E+11	121	1,815	15	2.26E+09	2.09E+09
1999	22	4.83E+10	175	2,615	15	2.20E+09	2.76E+08
2000	49	4.88E+10	136	2,040	15	9.96E+08	3.59E+08
2001	45	2.78E+11	183	2,745	15	6.18E+09	1.52E+09
2002	116	6.39E+11	107	1,605	15	5.51E+09	5.97E+09
2003	56	n/a	93	n/a			
Total	532	2.03E+12	1,260	15,946		5.22E+09	1.95E+09

Tianjin Civilian Radioactive Wate Generation Projection			
No. Year	Year	Activity ($Ba*10^{10}$)	Annual Change Activity ($Ba*10^{10}$)
1	1992-1993	0.01	n/a
2	1994	1.05	1.04
3	1995	19.20	18.15
4	1996	20.70	1.50
5	1997	34.80	14.10
6	1998	25.30	-9.50
7	1999	4.83	-20.47
8	2000	4.88	0.05
9	2001	27.80	22.92
10	2002	63.90	36.10
11	2003	57.51	-6.39
12	2004	51.76	-5.75
13	2005	46.58	-5.18
14	2006	41.92	-4.66
15	2007	37.73	-4.19
16	2008	33.96	-3.77
17	2009	30.56	-3.40
18	2010	27.51	-3.06
19	2011	24.76	-2.75
20	2012	22.28	-2.48
21	2013	20.05	-2.23
22	2014	18.05	-2.01
23	2015	16.24	-1.80
24	2016	14.62	-1.62
25	2017	13.16	-1.46
26	2018	11.84	-1.32
27	2019	10.66	-1.18
28	2020	9.59	-1.07

Tianjin Civilian Radioactive Source Use Projection					
No. Year	Year	No. of Source	Annual Change No. of Source	Activity ($Ba*10^{10}$)	Annual Change Activity ($Ba*10^{10}$)
1	1992-1993	2	2	1.11E+08	n/a
2	1994	5	3	1.05E+10	10.4E+9
3	1995	9	4	1.92E+11	181.5E+9
4	1996	27	18	2.07E+11	15.0E+9
5	1997	89	62	3.48E+11	141.0E+9
6	1998	112	23	2.53E+11	-95.0E+9
7	1999	22	(90)	4.83E+10	-204.7E+9
8	2000	49	27	4.88E+10	500.0E+6
9	2001	45	(4)	2.78E+11	229.2E+9
10	2002	116	71	6.39E+11	361.0E+9
11	2003	98	(18)	3.63E+11	-276.2E+9
12	2004	107	9	3.97E+11	34.0E+9
13	2005	116	9	4.31E+11	34.0E+9
14	2006	126	9	4.65E+11	34.0E+9
15	2007	135	9	4.99E+11	34.0E+9
16	2008	144	9	5.33E+11	34.0E+9
17	2009	153	9	5.67E+11	34.0E+9
18	2010	162	9	6.00E+11	34.0E+9
19	2011	171	9	6.34E+11	34.0E+9
20	2012	181	9	6.68E+11	34.0E+9
21	2013	190	9	7.02E+11	34.0E+9
22	2014	199	9	7.36E+11	34.0E+9
23	2015	208	9	7.70E+11	34.0E+9
24	2016	217	9	8.04E+11	34.0E+9
25	2017	227	9	8.38E+11	34.0E+9
26	2018	236	9	8.72E+11	34.0E+9
27	2019	245	9	9.06E+11	34.0E+9
28	2020	254	9	9.40E+11	34.0E+9

Note:

1.Radioactive waste generation data for 1992 through 2003 is provided by TJEPB

2. Radioactive material is classified into two types - one is radioactive waste, the other is radioactive source.

3. Radioactive waste is projected to decrease 10% per year using 2003 as the baseline year.

4. Radioactive source is projected to increase using linear regression method. First number of radioactive source is projected and the average radioacitivity for each source is multiplied by an average of 10mCi or 3.7+e09 Bq per source

Revenue Projection

Tianjin Civilian Radioactive Wate Generation Projection															
No. Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Activity ($Ba*10^{10}$)	41.92	37.73	33.96	30.56	27.51	24.76	22.28	20.05	18.05	16.24	14.62	13.16	11.84	10.66	9.59
Annual Change Activity ($Ba*10^{10}$)	n/a	-4.19	-3.77	-3.40	-3.06	-2.75	-2.48	-2.23	-2.01	-1.80	-1.62	-1.46	-1.32	-1.18	-1.07
Charge Rate: $0.75 per Activity ($Ba*10^{10}$)															
Revenue	31.44	28.30	25.47	22.92	20.63	18.57	16.71	15.04	13.54	12.18	10.96	9.87	8.88	7.99	7.19

Tianjin Civilian Radioactive Source Use Projection															
No. Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
No. of Source	126	135	144	153	162	171	181	190	199	208	217	227	236	245	254
Annual Change No. of Source	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
Activity ($Ba*10^{10}$)	46.47	49.86	53.26	56.65	60.05	63.44	66.84	70.23	73.63	77.03	80.42	83.82	87.21	90.61	94.00
Annual Change Activity ($Ba*10^{10}$)	n/a	3.4E+00	3.4E+00	3.4E+00	3.4E+00	3.4E+00	3.4E+00	3.4E+00	3.4E+00	3.4E+00	3.4E+00	3.4E+00	3.4E+00	3.4E+00	3.4E+00
Charge Rate: $3.9 per Activity ($Ba*10^{10}$) per month															
Revenue	2,174.78	2,333.67	2,492.56	2,651.45	2,810.33	2,969.22	3,128.11	3,287.00	3,445.88	3,604.77	3,763.66	3,922.55	4,081.43	4,240.32	4,399.21
Total Projected Revenue	2,206.23	2,361.97	2,518.03	2,674.37	2,830.96	2,987.79	3,144.82	3,302.04	3,459.42	3,616.95	3,774.62	3,932.41	4,090.31	4,248.31	4,406.40

Note:

1. Radioactive waste generation data for 1992 through 2003 is provided by TJEPB.
2. Radioactive material is classified into two types - one is radioactive waste, the other is radioactive source.
3. Radioactive waste is projected to decrease 10% per year using 2003 as the baseline year.
4. Radioactive source is projected to increase using linear regression method. First number of radioactive source is projected and the average radioacitivity for each source is multiplied by an average of 10mCi or 3.7+e09 Bq per source

Income Statement

Tianjin Radioactive Waste Treatment Project
Income Statement
For Year Ended Dec 31, 2006 (Year 1)

In 000 USD

	Prior Year	Current Year
Income		2,206.23
Other Income		-
Less Discount and Return		
Total Income		2,206.23
Cost Of Sales		
Waste Collection & Transportation Exp		
Labor		54.41
Vehicle Fuels		22.64
Disinfectant		28.30
Waste Collection & Transportation Exp Subtotal:		105.34
Thermal Treatment Expense		
Labor		25.03
Material		3.26
Utility		27.62
Fuel, Chemical etc.		79.74
Thermal Treatment Exp Subtotal:		135.66
Mechanical Treatment Labor		7.26
Lab & Field Labor		29.02
Final Disposal		18.16
Overhead Applied		1,678.21
Total Cost od Sales		1,973.64
Gross Prodit		232.59
Operating Expense		
Facility Maint.		36.28
Thermal Equipment Maint. Labor		0.91
Thermal Equipment Maint. Material		0.91
Thermal Equipment Insurance		11.08
Thermal Equipment Property Tax		11.08
Other Thermal Treatment Overhead		664.80
Vehicle Maintenance		54.91
Vehicle Insurance & Registration Fee	-	30.13
Other Vehicle Operation Overhead		96.15
Mechanical Treatment Equipment Maint.		43.20
Mechanical Treatment Insurance & Tax		19.97
Other Mechanical Treatment Overhead		30.27
Lab & Field Equipment Maint.		104.51
Lab & Field Equipment Insurance & Tax		46.16
Other Labor & Field Overhead		80.12
Depreciation Expense		324.68
Tax and Licenses		123.05
(Gain)/Loss on Disposal of FA		
Overhead Applied		-1,678.21
General Administrative Expense		22.16
Operating Expense Subtotal:		22.16
Income from operation		210.43
Other Expenses and Losses		
Interest Expenses		190.78
Income Bedore Income Tax		19.65
Income Tax		6.48
Net Income for the Year		13.17

Tianjin Radioactive Waste Treatment Project
Income Statement
For Year Ended Dec 31, 2007 (Year 2)

In 000 USD

	Prior Year	Current Year
Income	2,206.23	2,361.97
Other Income	-	-
Less Discount and Return		
Total Income	2,206.23	2,361.97
		-530.09
Cost Of Sales		
Waste Collection & Transportation Exp		
Labor	54.41	56.05
Vehicle Fuels	22.64	23.32
Disinfectant	28.30	29.14
Waste Collection & Transportation Exp Subtotal:	105.34	108.50
Thermal Treatment Expense		
Labor	25.03	25.78
Material	3.26	3.36
Utility	27.62	28.44
Fuel, Chemical etc.	79.74	82.14
Thermal Treatment Exp Subtotal:	135.66	139.73
Mechanical Treatment Labor	7.26	7.47
Lab & Field Labor	29.02	29.89
Final Disposal	18.16	18.70
Overhead Applied	1,678.21	1,723.81
Total Cost od Sales	1,973.64	2,028.11
Gross Prodit	232.59	333.87
Operating Expense		
Facility Maint.	36.28	37.36
Thermal Equipment Maint. Labor	0.91	0.93
Thermal Equipment Maint. Material	0.91	0.93
Thermal Equipment Insurance	11.08	11.41
Thermal Equipment Property Tax	11.08	11.41
Other Thermal Treatment Overhead	664.80	684.74
Vehicle Maintenance	54.91	56.56
Vehicle Insurance & Registration Fee	30.13	31.03
Other Vehicle Operation Overhead	96.15	99.04
Mechanical Treatment Equipment Maint.	43.20	44.50
Mechanical Treatment Insurance & Tax	19.97	20.57
Other Mechanical Treatment Overhead	30.27	31.18
Lab & Field Equipment Maint.	104.51	107.65
Lab & Field Equipment Insurance & Tax	46.16	47.54
Other Labor & Field Overhead	80.12	82.52
Depreciation Expense	324.68	324.68
Tax and Licenses	123.05	131.74
(Gain)/Loss on Disposal of FA	-	
Overhead Applied	-1,678.21	-1,723.81
General Administrative Expense	22.16	22.82
Operating Expense Subtotal:	22.16	22.82
Income from operation	210.43	311.04
Other Expenses and Losses		
Interest Expenses	190.78	181.03
Income Bedore Income Tax	19.65	130.01
Income Tax	6.48	42.90
Net Income for the Year	13.17	87.11

Income Statement

Tianjin Radioactive Waste Treatment Project
Income Statement
For Year Ended Dec 31, 2008 (Year 3)

In 000 USD

	Prior Year	Current Year
Income	2,361.97	2,518.03
Other Income	-	-
Less Discount and Return		
Total Income	2,361.97	2,518.03
Cost Of Sales		
Waste Collection & Transportation Exp		
Labor	56.05	57.73
Vehicle Fuels	23.32	24.01
Disinfectant	29.14	30.02
Waste Collection & Transportation Exp Subtotal:	108.50	111.76
Thermal Treatment Expense		
Labor	25.78	26.55
Material	3.36	3.46
Utility	28.44	29.30
Fuel, Chemical etc	82.14	84.60
Thermal Treatment Exp Subtotal:	139.73	143.92
Mechanical Treatment Labor	7.47	7.70
Lab & Field Labor	29.89	30.79
Final Disposal	18.70	19.26
Overhead Applied	1,723.81	1,770.53
Total Cost od Sales	2,028.11	2,083.96
Gross Prodit	333.87	434.07
Operating Expense		
Facility Maint.	37.38	38.48
Thermal Equipment Maint. Labor	0.93	0.96
Thermal Equipment Maint. Material	0.93	0.96
Thermal Equipment Insurance	11.41	11.75
Thermal Equipment Property Tax	11.41	11.75
Other Thermal Treatment Overhead	684.74	705.29
Vehicle Maintenance	56.56	58.26
Vehicle Insurance & Registration Fee	31.03	31.96
Other Vehicle Operation Overhead	99.04	102.01
Mechanical Treatment Equipment Maint.	44.50	45.83
Mechanical Treatment Insurance & Tax	20.57	21.18
Other Mechanical Treatment Overhead	31.18	32.12
Lab & Field Equipment Maint.	107.65	110.87
Lab & Field Equipment Insurance & Tax	47.54	48.97
Other Labor & Field Overhead	82.52	85.00
Depreciation Expense	324.68	324.68
Tax and Licenses	131.74	140.44
(Gain)/Loss on Disposal of FA	-	
Overhead Applied	-1,723.81	-1,770.53
General Administrative Expense	22.82	23.51
Operating Expense Subtotal:	22.82	23.51
Income from operation	311.04	410.56
Other Expenses and Losses		
Interest Expenses	181.03	171.28
Income Bedore Income Tax	130.01	239.28
Income Tax	42.90	78.96
Net Income for the Year	87.11	160.32

Tianjin Radioactive Waste Treatment Project
Income Statement
For Year Ended Dec 31, 2009 (Year 4)

In 000 USD

	Prior Year	Current Year
Income	2,518.03	2,674.37
Other Income	-	-
Less Discount and Return		
Total Income	2,518.03	2,674.37
Cost Of Sales		
Waste Collection & Transportation Exp		
Labor	57.73	59.46
Vehicle Fuels	24.01	24.74
Disinfectant	30.02	30.92
Waste Collection & Transportation Exp Subtotal:	111.76	115.11
Thermal Treatment Expense		
Labor	26.55	27.35
Material	3.46	3.57
Utility	29.30	30.18
Fuel, Chemical etc	84.60	87.14
Thermal Treatment Exp Subtotal:	143.92	148.23
Mechanical Treatment Labor	7.70	7.93
Lab & Field Labor	30.79	31.71
Final Disposal	19.26	19.84
Overhead Applied	1,770.53	1,818.42
Total Cost od Sales	2,083.96	2,141.25
Gross Prodit	434.07	533.12
Operating Expense		
Facility Maint.	38.48	39.64
Thermal Equipment Maint. Labor	0.96	0.99
Thermal Equipment Maint. Material	0.96	0.99
Thermal Equipment Insurance	11.75	12.11
Thermal Equipment Property Tax	11.75	12.11
Other Thermal Treatment Overhead	705.29	726.44
Vehicle Maintenance	58.26	60.01
Vehicle Insurance & Registration Fee	31.96	32.92
Other Vehicle Operation Overhead	102.01	105.07
Mechanical Treatment Equipment Maint.	45.83	47.21
Mechanical Treatment Insurance & Tax	21.18	21.82
Other Mechanical Treatment Overhead	32.12	33.08
Lab & Field Equipment Maint.	110.87	114.20
Lab & Field Equipment Insurance & Tax	48.97	50.44
Other Labor & Field Overhead	85.00	87.55
Depreciation Expense	324.68	324.68
Tax and Licenses	140.44	149.16
(Gain)/Loss on Disposal of FA	-	
Overhead Applied	-1,770.53	-1,818.42
General Administrative Expense	23.51	24.21
Operating Expense Subtotal:	23.51	24.21
Income from operation	410.56	508.91
Other Expenses and Losses		
Interest Expenses	171.28	158.28
Income Bedore Income Tax	239.28	350.63
Income Tax	78.96	115.71
Net Income for the Year	160.32	234.92

Income Statement

Tianjin Radioactive Waste Treatment Project
Income Statement
For Year Ended Dec 31, 2010 (Year 5)

In 000 USD

	Prior Year	Current Year
Income	2,674.37	2,830.96
Other Income	-	-
Less Discount and Return		
Total Income	2,674.37	2,830.96
Cost Of Sales		
Waste Collection & Transportation Exp		
Labor	59.46	61.24
Vehicle Fuels	24.74	25.48
Disinfectant	30.92	31.85
Waste Collection & Transportation Exp Subtotal:	115.11	118.57
Thermal Treatment Expense		
Labor	27.35	28.17
Material	3.57	3.67
Utility	30.18	31.08
Fuel, Chemical etc.	87.14	89.75
Thermal Treatment Exp Subtotal:	148.23	152.68
Mechanical Treatment Labor	7.93	8.17
Lab & Field Labor	31.71	32.66
Final Disposal	19.84	20.44
Overhead Applied	1,818.42	1,867.49
Total Cost od Sales	2,141.25	2,200.00
Gross Prodit	533.12	630.96
Operating Expense		
Facility Maint	39.64	40.83
Thermal Equipment Maint. Labor	0.99	1.02
Thermal Equipment Maint. Material	0.99	1.02
Thermal Equipment Insurance	12.11	12.47
Thermal Equipment Property Tax	12.11	12.47
Other Thermal Treatment Overhead	726.44	748.24
Vehicle Maintenance	60.01	61.81
Vehicle Insurance & Registration Fee	32.92	33.91
Other Vehicle Operation Overhead	105.07	108.22
Mechanical Treatment Equipment Maint	47.21	48.62
Mechanical Treatment Insurance & Tax	21.82	22.47
Other Mechanical Treatment Overhead	33.08	34.07
Lab & Field Equipment Maint.	114.20	117.63
Lab & Field Equipment Insurance & Tax	50.44	51.95
Other Labor & Field Overhead	87.55	90.17
Depreciation Expense	324.68	324.68
Tax and Licenses	149.16	157.90
(Gain)/Loss on Disposal of FA	-	
Overhead Applied	-1,818.42	-1,867.49
General Administrative Expense	24.21	24.94
Operating Expense Subtotal:	24.21	24.94
Income from operation	508.91	606.02
Other Expenses and Losses		
Interest Expenses	158.28	145.28
Income Bedore Income Tax	350.63	460.75
Income Tax	115.71	152.05
Net Income for the Year	234.92	308.70

Tianjin Radioactive Waste Treatment Project
Income Statement
For Year Ended Dec 31, 2011 (Year 6)

In 000 USD

	Prior Year	Current Year
Income	2,830.96	2,987.79
Other Income	-	-
Less Discount and Return		
Total Income	2,830.96	2,987.79
Cost Of Sales		
Waste Collection & Transportation Exp		
Labor	61.24	63.08
Vehicle Fuels	25.48	26.24
Disinfectant	31.85	32.80
Waste Collection & Transportation Exp Subtotal:	118.57	122.12
Thermal Treatment Expense		
Labor	28.17	29.02
Material	3.67	3.78
Utility	31.08	32.01
Fuel, Chemical etc.	89.75	92.45
Thermal Treatment Exp Subtotal:	152.68	157.26
Mechanical Treatment Labor	8.17	8.41
Lab & Field Labor	32.66	33.64
Final Disposal	20.44	21.05
Overhead Applied	1,867.49	1,917.78
Total Cost od Sales	2,200.00	2,260.27
Gross Prodit	630.96	727.52
Operating Expense		
Facility Maint.	40.83	42.05
Thermal Equipment Maint. Labor	1.02	1.05
Thermal Equipment Maint. Material	1.02	1.05
Thermal Equipment Insurance	12.47	12.84
Thermal Equipment Property Tax	12.47	12.84
Other Thermal Treatment Overhead	748.24	770.69
Vehicle Maintenance	61.81	63.66
Vehicle Insurance & Registration Fee	33.91	34.93
Other Vehicle Operation Overhead	108.22	111.47
Mechanical Treatment Equipment Maint.	48.62	50.08
Mechanical Treatment Insurance & Tax	22.47	23.15
Other Mechanical Treatment Overhead	34.07	35.09
Lab & Field Equipment Maint.	117.63	121.16
Lab & Field Equipment Insurance & Tax	51.95	53.51
Other Labor & Field Overhead	90.17	92.88
Depreciation Expense	324.68	324.68
Tax and Licenses	157.90	166.64
(Gain)/Loss on Disposal of FA	-	
Overhead Applied	-1,867.49	-1,917.78
General Administrative Expense	24.94	25.69
Operating Expense Subtotal:	24.94	25.69
Income from operation	606.02	701.83
Other Expenses and Losses		
Interest Expenses	145.28	129.03
Income Bedore Income Tax	460.75	572.80
Income Tax	152.05	189.02
Net Income for the Year	308.70	383.78

Income Statement

Tianjin Radioactive Waste Treatment Project
Income Statement
For Year Ended Dec 31, 2012 (Year 7)

In 000 USD

	Prior Year	Current Year
Income	2,987.79	3,144.82
Other Income	-	-
Less Discount and Return		
Total Income	2,987.79	3,144.82
Cost Of Sales		
Waste Collection & Transportation Exp		
Labor	63.08	64.97
Vehicle Fuels	26.24	27.03
Disinfectant	32.80	33.79
Waste Collection & Transportation Exp Subtotal:	122.12	125.79
Thermal Treatment Expense		
Labor	29.02	29.89
Material	3.78	3.90
Utility	32.01	32.97
Fuel, Chemical etc.	92.45	95.22
Thermal Treatment Exp Subtotal:	157.26	161.98
Mechanical Treatment Labor	8.41	8.66
Lab & Field Labor	33.64	34.65
Final Disposal	21.05	21.68
Overhead Applied	1,917.78	1,969.33
Total Cost od Sales	2,260.27	2,322.10
Gross Prodit	727.52	822.72
Operating Expense		
Facility Maint.	42.05	43.32
Thermal Equipment Maint. Labor	1.05	1.08
Thermal Equipment Maint. Material	1.05	1.08
Thermal Equipment Insurance	12.84	13.23
Thermal Equipment Property Tax	12.84	13.23
Other Thermal Treatment Overhead	770.69	793.81
Vehicle Maintenance	63.66	65.57
Vehicle Insurance & Registration Fee	34.93	35.97
Other Vehicle Operation Overhead	111.47	114.81
Mechanical Treatment Equipment Maint.	50.08	51.58
Mechanical Treatment Insurance & Tax	23.15	23.84
Other Mechanical Treatment Overhead	35.09	36.15
Lab & Field Equipment Maint.	121.16	124.79
Lab & Field Equipment Insurance & Tax	53.51	55.11
Other Labor & Field Overhead	92.88	95.67
Depreciation Expense	324.68	324.68
Tax and Licenses	166.64	175.40
(Gain)/Loss on Disposal of FA	-	
Overhead Applied	-1,917.78	-1,969.33
General Administrative Expense	25.69	26.46
Operating Expense Subtotal:	25.69	26.46
Income from operation	701.83	796.26
Other Expenses and Losses		
Interest Expenses	129.03	112.78
Income Bedore Income Tax	572.80	683.49
Income Tax	189.02	225.55
Net Income for the Year	383.78	457.93

Tianjin Radioactive Waste Treatment Project
Income Statement
For Year Ended Dec 31, 2013 (Year 8)

In 000 USD

	Prior Year	Current Year
Income	3,144.82	3,302.04
Other Income	-	-
Less Discount and Return		
Total Income	3,144.82	3,302.04
Cost Of Sales		
Waste Collection & Transportation Exp		
Labor	64.97	66.92
Vehicle Fuels	27.03	27.84
Disinfectant	33.79	34.80
Waste Collection & Transportation Exp Subtotal:	125.79	129.56
Thermal Treatment Expense		
Labor	29.89	30.78
Material	3.90	4.02
Utility	32.97	33.96
Fuel, Chemical etc.	95.22	98.08
Thermal Treatment Exp Subtotal:	161.98	166.84
Mechanical Treatment Labor	8.66	8.92
Lab & Field Labor	34.65	35.69
Final Disposal	21.68	22.33
Overhead Applied	1,969.33	2,022.18
Total Cost od Sales	2,322.10	2,385.53
Gross Prodit	822.72	916.51
Operating Expense		
Facility Maint.	43.32	44.61
Thermal Equipment Maint. Labor	1.08	1.12
Thermal Equipment Maint. Material	1.08	1.12
Thermal Equipment Insurance	13.23	13.63
Thermal Equipment Property Tax	13.23	13.63
Other Thermal Treatment Overhead	793.81	817.62
Vehicle Maintenance	65.57	67.54
Vehicle Insurance & Registration Fee	35.97	37.05
Other Vehicle Operation Overhead	114.81	118.26
Mechanical Treatment Equipment Maint.	51.58	53.13
Mechanical Treatment Insurance & Tax	23.84	24.56
Other Mechanical Treatment Overhead	36.15	37.23
Lab & Field Equipment Maint.	124.79	128.53
Lab & Field Equipment Insurance & Tax	55.11	56.77
Other Labor & Field Overhead	95.67	98.54
Depreciation Expense	324.68	324.68
Tax and Licenses	175.40	184.17
(Gain)/Loss on Disposal of FA	-	
Overhead Applied	-1,969.33	-2,022.18
General Administrative Expense	26.46	27.25
Operating Expense Subtotal:	26.46	27.25
Income from operation	796.26	889.26
Other Expenses and Losses		
Interest Expenses	112.78	96.53
Income Bedore Income Tax	683.49	792.73
Income Tax	225.55	261.60
Net Income for the Year	457.93	531.13

Income Statement

Tianjin Radioactive Waste Treatment Project
Income Statement
For Year Ended Dec 31, 2014 (Year 9)

In 000 USD

	Prior Year	Current Year
Income	3,302.04	3,459.42
Other Income	-	-
Less Discount and Return		
Total Income	3,302.04	3,459.42
Cost Of Sales		
Waste Collection & Transportation Exp		
Labor	66.92	68.93
Vehicle Fuels	27.84	28.67
Disinfectant	34.80	35.84
Waste Collection & Transportation Exp Subtotal:	129.56	133.45
Thermal Treatment Expense		
Labor	30.78	31.71
Material	4.02	4.14
Utility	33.96	34.98
Fuel, Chemical etc.	98.08	101.02
Thermal Treatment Exp Subtotal:	166.84	171.84
Mechanical Treatment Labor	8.92	9.19
Lab & Field Labor	35.69	36.76
Final Disposal	22.33	23.00
Overhead Applied	2,022.18	2,076.36
Total Cost od Sales	2,385.53	2,450.60
Gross Prodit	916.51	1,008.81
Operating Expense		
Facility Maint.	44.61	45.95
Thermal Equipment Maint. Labor	1.12	1.15
Thermal Equipment Maint. Material	1.12	1.15
Thermal Equipment Insurance	13.63	14.04
Thermal Equipment Property Tax	13.63	14.04
Other Thermal Treatment Overhead	817.62	842.15
Vehicle Maintenance	67.54	69.56
Vehicle Insurance & Registration Fee	37.05	38.16
Other Vehicle Operation Overhead	118.26	121.81
Mechanical Treatment Equipment Maint.	53.13	54.72
Mechanical Treatment Insurance & Tax	24.56	25.30
Other Mechanical Treatment Overhead	37.23	38.35
Lab & Field Equipment Maint.	128.53	132.39
Lab & Field Equipment Insurance & Tax	56.77	58.47
Other Labor & Field Overhead	98.54	101.49
Depreciation Expense	324.68	324.68
Tax and Licenses	184.17	192.95
(Gain)/Loss on Disposal of FA	-	
Overhead Applied	-2,022.18	-2,076.36
General Administrative Expense	27.25	28.07
Operating Expense Subtotal:	27.25	28.07
Income from operation	889.26	980.74
Other Expenses and Losses		
Interest Expenses	96.53	80.28
Income Bedore Income Tax	792.73	900.47
Income Tax	261.60	297.15
Net Income for the Year	531.13	603.31

Tianjin Radioactive Waste Treatment Project
Income Statement
For Year Ended Dec 31, 2015 (Year 10)

In 000 USD

	Prior Year	Current Year
Income	3,459.42	3,616.95
Other Income	-	-
Less Discount and Return		
Total Income	3,459.42	3,616.95
Cost Of Sales		
Waste Collection & Transportation Exp		
Labor	68.93	71.00
Vehicle Fuels	28.67	29.53
Disinfectant	35.84	36.92
Waste Collection & Transportation Exp Subtotal:	133.45	137.45
Thermal Treatment Expense		
Labor	31.71	32.66
Material	4.14	4.26
Utility	34.98	36.03
Fuel, Chemical etc.	101.02	104.05
Thermal Treatment Exp Subtotal:	171.84	177.00
Mechanical Treatment Labor	9.19	9.47
Lab & Field Labor	36.76	37.87
Final Disposal	23.00	23.69
Overhead Applied	2,076.36	2,131.91
Total Cost od Sales	2,450.60	2,517.38
Gross Prodit	1,008.81	1,099.57
Operating Expense		
Facility Maint.	45.95	47.33
Thermal Equipment Maint. Labor	1.15	1.18
Thermal Equipment Maint. Material	1.15	1.18
Thermal Equipment Insurance	14.04	14.46
Thermal Equipment Property Tax	14.04	14.46
Other Thermal Treatment Overhead	842.15	867.41
Vehicle Maintenance	69.56	71.65
Vehicle Insurance & Registration Fee	38.16	39.31
Other Vehicle Operation Overhead	121.81	125.46
Mechanical Treatment Equipment Maint.	54.72	56.37
Mechanical Treatment Insurance & Tax	25.30	26.05
Other Mechanical Treatment Overhead	38.35	39.50
Lab & Field Equipment Maint.	132.39	136.36
Lab & Field Equipment Insurance & Tax	58.47	60.22
Other Labor & Field Overhead	101.49	104.54
Depreciation Expense	324.68	324.68
Tax and Licenses	192.95	201.74
(Gain)/Loss on Disposal of FA	-	
Overhead Applied	-2,076.36	-2,131.91
General Administrative Expense	28.07	28.91
Operating Expense Subtotal:	28.07	28.91
Income from operation	980.74	1,070.66
Other Expenses and Losses		
Interest Expenses	80.28	67.28
Income Bedore Income Tax	900.47	1,003.38
Income Tax	297.15	331.12
Net Income for the Year	603.31	672.27

Income Statement

Tianjin Radioactive Waste Treatment Project
Income Statement
For Year Ended Dec 31, 2016 (Year 11)

In 000 USD

	Prior Year	Current Year
Income	3,616.95	3,774.62
Other Income	-	-
Less Discount and Return		
Total Income	3,616.95	3,774.62
Cost Of Sales		
Waste Collection & Transportation Exp		
Labor	71.00	73.13
Vehicle Fuels	29.53	30.42
Disinfectant	36.92	38.03
Waste Collection & Transportation Exp Subtotal:	137.45	141.57
Thermal Treatment Expense		
Labor	32.66	33.64
Material	4.26	4.39
Utility	36.03	37.11
Fuel, Chemical etc.	104.05	107.17
Thermal Treatment Exp Subtotal:	177.00	182.31
Mechanical Treatment Labor	9.47	9.75
Lab & Field Labor	37.87	39.00
Final Disposal	23.69	24.40
Overhead Applied	2,131.91	2,605.50
Total Cost od Sales	2,517.38	3,002.54
Gross Prodit	1,099.57	772.08
Operating Expense		
Facility Maint.	47.33	48.75
Thermal Equipment Maint. Labor	1.18	1.22
Thermal Equipment Maint. Material	1.18	1.22
Thermal Equipment Insurance	14.46	14.89
Thermal Equipment Property Tax	14.46	14.89
Other Thermal Treatment Overhead	867.41	893.44
Vehicle Maintenance	71.65	73.80
Vehicle Insurance & Registration Fee	39.31	40.49
Other Vehicle Operation Overhead	125.46	129.22
Mechanical Treatment Equipment Maint.	56.37	58.06
Mechanical Treatment Insurance & Tax	26.05	26.84
Other Mechanical Treatment Overhead	39.50	40.68
Lab & Field Equipment Maint.	136.36	140.45
Lab & Field Equipment Insurance & Tax	60.22	62.03
Other Labor & Field Overhead	104.54	107.67
Depreciation Expense	324.68	414.27
Tax and Licenses	201.74	210.53
(Gain)/Loss on Disposal of FA	-	327.05
Overhead Applied	-2,131.91	-2,605.50
General Administrative Expense	28.91	29.78
Operating Expense Subtotal:	28.91	29.78
Income from operation	1,070.66	742.30
Other Expenses and Losses		
Interest Expenses	67.28	54.28
Income Bedore Income Tax	1,003.38	688.03
Income Tax	331.12	227.05
Net Income for the Year	672.27	460.98

Tianjin Radioactive Waste Treatment Project
Income Statement
For Year Ended Dec 31, 2017 (Year 12)

In 000 USD

	Prior Year	Current Year
Income	3,774.62	3,932.41
Other Income	-	-
Less Discount and Return		
Total Income	3,774.62	3,932.41
Cost Of Sales		
Waste Collection & Transportation Exp		
Labor	73.13	75.32
Vehicle Fuels	30.42	31.33
Disinfectant	38.03	39.17
Waste Collection & Transportation Exp Subtotal:	141.57	145.82
Thermal Treatment Expense		
Labor	33.64	34.65
Material	4.39	4.52
Utility	37.11	38.23
Fuel, Chemical etc.	107.17	110.38
Thermal Treatment Exp Subtotal:	182.31	187.78
Mechanical Treatment Labor	9.75	10.04
Lab & Field Labor	39.00	40.17
Final Disposal	24.40	25.14
Overhead Applied	2,605.50	2,336.86
Total Cost od Sales	3,002.54	2,745.81
Gross Prodit	772.08	1,186.60
Operating Expense		
Facility Maint.	48.75	50.21
Thermal Equipment Maint. Labor	1.22	1.26
Thermal Equipment Maint. Material	1.22	1.26
Thermal Equipment Insurance	14.89	15.34
Thermal Equipment Property Tax	14.89	15.34
Other Thermal Treatment Overhead	893.44	920.24
Vehicle Maintenance	73.80	76.01
Vehicle Insurance & Registration Fee	40.49	41.70
Other Vehicle Operation Overhead	129.22	133.10
Mechanical Treatment Equipment Maint.	58.06	59.80
Mechanical Treatment Insurance & Tax	26.84	27.64
Other Mechanical Treatment Overhead	40.68	41.91
Lab & Field Equipment Maint.	140.45	144.67
Lab & Field Equipment Insurance & Tax	62.03	63.89
Other Labor & Field Overhead	107.67	110.90
Depreciation Expense	414.27	414.27
Tax and Licenses	210.53	219.33
(Gain)/Loss on Disposal of FA	327.05	
Overhead Applied	-2,605.50	-2,336.86
General Administrative Expense	29.78	30.67
Operating Expense Subtotal:	29.78	30.67
Income from operation	742.30	1,155.93
Other Expenses and Losses		
Interest Expenses	54.28	38.03
Income Bedore Income Tax	688.03	1,117.90
Income Tax	227.05	368.91
Net Income for the Year	460.98	748.99

Income Statement

Tianjin Radioactive Waste Treatment Project
Income Statement
For Year Ended Dec 31, 2018 (Year 13)

In 000 USD

	Prior Year	Current Year
Income	3,932.41	4,090.31
Other Income	-	-
Less Discount and Return		
Total Income	3,932.41	4,090.31
Cost Of Sales		
Waste Collection & Transportation Exp		
Labor	75.32	77.58
Vehicle dules	31.33	32.27
Disinfectant	39.17	40.34
Waste Collection & Transportation Exp Subtotal:	145.82	150.20
Thermal Treatment Expense		
Labor	34.65	35.69
Material	4.52	4.65
Utility	38.23	39.37
Fuel, Chemical etc.	110.38	113.70
Thermal Treatment Exp Subtotal:	187.78	193.41
Mechanical Treatment Labor	10.04	10.34
Lab & Field Labor	40.17	41.38
Final Disposal	25.14	25.89
Overhead Applied	2,336.86	2,396.77
Total Cost od Sales	2,745.81	2,817.98
Gross Prodlt	1,186.60	1,272.33
Operating Expense		
Facility Maint.	50.21	51.72
Thermal Equipment Maint. Labor	1.26	1.29
Thermal Equipment Maint. Material	1.26	1.29
Thermal Equipment Insurance	15.34	15.80
Thermal Equipment Property Tax	15.34	15.80
Other Thermal Treatment Overhead	920.24	947.85
Vehicle Maintenance	76.01	78.29
Vehicle Insurance & Registration Fee	41.70	42.95
Other Vehicle Operation Overhead	133.10	137.09
Mechanical Treatment Equipment Maint.	59.80	61.59
Mechanical Treatment Insurance & Tax	27.64	28.47
Other Mechanical Treatment Overhead	41.91	43.16
Lab & Field Equipment Maint.	144.67	149.01
Lab & Field Equipment Insurance & Tax	63.89	65.81
Other Labor & Field Overhead	110.90	114.23
Depreciation Expense	414.27	414.27
Tax and Licenses	219.33	228.14
(Gain)/Loss on Disposal of FA	-	
Overhead Applied	-2,336.86	-2,396.77
General Administrative Expense	30.67	31.59
Operating Expense Subtotal:	30.67	31.59
Income from operation	1,155.93	1,240.74
Other Expenses and Losses		
Interest Expenses	38.03	21.78
Income Bedore Income Tax	1,117.90	1,218.96
Income Tax	368.91	402.26
Net Income for the Year	748.99	816.70

Tianjin Radioactive Waste Treatment Project
Income Statement
For Year Ended Dec 31, 2019 (Year 14)

In 000 USD

	Prior Year	Current Year
Income	4,090.31	4,248.31
Other Income	-	-
Less Discount and Return		
Total Income	4,090.31	4,248.31
Cost Of Sales		
Waste Collection & Transportation Exp		
Labor	77.58	79.91
Vehicle dules	32.27	33.24
Disinfectant	40.34	41.55
Waste Collection & Transportation Exp Subtotal:	150.20	154.70
Thermal Treatment Expense		
Labor	35.69	36.76
Material	4.65	4.79
Utility	39.37	40.55
Fuel, Chemical etc.	113.70	117.11
Thermal Treatment Exp Subtotal:	193.41	199.21
Mechanical Treatment Labor	10.34	10.65
Lab & Field Labor	41.38	42.62
Final Disposal	25.89	26.67
Overhead Applied	2,396.77	2,458.21
Total Cost od Sales	2,817.98	2,892.06
Gross Prodlt	1,272.33	1,356.25
Operating Expense		
Facility Maint.	51.72	53.27
Thermal Equipment Maint. Labor	1.29	1.33
Thermal Equipment Maint. Material	1.29	1.33
Thermal Equipment Insurance	15.80	16.27
Thermal Equipment Property Tax	15.80	16.27
Other Thermal Treatment Overhead	947.85	976.28
Vehicle Maintenance	78.29	80.64
Vehicle Insurance & Registration Fee	42.95	44.24
Other Vehicle Operation Overhead	137.09	141.21
Mechanical Treatment Equipment Maint.	61.59	63.44
Mechanical Treatment Insurance & Tax	28.47	29.32
Other Mechanical Treatment Overhead	43.16	44.46
Lab & Field Equipment Maint.	149.01	153.48
Lab & Field Equipment Insurance & Tax	65.81	67.78
Other Labor & Field Overhead	114.23	117.66
Depreciation Expense	414.27	414.27
Tax and Licenses	228.14	236.95
(Gain)/Loss on Disposal of FA	-	
Overhead Applied	-2,396.77	-2,458.21
General Administrative Expense	31.59	32.54
Operating Expense Subtotal:	31.59	32.54
Income from operation	1,240.74	1,323.71
Other Expenses and Losses		
Interest Expenses	21.78	5.53
Income Bedore Income Tax	1,218.96	1,318.18
Income Tax	402.26	435.00
Net Income for the Year	816.70	883.18

Income Statement

Tianjin Radioactive Waste Treatment Project
Income Statement
For Year Ended Dec 31, 2020 (Year 15)

In 000 USD

	Prior Year	Current Year
Income	4,248.31	4,406.40
Other Income	-	-
Less Discount and Return		
Total Income	4,248.31	4,406.40
Cost Of Sales		
Waste Collection & Transportation Exp		
Labor	79.91	82.31
Vehicle dules	33.24	34.24
Disinfectant	41.55	42.80
Waste Collection & Transportation Exp Subtotal:	154.70	159.34
Thermal Treatment Expense		
Labor	36.76	37.86
Material	4.79	4.94
Utility	40.55	41.77
Fuel, Chemical etc.	117.11	120.62
Thermal Treatment Exp Subtotal:	199.21	205.19
Mechanical Treatment Labor	10.65	10.97
Lab & Field Labor	42.62	43.90
Final Disposal	26.67	27.47
Overhead Applied	2,458.21	2,521.24
Total Cost od Sales	2,892.06	2,968.11
Gross Prodit	1,356.25	1,438.30
Operating Expense		
Facility Maint.	53.27	54.87
Thermal Equipment Maint. Labor	1.33	1.37
Thermal Equipment Maint. Material	1.33	1.37
Thermal Equipment Insurance	16.27	16.76
Thermal Equipment Property Tax	16.27	16.76
Other Thermal Treatment Overhead	976.28	1,005.57
Vehicle Maintenance	80.64	83.06
Vehicle Insurance & Registration Fee	44.24	45.57
Other Vehicle Operation Overhead	141.21	145.44
Mechanical Treatment Equipment Maint.	63.44	65.34
Mechanical Treatment Insurance & Tax	29.32	30.20
Other Mechanical Treatment Overhead	44.46	45.79
Lab & Field Equipment Maint.	153.48	158.08
Lab & Field Equipment Insurance & Tax	67.78	69.82
Other Labor & Field Overhead	117.66	121.19
Depreciation Expense	414.27	414.27
Tax and Licenses	236.95	245.77
(Gain)/Loss on Disposal of FA	-	
Overhead Applied	-2,458.21	-2,521.24
General Administrative Expense	32.54	33.52
Operating Expense Subtotal:	32.54	33.52
Income from operation	1,323.71	1,404.78
Other Expenses and Losses		
Interest Expenses	5.53	0.00
Income Bedore Income Tax	1,318.18	1,404.78
Income Tax	435.00	463.58
Net Income for the Year	883.18	941.20

Tianjin Radioactive Waste Treatment
Project Balance Sheet

For Year Ended Dec 31, 2006 (Year 1)

Assets		
		In $1,000
	Beginning	Ending
Current Assets		
Cash		54.00
Accounts Receivable		183.85
Note Receivable		
Inventory		
Material		2.71
Total Current Assets		240.55
Long-Term Investment		
Property, Plant and Equipment		
Construction in Progress		
Acqusition Cost		4,281.73
Accumulated Depreciation		(324.68)
Total Property, Plant and Equipment		3,957.05
Intangible Asset		
Land Lease-Permit		
Amortization		
Other Intangible		
Total Intangible Assets		
Total Assets		4,197.60
Liability and Stockholders' Equity		
Current Liability		
Account Payable		2.71
Note Payable		
Accrued Interest		
Income Tax Payable		
Accrued Wages, Salaries		
Deposits Received from Customers		
Total Current Liabilities		2.71
Long-Term Debt		2,935.03
Total Liabilities		2,937.74
Stockholder's Equity		
Capital Stock		1,246.70
Additional Paid-in Capital		
Retained Earnings		
Appropriated Earnings		1.97
Unappropriated Earnings		11.19
Total Retained Earnings		13.17
Total Liabilities and Stockholders' Equity		4,197.60
		(0)

Note
1. Inventory-material: 1 month of supply for waste treatment mat
2. Appropriated Earning: 15% of net income as required by Chin

For Year Ended Dec 31, 2007 (Year 2)

Assets		
		In $1,000
	Beginning	Ending
Current Assets		
Cash	54.00	302.81
Accounts Receivable	183.85	196.83
Note Receivable		
Inventory		
Material	2.71	2.79
Total Current Assets	240.55	502.43
Long-Term Investment		
Property, Plant and Equipment		
Construction in Progress		
Acqusition Cost	4,281.73	4,281.73
Accumulated Depreciation	(324.68)	(649.37)
Total Property, Plant and Equipment	3,957.05	3,632.37
Intangible Asset		
Land Lease-Permit		
Amortization		
Other Intangible		
Total Intangible Assets		
Total Assets	4,197.60	4,134.80
Liability and Stockholders' Equity		
Current Liability		
Account Payable	2.71	2.79
Note Payable		
Accrued Interest		
Income Tax Payable		
Accrued Wages, Salaries		
Deposits Received from Customers		
Total Current Liabilities	2.71	2.79
Long-Term Debt	2,935.03	2,785.03
Total Liabilities	2,937.74	2,787.82
Stockholder's Equity		
Capital Stock	1,246.70	1,246.70
Additional Paid-in Capital		
Retained Earnings		
Appropriated Earnings	1.97	15.04
Unappropriated Earnings	11.19	85.23
Total Retained Earnings	13.17	100.27
Total Liabilities and Stockholders' Equity	4,197.60	4,134.79
	(0.00)	(0.00)

Note
1. Inventory-material: 1 month of supply for waste treatment material and equi
2. Appropriated Earning: 15% of net income as required by China laws for futu

Tianjin Radioactive Waste Treatment
Project Balance Sheet

For Year Ended Dec 31, 2008 (Year 3)

Assets		In $1,000
	Beginning	Ending
Current Assets		
Cash	302.81	624.81
Accounts Receivable	196.83	209.84
Note Receivable		
Inventory		
Material	2.79	2.87
Total Current Assets	502.43	837.51
Long-Term Investment		
Property, Plant and Equipment		
Construction in Progress		
Acqusition Cost	4,281.73	4,281.73
Accumulated Depreciation	(649.37)	(974.05)
Total Property, Plant and Equipment	3,632.37	3,307.68
Intangible Asset		
Land Lease-Permit		
Amortization		
Other Intangible		
Total Intangible Assets		
Total Assets	4,134.80	4,145.20
Liability and Stockholders' Equity		
Current Liability		
Account Payable	2.79	2.87
Note Payable		
Accrued Interest		
Income Tax Payable		
Accrued Wages, Salaries		
Deposits Received from Customers		
Total Current Liabilities	2.79	2.87
Long-Term Debt	2,785.03	2,635.03
Total Liabilities	2,787.82	2,637.90
Stockholder's Equity		
Capital Stock	1,246.70	1,246.70
Additional Paid-in Capital		
Retained Earnings		
Appropriated Earnings	15.04	39.09
Unappropriated Earnings	85.23	221.50
Total Retained Earnings	100.27	260.59
Total Liabilities and Stockholders' Equity	4,134.79	4,145.19
	(0.00)	(0.00)

Note
1. Inventory-material: 1 month of supply for waste treatment material and equi
2. Appropriated Earning: 15% of net income as required by China laws for futu

For Year Ended Dec 31, 2009 (Year 4)

Assets		In $1,000
	Beginning	Ending
Current Assets		
Cash	624.81	971.39
Accounts Receivable	209.84	222.86
Note Receivable		
Inventory		
Material	2.87	2.96
Total Current Assets	837.51	1,197.21
Long-Term Investment		
Property, Plant and Equipment		
Construction in Progress		
Acqusition Cost	4,281.73	4,281.73
Accumulated Depreciation	(974.05)	(1,298.73)
Total Property, Plant and Equipment	3,307.68	2,983.00
Intangible Asset		
Land Lease-Permit		
Amortization		
Other Intangible		
Total Intangible Assets		
Total Assets	4,145.20	4,180.21
Liability and Stockholders' Equity		
Current Liability		
Account Payable	2.87	2.96
Note Payable		
Accrued Interest		
Income Tax Payable		
Accrued Wages, Salaries		
Deposits Received from Customers		
Total Current Liabilities	2.87	2.96
Long-Term Debt	2,635.03	2,435.03
Total Liabilities	2,637.90	2,437.99
Stockholder's Equity		
Capital Stock	1,246.70	1,246.70
Additional Paid-in Capital		
Retained Earnings		
Appropriated Earnings	39.09	74.33
Unappropriated Earnings	221.50	421.19
Total Retained Earnings	260.59	495.52
Total Liabilities and Stockholders' Equity	4,145.19	4,180.20
	(0.00)	(0.00)

Note
1. Inventory-material: 1 month of supply for waste treatment material and equi
2. Appropriated Earning: 15% of net income as required by China laws for futu

Tianjin Radioactive Waste Treatment
Project Balance Sheet

For Year Ended Dec 31, 2010 (Year 5)

Assets		In $1,000
	Beginning	Ending
Current Assets		
Cash	971.39	1,391.72
Accounts Receivable	222.86	235.91
Note Receivable		
Inventory		
Material	2.96	3.05
Total Current Assets	1,197.21	1,630.68
Long-Term Investment		
Property, Plant and Equipment		
Construction in Progress		
Acqusition Cost	4,281.73	4,281.73
Accumulated Depreciation	(1,298.73)	(1,623.42)
Total Property, Plant and Equipment	2,983.00	2,658.32
Intangible Asset		
Land Lease-Permit		
Amortization		
Other Intangible		
Total Intangible Assets		
Total Assets	4,180.21	4,289.00
Liability and Stockholders' Equity		
Current Liability		
Account Payable	2.96	3.05
Note Payable		
Accrued Interest		
Income Tax Payable		
Accrued Wages, Salaries		
Deposits Received from Customers		
Total Current Liabilities	2.96	3.05
Long-Term Debt	2,435.03	2,235.03
Total Liabilities	2,437.99	2,238.08
Stockholder's Equity		
Capital Stock	1,246.70	1,246.70
Additional Paid-in Capital		
Retained Earnings		
Appropriated Earnings	74.33	120.63
Unappropriated Earnings	421.19	683.58
Total Retained Earnings	495.52	804.22
Total Liabilities and Stockholders' Equity	4,180.20	4,288.99
	(0.00)	(0.00)

Note
1. Inventory-material: 1 month of supply for waste treatment material and equi
2. Appropriated Earning: 15% of net income as required by China laws for futu

For Year Ended Dec 31, 2011 (Year 6)

Assets		In $1,000
	Beginning	Ending
Current Assets		
Cash	1,391.72	1,837.11
Accounts Receivable	235.91	248.98
Note Receivable		
Inventory		
Material	3.05	3.14
Total Current Assets	1,630.68	2,089.23
Long-Term Investment		
Property, Plant and Equipment		
Construction in Progress		
Acqusition Cost	4,281.73	4,281.73
Accumulated Depreciation	(1,623.42)	(1,948.10)
Total Property, Plant and Equipment	2,658.32	2,333.63
Intangible Asset		
Land Lease-Permit		
Amortization		
Other Intangible		
Total Intangible Assets		
Total Assets	4,289.00	4,422.86
Liability and Stockholders' Equity		
Current Liability		
Account Payable	3.05	3.14
Note Payable		
Accrued Interest		
Income Tax Payable		
Accrued Wages, Salaries		
Deposits Received from Customers		
Total Current Liabilities	3.05	3.14
Long-Term Debt	2,235.03	1,985.03
Total Liabilities	2,238.08	1,988.17
Stockholder's Equity		
Capital Stock	1,246.70	1,246.70
Additional Paid-in Capital		
Retained Earnings		
Appropriated Earnings	120.63	178.20
Unappropriated Earnings	683.58	1,009.79
Total Retained Earnings	804.22	1,187.99
Total Liabilities and Stockholders' Equity	4,288.99	4,422.86
	(0.00)	(0.00)

Note
1. Inventory-material: 1 month of supply for waste treatment material and equi
2. Appropriated Earning: 15% of net income as required by China laws for futu

Tianjin Radioactive Waste Treatment
Project Balance Sheet

For Year Ended Dec 31, 2012 (Year 7)

Assets		In $1,000
	Beginning	Ending
Current Assets		
Cash	1,837.11	2,356.64
Accounts Receivable	248.98	262.07
Note Receivable		
Inventory		
Material	3.14	3.23
Total Current Assets	2,089.23	2,621.94
Long-Term Investment		
Property, Plant and Equipment		
Construction in Progress		
Acqusition Cost	4,281.73	4,281.73
Accumulated Depreciation	(1,948.10)	(2,272.78)
Total Property, Plant and Equipment	2,333.63	2,008.95
Intangible Asset		
Land Lease-Permit		
Amortization		
Other Intangible		
Total Intangible Assets		
Total Assets	4,422.86	4,630.89
Liability and Stockholders' Equity		
Current Liability		
Account Payable	3.14	3.23
Note Payable		
Accrued Interest		
Income Tax Payable		
Accrued Wages, Salaries		
Deposits Received from Customers		
Total Current Liabilities	3.14	3.23
Long-Term Debt	1,985.03	1,735.03
Total Liabilities	1,988.17	1,738.26
Stockholder's Equity		
Capital Stock	1,246.70	1,246.70
Additional Paid-in Capital		
Retained Earnings		
Appropriated Earnings	178.20	246.89
Unappropriated Earnings	1,009.79	1,399.04
Total Retained Earnings	1,187.99	1,645.93
Total Liabilities and Stockholders' Equity	4,422.86	4,630.89
	(0.00)	(0.00)

Note
1. Inventory-material: 1 month of supply for waste treatment material and equi
2. Appropriated Earning: 15% of net income as required by China laws for futu

For Year Ended Dec 31, 2013 (Year 8)

Assets		In $1,000
	Beginning	Ending
Current Assets		
Cash	2,356.64	2,949.35
Accounts Receivable	262.07	275.17
Note Receivable		
Inventory		
Material	3.23	3.33
Total Current Assets	2,621.94	3,227.85
Long-Term Investment		
Property, Plant and Equipment		
Construction in Progress		
Acqusition Cost	4,281.73	4,281.73
Accumulated Depreciation	(2,272.78)	(2,597.47)
Total Property, Plant and Equipment	2,008.95	1,684.27
Intangible Asset		
Land Lease-Permit		
Amortization		
Other Intangible		
Total Intangible Assets		
Total Assets	4,630.89	4,912.12
Liability and Stockholders' Equity		
Current Liability		
Account Payable	3.23	3.33
Note Payable		
Accrued Interest		
Income Tax Payable		
Accrued Wages, Salaries		
Deposits Received from Customers		
Total Current Liabilities	3.23	3.33
Long-Term Debt	1,735.03	1,485.03
Total Liabilities	1,738.26	1,488.36
Stockholder's Equity		
Capital Stock	1,246.70	1,246.70
Additional Paid-in Capital		
Retained Earnings		
Appropriated Earnings	246.89	326.56
Unappropriated Earnings	1,399.04	1,850.50
Total Retained Earnings	1,645.93	2,177.06
Total Liabilities and Stockholders' Equity	4,630.89	4,912.11
	(0.00)	(0.00)

Note
1. Inventory-material: 1 month of supply for waste treatment material and equip
2. Appropriated Earning: 15% of net income as required by China laws for futur

Tianjin Radioactive Waste Treatment
Project Balance Sheet

For Year Ended Dec 31, 2014 (Year 9)

Assets		In $1,000
	Beginning	Ending
Current Assets		
Cash	2,949.35	3,614.23
Accounts Receivable	275.17	288.28
Note Receivable		
Inventory		
Material	3.33	3.43
Total Current Assets	3,227.85	3,905.95
Long-Term Investment		
Property, Plant and Equipment		
Construction in Progress		
Acqusition Cost	4,281.73	4,281.73
Accumulated Depreciation	(2,597.47)	(2,922.15)
Total Property, Plant and Equipment	1,684.27	1,359.59
Intangible Asset		
Land Lease-Permit		
Amortization		
Other Intangible		
Total Intangible Assets		
Total Assets	4,912.12	5,265.53
Liability and Stockholders' Equity		
Current Liability		
Account Payable	3.33	3.43
Note Payable		
Accrued Interest		
Income Tax Payable		
Accrued Wages, Salaries		
Deposits Received from Customers		
Total Current Liabilities	3.33	3.43
Long-Term Debt	1,485.03	1,235.03
Total Liabilities	1,488.36	1,238.46
Stockholder's Equity		
Capital Stock	1,246.70	1,246.70
Additional Paid-in Capital		
Retained Earnings		
Appropriated Earnings	326.56	417.06
Unappropriated Earnings	1,850.50	2,363.31
Total Retained Earnings	2,177.06	2,780.37
Total Liabilities and Stockholders' Equity	4,912.11	5,265.53
	(0.00)	(0.00)

Note
1. Inventory-material: 1 month of supply for waste treatment material and equip
2. Appropriated Earning: 15% of net income as required by China laws for futur

For Year Ended Dec 31, 2015 (Year 10)

Assets		In $1,000
	Beginning	Ending
Current Assets		
Cash	3,614.23	4,398.05
Accounts Receivable	288.28	301.41
Note Receivable		
Inventory		
Material	3.43	3.53
Total Current Assets	3,905.95	4,703.00
Long-Term Investment		
Property, Plant and Equipment		
Construction in Progress		
Acqusition Cost	4,281.73	4,281.73
Accumulated Depreciation	(2,922.15)	(3,246.83)
Total Property, Plant and Equipment	1,359.59	1,034.90
Intangible Asset		
Land Lease-Permit		
Amortization		
Other Intangible		
Total Intangible Assets		
Total Assets	5,265.53	5,737.90
Liability and Stockholders' Equity		
Current Liability		
Account Payable	3.43	3.53
Note Payable		
Accrued Interest		
Income Tax Payable		
Accrued Wages, Salaries		
Deposits Received from Customers		
Total Current Liabilities	3.43	3.53
Long-Term Debt	1,235.03	1,035.03
Total Liabilities	1,238.46	1,038.56
Stockholder's Equity		
Capital Stock	1,246.70	1,246.70
Additional Paid-in Capital		
Retained Earnings		
Appropriated Earnings	417.06	517.90
Unappropriated Earnings	2,363.31	2,934.74
Total Retained Earnings	2,780.37	3,452.64
Total Liabilities and Stockholders' Equity	5,265.53	5,737.90
	(0.00)	(0.00)

Note
1. Inventory-material: 1 month of supply for waste treatment material and equipn
2. Appropriated Earning: 15% of net income as required by China laws for future

Tianjin Radioactive Waste Treatment
Project Balance Sheet

For Year Ended Dec 31, 2016 (Year 11)

Assets		In $1,000
	Beginning	Ending
Current Assets		
Cash	4,398.05	1,121.29
Accounts Receivable	301.41	314.55
Note Receivable		
Inventory		
Material	3.53	3.64
Total Current Assets	4,703.00	1,439.48
Long-Term Investment		
Property, Plant and Equipment		
Construction in Progress		
Acqusition Cost	4,281.73	5,277.13
Accumulated Depreciation	(3,246.83)	(717.63)
Total Property, Plant and Equipment	1,034.90	4,559.50
Intangible Asset		
Land Lease-Permit		
Amortization		
Other Intangible		
Total Intangible Assets		
Total Assets	5,737.90	5,998.98
Liability and Stockholders' Equity		
Current Liability		
Account Payable	3.53	3.64
Note Payable		
Accrued Interest		
Income Tax Payable		
Accrued Wages, Salaries		
Deposits Received from Customers		
Total Current Liabilities	3.53	3.64
Long-Term Debt	1,035.03	835.03
Total Liabilities	1,038.56	838.67
Stockholder's Equity		
Capital Stock	1,246.70	1,246.70
Additional Paid-in Capital		
Retained Earnings		
Appropriated Earnings	517.90	587.04
Unappropriated Earnings	2,934.74	3,326.57
Total Retained Earnings	3,452.64	3,913.61
Total Liabilities and Stockholders' Equity	5,737.90	5,998.98
	(0.00)	(0.00)

Note
1. Inventory-material: 1 month of supply for waste treatment material and equi
2. Appropriated Earning: 15% of net income as required by China laws for futu

For Year Ended Dec 31, 2017 (Year 12)

Assets		In $1,000
	Beginning	Ending
Current Assets		
Cash	1,121.29	2,021.41
Accounts Receivable	314.55	327.70
Note Receivable		
Inventory		
Material	3.64	3.75
Total Current Assets	1,439.48	2,352.85
Long-Term Investment		
Property, Plant and Equipment		
Construction in Progress		
Acqusition Cost	5,277.13	5,277.13
Accumulated Depreciation	(717.63)	(1,131.90)
Total Property, Plant and Equipment	4,559.50	4,145.23
Intangible Asset		
Land Lease-Permit		
Amortization		
Other Intangible		
Total Intangible Assets		
Total Assets	5,998.98	6,498.08
Liability and Stockholders' Equity		
Current Liability		
Account Payable	3.64	3.75
Note Payable		
Accrued Interest		
Income Tax Payable		
Accrued Wages, Salaries		
Deposits Received from Customers		
Total Current Liabilities	3.64	3.75
Long-Term Debt	835.03	585.03
Total Liabilities	838.67	588.78
Stockholder's Equity		
Capital Stock	1,246.70	1,246.70
Additional Paid-in Capital		
Retained Earnings		
Appropriated Earnings	587.04	699.39
Unappropriated Earnings	3,326.57	3,963.22
Total Retained Earnings	3,913.61	4,662.61
Total Liabilities and Stockholders' Equity	5,998.98	6,498.08
	(0.00)	(0.00)

Note
1. Inventory-material: 1 month of supply for waste treatment material and equip
2. Appropriated Earning: 15% of net income as required by China laws for futur

Tianjin Radioactive Waste Treatment
Project Balance Sheet

For Year Ended Dec 31, 2018 (Year 13)

Assets		
		In $1,000
	Beginning	Ending
Current Assets		
Cash	2,021.41	2,989.22
Accounts Receivable	327.70	340.86
Note Receivable		
Inventory		
Material	3.75	3.86
Total Current Assets	2,352.85	3,333.94
Long-Term Investment		
Property, Plant and Equipment		
Construction in Progress		
Acqusition Cost	5,277.13	5,277.13
Accumulated Depreciation	(1,131.90)	(1,546.17)
Total Property, Plant and Equipment	4,145.23	3,730.96
Intangible Asset		
Land Lease-Permit		
Amortization		
Other Intangible		
Total Intangible Assets		
Total Assets	6,498.08	7,064.90
Liability and Stockholders' Equity		
Current Liability		
Account Payable	3.75	3.86
Note Payable		
Accrued Interest		
Income Tax Payable		
Accrued Wages, Salaries		
Deposits Received from Customers		
Total Current Liabilities	3.75	3.86
Long-Term Debt	585.03	335.03
Total Liabilities	588.78	338.89
Stockholder's Equity		
Capital Stock	1,246.70	1,246.70
Additional Paid-in Capital		
Retained Earnings		
Appropriated Earnings	699.39	821.90
Unappropriated Earnings	3,963.22	4,657.41
Total Retained Earnings	4,662.61	5,479.31
Total Liabilities and Stockholders' Equity	6,498.08	7,064.90
	(0.00)	(0.00)

Note
1. Inventory-material: 1 month of supply for waste treatment material and equi
2. Appropriated Earning: 15% of net income as required by China laws for futu

For Year Ended Dec 31, 2019 (Year 14)

Assets		
		In $1,000
	Beginning	Ending
Current Assets		
Cash	2,989.22	4,023.50
Accounts Receivable	340.86	354.03
Note Receivable		
Inventory		
Material	3.86	3.97
Total Current Assets	3,333.94	4,381.50
Long-Term Investment		
Property, Plant and Equipment		
Construction in Progress		
Acqusition Cost	5,277.13	5,277.13
Accumulated Depreciation	(1,546.17)	(1,960.44)
Total Property, Plant and Equipment	3,730.96	3,316.69
Intangible Asset		
Land Lease-Permit		
Amortization		
Other Intangible		
Total Intangible Assets		
Total Assets	7,064.90	7,698.19
Liability and Stockholders' Equity		
Current Liability		
Account Payable	3.86	3.97
Note Payable		
Accrued Interest		
Income Tax Payable		
Accrued Wages, Salaries		
Deposits Received from Customers		
Total Current Liabilities	3.86	3.97
Long-Term Debt	335.03	85.03
Total Liabilities	338.89	89.00
Stockholder's Equity		
Capital Stock	1,246.70	1,246.70
Additional Paid-in Capital		
Retained Earnings		
Appropriated Earnings	821.90	954.37
Unappropriated Earnings	4,657.41	5,408.12
Total Retained Earnings	5,479.31	6,362.49
Total Liabilities and Stockholders' Equity	7,064.90	7,698.19
	(0.00)	(0.00)

Note
1. Inventory-material: 1 month of supply for waste treatment material and equi
2. Appropriated Earning: 15% of net income as required by China laws for futu

Tianjin Radioactive Waste Treatment
Project Balance Sheet

For Year Ended Dec 31, 2020 (Year 15)

Assets		
		In $1,000
	Beginning	Ending
Current Assets		
Cash	4,023.50	5,280.77
Accounts Receivable	354.03	367.20
Note Receivable		
Inventory		
Material	3.97	4.09
Total Current Assets	4,381.50	5,652.06
Long-Term Investment		
Property, Plant and Equipment		
Construction in Progress		
Acqusition Cost	5,277.13	5,277.13
Accumulated Depreciation	(1,960.44)	(2,374.71)
Total Property, Plant and Equipment	3,316.69	2,902.42
Intangible Asset		
Land Lease-Permit		
Amortization		
Other Intangible		
Total Intangible Assets		
Total Assets	7,698.19	8,554.48
Liability and Stockholders' Equity		
Current Liability		
Account Payable	3.97	4.09
Note Payable		
Accrued Interest		
Income Tax Payable		
Accrued Wages, Salaries		
Deposits Received from Customers		
Total Current Liabilities	3.97	4.09
Long-Term Debt	85.03	0.00
Total Liabilities	89.00	4.09
Stockholder's Equity		
Capital Stock	1,246.70	1,246.70
Additional Paid-in Capital		
Retained Earnings		
Appropriated Earnings	954.37	1,095.55
Unappropriated Earnings	5,408.12	6,208.14
Total Retained Earnings	6,362.49	7,303.69
Total Liabilities and Stockholders' Equity	7,698.19	8,554.48
	(0.00)	(0.00)

Note
1. Inventory-material: 1 month of supply for waste treatment material and equipment maint. material
2. Appropriated Earning: 15% of net income as required by China laws for future growth and welfare.

Cash Flow Analysis and Internal Rate of Return

Cash Flow Analysis

(In $1,000 USD)

Item	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Total	Per Year
Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020		
Cash Inflow																		
Cash Sales	0	2,022.38	2,165.14	2,308.19	2,451.51	2,595.05	2,738.81	2,882.75	3,026.87	3,171.13	3,315.54	3,315.54	3,604.71	3,749.45	3,894.29	4,039.20	45,280.56	3,018.70
Cash Collection from Receivable			183.85	196.83	209.84	222.86	235.91	248.98	262.07	275.17	288.28	301.41	314.55	327.70	340.86	354.03	3762.3536	268.74
Proceeds from Sale of FA																		
Total Cash Inflow	-	2,022.38	2,348.99	2,505.02	2,661.34	2,817.91	2,974.72	3,131.73	3,288.93	3,446.30	3,603.83	3,616.95	3,919.26	4,077.16	4,235.15	4,393.23	49042.915	3,269.53
Cash Outflow																		
Start-up Investment	4,281.73																	
Plant & Equipment Replacement												4265.92						
Annual Operation Cost Payment		1,375.68	1,421.95	1,469.36	1,517.95	1,567.75	1,618.79	1,671.11	1,724.75	1,779.75	1,836.14	1,893.96	1,953.27	2,014.09	2,076.48	2,140.49	26,061.51	1,737.43
Interest Payment		190.78	181.03	171.28	158.28	145.28	129.03	112.78	96.53	80.28	67.28	54.28	38.03	21.78	5.53	0.00	1,452.13	96.81
Income Tax Payment		6.48	42.90	78.96	115.71	152.05	189.02	225.55	261.60	297.15	331.12	227.05	368.91	402.26	435.00	463.58	3,597.34	239.82
Loan Principal Repayment		100.00	150.00	150.00	200.00	200.00	250.00	250.00	250.00	250.00	200.00	200.00	250.00	250.00	250.00	85.03	3,035.03	202.34
Total Cash Outflow	4,281.73	1,672.95	1,795.88	1,869.60	1,991.93	2,065.07	2,186.84	2,259.44	2,332.88	2,407.18	2,434.53	6,641.21	2,610.20	2,688.12	2,767.01	2,689.09	42,693.66	2,560.79
Annual Net Cash Inflow	(4,281.73)	349.43	553.11	635.42	669.41	752.85	787.88	872.30	956.06	1,039.13	1,169.30	(3,024.25)	1,309.06	1,389.03	1,468.14	1,704.14	6,349.26	708.73
Accumulated Cash Flow	(4,281.73)	349.43	902.54	1,537.96	2,207.37	2,960.22	3,748.10	4,620.40	5,576.45	6,615.58	7,784.88	4,760.62	6,069.68	7,458.72	8,926.85	10,630.99	69,868.06	4,943.32

Internal Rate of Return 12%

Note:

1. Cash Sales: Formula: Annual Sales / 12 * 11
2. Annual Operation Cost: Non cash expense, such as depreciation, is not included.

Tianjin Radioactive Waste Treatment Project
Statement of Cash Flow Analysis

For Year Ended Dec 31, 2006 (Year 1)			*For Year Ended Dec 31, 2007 (Year 2)*		
	In $1,000 USD			In $1,000 USD	
Cash Flow from Operating Activities			Cash Flow from Operating Activities		
Net Income		13.17	Net Income		87.11
Adjustment to reconcile net income to			Adjustment to reconcile net income to		
net cash provided by operating acitivities			net cash provided by operating acitivities		
Depreciation Expense	324.68		Depreciation Expense	324.68	
(Gain)/Loss on disposal of FA			(Gain)/Loss on disposal of FA		
Increase in Accounts Receivable	(183.85)		Increase in Accounts Receivable	(12.98)	
Increase in Accounts Payable	2.71		Increase in Accounts Payable	2.79	
Increase in Inventory	(2.71)	140.83	Increase in Inventory	(2.79)	311.70
Net cash provided by operating acitivities		154.00	Net cash provided by operating acitivities		398.81
Cash Flow from Investing Activitis			Cash Flow from Investing Activitis		
Purchase of land			Purchase of land		
Purchase of building			Purchase of building		
Purchase of equipment			Purchase of equipment		
Net cash provided by investing activities			Net cash provided by investing activities		
Cash Flow from Financing Activities			Cash Flow from Financing Activities		
Payment of Long-Term Debt	(100.00)		Payment of Long-Term Debt	(150.00)	
Appropriated Earning			Appropriated Earning		
Payment of Cash Dividends			Payment of Cash Dividends		
Net Cash Provided by financing activities		-100.00	Net Cash Provided by financing activities		-150.00
Net Increase in Cash		54.00	Net Increase in Cash		248.81
Cash, Jan 1, 2006		-	Cash, Jan 1, 2007		54.00
Cash, Dec 31,2006		54.00	Cash, Dec 31,2007		302.81
		-			-

Tianjin Radioactive Waste Treatment Project
Statement of Cash Flow Analysis

For Year Ended Dec 31, 2008 (Year 3)		In $1,000 USD	*For Year Ended Dec 31, 2009 (Year 4)*		In $1,000 USD
Cash Flow from Operating Activities			Cash Flow from Operating Activities		
Net Income		160.32	Net Income		234.92
Adjustment to reconcile net income to			Adjustment to reconcile net income to		
net cash provided by operating acitivities			net cash provided by operating acitivities		
Depreciation Expense	324.68		Depreciation Expense	324.68	
(Gain)/Loss on disposal of FA			(Gain)/Loss on disposal of FA		
Increase in Accounts Receivable	(13.00)		Increase in Accounts Receivable	(13.03)	
Increase in Accounts Payable	2.87		Increase in Accounts Payable	2.96	
Increase in Inventory	(2.87)	311.68	Increase in Inventory	(2.96)	311.65
Net cash provided by operating acitivities		472.00	Net cash provided by operating acitivities		546.58
Cash Flow from Investing Activitis			Cash Flow from Investing Activitis		
Purchase of land			Purchase of land		
Purchase of building			Purchase of building		
Purchase of equipment			Purchase of equipment		
Net cash provided by investing activities			Net cash provided by investing activities		
Cash Flow from Financing Activities			Cash Flow from Financing Activities		
Payment of Long-Term Debt	(150.00)		Payment of Long-Term Debt	(200.00)	
Appropriated Earning			Appropriated Earning		
Payment of Cash Dividends			Payment of Cash Dividends		
Net Cash Provided by financing activities		(150.00)	Net Cash Provided by financing activities		(200.00)
Net Increase in Cash		322.00	Net Increase in Cash		346.58
Cash, Jan 1, 2008		302.81	Cash, Jan 1, 2009		624.81
Cash, Dec 31,2008		624.81	Cash, Dec 31,2009		971.39
		-			-

Tianjin Radioactive Waste Treatment Project
Statement of Cash Flow Analysis

For Year Ended Dec 31, 2010 (Year 5)		In $1,000 USD	*For Year Ended Dec 31, 2011 (Year 6)*		In $1,000 USD
Cash Flow from Operating Activities			Cash Flow from Operating Activities		
Net Income		308.70	Net Income		383.78
Adjustment to reconcile net income to			Adjustment to reconcile net income to		
net cash provided by operating acitivities			net cash provided by operating acitivities		
Depreciation Expense	324.68		Depreciation Expense	324.68	
(Gain)/Loss on disposal of FA			(Gain)/Loss on disposal of FA		
Increase in Accounts Receivable	(13.05)		Increase in Accounts Receivable	(13.07)	
Increase in Accounts Payable	3.05		Increase in Accounts Payable	3.14	
Increase in Inventory	(3.05)	311.63	Increase in Inventory	(3.14)	311.61
Net cash provided by operating acitivities		620.33	Net cash provided by operating acitivities		695.39
Cash Flow from Investing Activitis			Cash Flow from Investing Activitis		
Purchase of land			Purchase of land		
Purchase of building			Purchase of building		
Purchase of equipment			Purchase of equipment		
Net cash provided by investing activities			Net cash provided by investing activities		
Cash Flow from Financing Activities			Cash Flow from Financing Activities		
Payment of Long-Term Debt	(200.00)		Payment of Long-Term Debt	(250.00)	
Appropriated Earning			Appropriated Earning		
Payment of Cash Dividends			Payment of Cash Dividends		
Net Cash Provided by financing activities		(200.00)	Net Cash Provided by financing activities		(250.00)
Net Increase in Cash		420.33	Net Increase in Cash		445.39
Cash, Jan 1, 2010		971.39	Cash, Jan 1, 2011		1,391.72
Cash, Dec 31,2010		1,391.72	Cash, Dec 31,2011		1,837.11
		-			-

Tianjin Radioactive Waste Treatment Project
Statement of Cash Flow Analysis

For Year Ended Dec 31, 2012 (Year 7)		In $1,000 USD	*For Year Ended Dec 31, 2013 (Year 8)*		In $1,000 USD
Cash Flow from Operating Activities			Cash Flow from Operating Activities		
Net Income		457.93	Net Income		531.13
Adjustment to reconcile net income to			Adjustment to reconcile net income to		
net cash provided by operating acitivities			net cash provided by operating acitivities		
Depreciation Expense	324.68		Depreciation Expense	324.68	
(Gain)/Loss on disposal of FA			(Gain)/Loss on disposal of FA		
Increase in Accounts Receivable	(13.09)		Increase in Accounts Receivable	(13.10)	
Increase in Accounts Payable	3.23		Increase in Accounts Payable	3.33	
Increase in Inventory	(3.23)	311.60	Increase in Inventory	(3.33)	311.58
Net cash provided by operating acitivities		769.53	Net cash provided by operating acitivities		842.71
Cash Flow from Investing Activitis			Cash Flow from Investing Activitis		
Purchase of land			Purchase of land		
Purchase of building			Purchase of building		
Purchase of equipment			Purchase of equipment		
Net cash provided by investing activities			Net cash provided by investing activities		
Cash Flow from Financing Activities			Cash Flow from Financing Activities		
Payment of Long-Term Debt	(250.00)		Payment of Long-Term Debt	(250.00)	
Appropriated Earning			Appropriated Earning		
Payment of Cash Dividends			Payment of Cash Dividends		
Net Cash Provided by financing activities		(250.00)	Net Cash Provided by financing activities		(250.00)
Net Increase in Cash		519.53	Net Increase in Cash		592.71
Cash, Jan 1, 2012		1,837.11	Cash, Jan 1, 2013		2,356.64
Cash, Dec 31,2012		2,356.64	Cash, Dec 31,2013		2,949.35
		-			-

Tianjin Radioactive Waste Treatment Project
Statement of Cash Flow Analysis

For Year Ended Dec 31, 2014 (Year 9)		In $1,000 USD	*For Year Ended Dec 31, 2015 (Year 10)*		In $1,000 USD
Cash Flow from Operating Activities			Cash Flow from Operating Activities		
Net Income		603.31	Net Income		672.27
Adjustment to reconcile net income to			Adjustment to reconcile net income to		
net cash provided by operating acitivities			net cash provided by operating acitivities		
Depreciation Expense	324.68		Depreciation Expense	324.68	
(Gain)/Loss on disposal of FA			(Gain)/Loss on disposal of FA		
Increase in Accounts Receivable	(13.12)		Increase in Accounts Receivable	(13.13)	
Increase in Accounts Payable	3.43		Increase in Accounts Payable	3.53	
Increase in Inventory	(3.43)	311.57	Increase in Inventory	(3.53)	311.56
Net cash provided by operating acitivities		914.88	Net cash provided by operating acitivities		983.82
Cash Flow from Investing Activitis			Cash Flow from Investing Activitis		
Purchase of land			Purchase of land		
Purchase of building			Purchase of building		
Purchase of equipment			Purchase of equipment		
Net cash provided by investing activities			Net cash provided by investing activities		
Cash Flow from Financing Activities			Cash Flow from Financing Activities		
Payment of Long-Term Debt	(250.00)		Payment of Long-Term Debt	(200.00)	
Appropriated Earning			Appropriated Earning		
Payment of Cash Dividends			Payment of Cash Dividends		
Net Cash Provided by financing activities		(250.00)	Net Cash Provided by financing activities		(200.00)
Net Increase in Cash		664.88	Net Increase in Cash		783.82
Cash, Jan 1, 2014		2,949.35	Cash, Jan 1, 2015		3,614.23
Cash, Dec 31,2014		3,614.23	Cash, Dec 31,2015		4,398.05
		-			-

Tianjin Radioactive Waste Treatment Project
Statement of Cash Flow Analysis

For Year Ended Dec 31, 2016 (Year 11)		In $1,000 USD	*For Year Ended Dec 31, 2017 (Year 12)*		In $1,000 USD
Cash Flow from Operating Activities			Cash Flow from Operating Activities		
Net Income		460.98	Net Income		748.99
Adjustment to reconcile net income to			Adjustment to reconcile net income to		
net cash provided by operating acitivities			net cash provided by operating acitivities		
Depreciation Expense	414.27		Depreciation Expense	414.27	
(Gain)/Loss on disposal of FA	327.05		(Gain)/Loss on disposal of FA		
Increase in Accounts Receivable	(13.14)		Increase in Accounts Receivable	(13.15)	
Increase in Accounts Payable	3.64		Increase in Accounts Payable	3.75	
Increase in Inventory	(3.64)	728.18	Increase in Inventory	(3.75)	401.12
Net cash provided by operating acitivities		1,189.16	Net cash provided by operating acitivities		1,150.11
Cash Flow from Investing Activitis			Cash Flow from Investing Activitis		
Purchase of land			Purchase of land		
Purchase of building			Purchase of building		
Purchase of equipment	-4265.92		Purchase of equipment		
Net cash provided by investing activities		-4,265.92	Net cash provided by investing activities		-
Cash Flow from Financing Activities			Cash Flow from Financing Activities		
Payment of Long-Term Debt	(200.00)		Payment of Long-Term Debt	(250.00)	
Appropriated Earning			Appropriated Earning		
Payment of Cash Dividends			Payment of Cash Dividends		
Net Cash Provided by financing activities		(200.00)	Net Cash Provided by financing activities		(250.00)
Net Increase in Cash		-3,276.76	Net Increase in Cash		900.11
Cash, Jan 1, 2016		4,398.05	Cash, Jan 1, 2017		1,121.29
Cash, Dec 31,2016		1,121.29	Cash, Dec 31,2017		2,021.41
		-			-

Tianjin Radioactive Waste Treatment Project
Statement of Cash Flow Analysis

For Year Ended Dec 31, 2018 (Year 13)		In $1,000 USD	*For Year Ended Dec 31, 2019 (Year 14)*		In $1,000 USD
Cash Flow from Operating Activities			Cash Flow from Operating Activities		
Net Income		816.70	Net Income		883.18
Adjustment to reconcile net income to			Adjustment to reconcile net income to		
net cash provided by operating acitivities			net cash provided by operating acitivities		
Depreciation Expense	414.27		Depreciation Expense	414.27	
(Gain)/Loss on disposal of FA			(Gain)/Loss on disposal of FA		
Increase in Accounts Receivable	(13.16)		Increase in Accounts Receivable	(13.17)	
Increase in Accounts Payable	3.86		Increase in Accounts Payable	3.97	
Increase in Inventory	(3.86)	401.11	Increase in Inventory	(3.97)	401.10
Net cash provided by operating acitivities		1,217.81	Net cash provided by operating acitivities		1,284.28
Cash Flow from Investing Activitis			Cash Flow from Investing Activitis		
Purchase of land			Purchase of land		
Purchase of building			Purchase of building		
Purchase of equipment			Purchase of equipment		
Net cash provided by investing activities		-	Net cash provided by investing activities		-
Cash Flow from Financing Activities			Cash Flow from Financing Activities		
Payment of Long-Term Debt	(250.00)		Payment of Long-Term Debt	(250.00)	
Appropriated Earning			Appropriated Earning		
Payment of Cash Dividends			Payment of Cash Dividends		
Net Cash Provided by financing activities		(250.00)	Net Cash Provided by financing activities		(250.00)
Net Increase in Cash		967.81	Net Increase in Cash		1,034.28
Cash, Jan 1, 2018		2,021.41	Cash, Jan 1, 2019		2,989.22
Cash, Dec 31,2018		2,989.22	Cash, Dec 31,2019		4,023.50
		-			-

Tianjin Radioactive Waste Treatment Project
Statement of Cash Flow Analysis

For Year Ended Dec 31, 2020 (Year 15)

		In $1,000 USD
Cash Flow from Operating Activities		
Net Income		941.20
Adjustment to reconcile net income to		
net cash provided by operating acitivities		
Depreciation Expense	414.27	
(Gain)/Loss on disposal of FA		
Increase in Accounts Receivable	(13.17)	
Increase in Accounts Payable	4.09	
Increase in Inventory	(4.09)	401.10
Net cash provided by operating acitivities		1,342.30
Cash Flow from Investing Activitis		
Purchase of land		
Purchase of building		
Purchase of equipment		
Net cash provided by investing activities		-
Cash Flow from Financing Activities		
Payment of Long-Term Debt	(85.03)	
Appropriated Earning		
Payment of Cash Dividends		
Net Cash Provided by financing activities		(85.03)
Net Increase in Cash		1,257.27
Cash, Jan 1, 2020		4,023.50
Cash, Dec 31,2020		5,280.77
		-

VOLUME III

CHEMICAL/HAZARDOUS MATERIAL EMERGENCY RESPONSE SYSTEM

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Appendix C Various Field Emergency Monitoring Equipments, together with the Manufacturer Names, Locations and Contact, Models, Application, and Technical Specifications

1.0 INTRODUCTION

Part of the FS task is to assist Tianjing Environmental Protection Bureau (TEPB) in developing an emergency management, monitoring, and response system for chemical/hazardous material releases. Tianjin is a politically independent unit administrated directly by the People's of Republic China (PRC) central government. With approximately 4,400 square miles (11,399 square kilometers) of area and over 10.2 millions of population, Tianjin is the third largest city in China and a leading international port that serves as a collection and distribution center for the northern China plain. In addition to its importance in trading and transportation, Tianjin is also well known for its rich culture and industrial manufacturing background.

Tianjin is regarded as a city with the most abundant energy and mineral resources in China, including petroleum (over 1.4 billion tons in Dagang oil field), coal (over 0.68 billion tons), natural gas (over 10 billion cubic meters), geothermal energy, manganese, boron, tungsten, platinum, copper, zinc, iron, cement limestone, heavy spar, marble, and salt (one of the PRC's most important salt production areas). Tianjin started its salt and machinery parts manufacturing industries at the end of 14th century. Industrial and manufacturing operations have been further developed in a much faster pace after PRC's economic reform and open to the outside world. Currently, a system of 180 categories, 36 large enterprises of the pillar industries in machinery, electronics, chemical, and metallurgy forms Tianjin's industrial backbone. Representative industrial manufacturing activities include iron- and steel works; textile mills (cotton, woolen, and hemp); machine shops; a chemical industry based on salt, flour mills, and other food-processing establishments; paper mills; and plants making heavy machinery, automobiles, precision instruments/tools, cement, fertilizers, rubber products, carpets, lubricants, computers and computer components, and telecommunication equipment. It was reported that in 2004, the manufacturing sector accounted for the largest (53.2%) and fastest-growing (19.8%) sector of Tianjin's GDP. In 2005, the 12,000 industrial enterprises produced over RMB $283.3 billions (equivalent to US $35.5 billions), which is 4 times of that in 1990.

The need for establishing an emergency management, monitoring, and response system for chemical/hazardous material releases has become increasingly important for Tianjing as most of the industrial manufacturing operations utilize extensive chemicals and have potential risks for accidental releases or spills during the transportation, storage, processing, or post-processing (waste) phases.

2.0 CHEMICAL/HAZARDOUS MATERIAL EMERGENCY MANAGEMENT, MONITORING, AND RESPONSE SYSTEM IN U.S.

The framework of the U.S. hazardous material emergency management, monitoring, and response system consists of legislations and organizations that cross-over the fields of hazardous materials/chemicals, emergency planning and community right-to-know, public/worker health and safety, and environmental restoration.

2.1 Chemical/Hazardous Materials

Chemical/hazardous materials or substances (hereinafter referred to as hazardous materials) are generally referred to those chemicals, upon being exposed to or released into the environment,

result or may result in adverse impacts to the health and safety of employees or the public, natural ecological systems, or the environment. It includes chemicals, biological and disease-causing agents, hazardous wastes, or any other regulated substances. In the U.S., the regulatory agencies that are responsible for hazardous materials/substances may include U.S. Environmental Protection Agency (USEPA), Department of Transportation (DOT), Department of Energy (DOE), and Occupational Safety and Health Administration (OSHA) at the federal level; state environmental protection agency, department of health services, and occupational safety and health administration (such as Cal-OSHA in California) at the state level; and city or county health departments and fire departments at the local level.

At the federal level, the responsibility for regulating and enforcing hazardous materials laws is divided among several federal regulatory agencies, each with its own specific title in the Code of Federal Regulations (CFR):

- USEPA – regulates the release and cleanup of chemical/hazardous materials under the 40 CFR series
- OSHA – regulates occupational health and safety risks from the exposures of chemicals/hazardous material under the 29 CFR series
- DOT – regulates the transportation of chemical/hazardous materials under the 49 CFR series

State regulations may not always be the same as the federal regulations since some of them have independent authorities. The state may operate by delegation when receiving authorization from the federal agencies. They may also regulate beyond that required by the federal authority under provision of the state laws as long as these state laws are more stringent or address areas above those addressed by the federal government.

Several federal legislations have led to the development of environmental and occupational laws and regulations. These included the 1969 National Environmental Policy Act (NEPA), the 1970 Occupational Safety and Health Act, and the 1974 Transportation safety Act. Table 1 summarizes several applicable U.S. regulations and the responsible agencies governing hazardous materials/chemicals and wastes or emergency response for their releases. Table 1 clearly demonstrates that the emergency response process in the U.S. is built on the foundation of various environmental and health & safety laws and regulations that define hazardous substances/materials, safe handling and disposal procedures, specific functions of regulatory agencies, financial and legal liabilities of the responsible parties, and public involvements. This is also a constant evolving process as our knowledge and technology advances.

The 1995 Hazardous Material Transportation Act (HMTA) authorizes U.S. Department of Transportation (DOT) to regulate the transportation of hazardous materials and waste by land, water, or air, including pipelines. HMTA also authorizes United States Coast Guard (USCG) and International Maritime Organization (IMO) to regulate bulk shipment of hazardous materials by water. Under this act, DOT designated and assigned hazardous material to nine (9) specific classes and 17 divisions based on similarity of risks or chemical characteristics, with each class and division of hazardous material triggers different packaging, labeling, handling, and registration requirements. The transporters/shippers are responsible for properly identifying and classifying the shipment and providing appropriate containerization and labeling, including

Table 1. U.S. Regulations for Hazardous Chemical/Waste Emergency Response Program

Regulations/Laws	Major Contents	Authority and Responsibility
Hazardous Materials Transportation Act (HMTA), 1995	Regulates transportation of hazardous materials, DOT designates and assigns hazardous material to specific classes and divisions based on similarity of risks, with each class and division of hazardous material triggers different packaging, labeling, handling, and registration requirements. The following classification system was developed by DOT in 1990 using international classification standards: **Class 1 Explosives** Division 1.1 with massive explosion hazard 1.2 with projection hazard 1.3 with predominantly fire hazard 1.4 with no significant blast hazard 1.5 very intensive explosives (blasting agents) 1.6 extremely intensive detonating substances **Class 2 Gases** Division 2.1 flammable gas 2.2 non-flammable, non-poisonous compressed gas 2.3 gas poisonous by inhalation 2.4 corrosive gas (Canadian) **Class 3 Flammable Liquid and Combustible Liquid** **Class 4. Flammable Solid; Spontaneously Combustible Material; and Dangerous when Wet Material** Division 4.1 flammable solid 4.2 spontaneously combustible material 4.3 dangerous when wet material **Class 5 Oxidizers and Organic Peroxides** Division 5.1 oxidizers 5.2 organic peroxide **Class 6 Poisonous Material and Infectious Substances** Division 6.1 poisonous material 6.2 infectious substances **Class 7 Radioactive Material** **Class 8 Corrosive Material** **Class 9 Misc. Hazardous Material** When a material presents more than one class of hazards, DOT has established a "precedence of hazard" system to address the most serious hazard.	**DOT** – regulates the transportation of hazardous materials and wastes by land, water, or air, including pipelines **United States Coast Guard (USCG) and International Maritime Organization (IMO)** – regulates bulk shipment of materials by water **Shippers** – responsible for properly identifying and classifying the shipment and providing appropriate containerization and labeling, including the "class" in which the material will be shipped under
Resources Conservation and Recovery Act (RCRA), 1976	Establishes guidelines for the proper management and disposal of all hazardous wastes. The five major elements addressed are: 1. Classification of waste and hazardous waste 2. Cradle-to-grave manifest system, recordkeeping and reporting requirements 3. Standards for generators, transporters, and owners or operators of treatment, storage, or disposal facilities (TSDF) to follow, including detailed permitting processes 4. Enforcement of the standards through a permitting program and civil penalty policies 5. Authorization of state programs to operate in lieu of the federal program	**USEPA** – responsible for administering and implementing the rules and regulations set forth in RCRA **State EPA** – upon being delegated, acts as a representative of USEPA on the state level for administering and implementing the rules and regulations set forth in RCRA **Generators** – responsible for properly characterizing, classifying, and disposing of hazardous wastes under the RCRA manifest system **TSDF Owner and Operator** – responsible for securing proper permit and adhering to standard operating procedures for a TSDF that handling hazardous waste per RCRA guidelines
Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 1980	Commonly referred to as the "Superfund Act," with its main focus on immediate cleanup of hazardous waste contamination from accidental spills or from waste disposal sites that may result in long-term environmental damages. There are three types of responses taken under CERCLA: removal of the wastes, remedial actions at the site, and enforcement actions. The ultimate goal of CERCLA is to compel the responsible party/parties (RP or RPs) for the release of materials or contamination to pay for the cleanup of the release and any associated cleanup of the environment where the releases occurred. In the case where a potential responsible party/parties (PRP or PRPs) cannot be identified or located, the federal government, through CERCLA and its funds, would then cleanup the site to protect the public health and welfare of the environment	**USEPA** – responsible for administering and implementing the rules and regulations set forth in CERCLA **RP/RPs or PRP/PRPs** – responsible for all financial and civil responsibilities associated with unauthorized releases of chemicals/hazardous materials or wastes into the environment

Superfund Amendments Reauthorization Act (SARA), 1986	Provides five times the initial funding authorized under CERCLA, strengthens cleanup standards for contaminated sites and provides specific settlement procedures, increased enforcement power, and deadlines for cleanups. SARA also adds the Title III Community Right-To-Know provisions, requiring businesses to provide the public with information on their hazardous substances activities. Four major elements in the Emergency Planning and Community Right-To-Know Act (EPCRA) are: 1. Emergency planning and releases notification (Sections 301-304) 2. Community RTK reporting on chemicals (sections 311 and 312) 3. Emission Inventory (Section 313) 4. Misc. provisions (Section 322)	**USEPA** – responsible for administering and implementing the rules and regulations set forth in CERCLA **State and Local Governments** – responsible for developing emergency plans to respond to unexpected environmental release of potentially hazardous chemical substances **Facility/Business Owner or Operator** – responsible for completing an inventory of material safety data sheets (MSDS) for chemicals under OSHA requirements and submitting the MSDS inventory to the Local Emergency Planning Committee (LEPC), the State Emergency Planning Committee (SEPC), and local fire department with jurisdiction over the facility
Hazardous Waste Operations and Emergency Response (HAZWOPER), 1989	Rules and regulations promulgated by OSHA for the protection of workers from health and safety risks posed by hazardous material incidences or hazardous waste. It set forth requirements for hazard evaluation, training, medical surveillance, monitoring, personnel protective equipment (PPE), container handling, safety, decontamination, and emergency response	Various
Hazardous Waste Control Law (HWCL)	Outlined in the Health and Safety Code, Section 25100 through 25250, which is the basic hazardous waste law for California. It empowers California EPA to administer the state hazardous waste program. The HWCL outlines the basic cradle-to-grave concept, but is more stringent with regard to: 1. Small quantity generators 2. Transportation 3. Permitting of TSDF 4. Penalties for violations 5. Recycling of certain wastes 6. Stricter regulation of hazardous waste facilities	**California EPA** – as an authorized agency for USEPA to develop, administer, and implement all hazardous waste regulations in California **Transporters** – responsible for securing hazardous waste transporter licenses for transporting California and RCRA hazardous waste **Generators** – responsible for property characterizing, classifying, and disposing of hazardous wastes under the hazardous manifest system **TSDF Owner and Operator** – responsible for securing proper permit and adhering to standard operating procedures for a TSDF that handling hazardous waste per HWCL guidelines

the "class" in which the material are shipped under. Based on this, hazardous materials as defined by DOT include any chemicals/materials/substances exhibiting the following characteristics.

Hazardous Materials by DOT

- Class 1 - Explosives
  - ✓ Division 1.1 with massive explosion hazard
  - ✓ Division 1.2 with projection hazard
  - ✓ Division 1.3 with predominantly fire hazard
  - ✓ Division 1.4 with no significant blast hazard
  - ✓ Division 1.5 very intensive explosives (blasting agents)
  - ✓ Division 1.6 extremely intensive detonating substances
- Class 2 - Gases
  - ✓ Division 2.1 flammable gas
  - ✓ Division 2.2 non-flammable, non-poisonous compressed gas
  - ✓ Division 2.3 gas poisonous by inhalation
  - ✓ Division 2.4 corrosive gas (Canadian)
- Class 3 Flammable Liquid and Combustible Liquid
- Class 4. Flammable Solid; Spontaneously Combustible Material; and Dangerous when Wet Material
  - ✓ Division 4.1 flammable solid
  - ✓ Division 4.2 spontaneously combustible material
  - ✓ Division 4.3 dangerous when wet material
- Class 5 Oxidizers and Organic Peroxides
  - ✓ Division 5.1 oxidizers
  - ✓ Division 5.2 organic peroxide
- Class 6 Poisonous Material and Infectious Substances
  - ✓ Division 6.1 poisonous material
  - ✓ Division 6.2 infectious substances

- Class 7 Radioactive Material
- Class 8 Corrosive Material
- Class 9 Misc. Hazardous Material

When a material presents more than one class of hazards, DOT has established a "precedence of hazard" system to address the most serious hazard.

As stated, hazardous materials also include waste generated from industrial or commercial manufacturing and/or processing activities. Therefore, USEPA has developed hazardous waste criteria and regulations for waste generators and treatment/storage/disposal facilities (TSDF).under the 1976 Resources Conservation and Recovery Act (RCRA), 1980 Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, also known as the Superfund Act), and 1986 Superfund Amendment Reauthorization Act (SARA). The CERCLA also broadened the definition of hazardous substances to include hazardous substances under the clean water act (CWA), hazardous waste regulated by RCRA, and "imminently hazardous chemicals" under the Toxic Substances Control Act (TSCA); but excluded crude oils, petroleum products, and natural gas products.

Hazardous Waste (HW) by USEPA

- It is a subset of "Solid Waste" and may include wastes in solid, semi-solid, liquid, or even contained (compressed) gas forms
- RCRA also included certain "agricultural wastes, certain "chemicals of medical waste," and specified "high-volume (>45,000 metric tons of non-liquid or 1 million metric tons of liquid wastes), low toxicity waste (meets USEPA leachate tests or pH measurement)"
- USEPA four categories of listed chemicals (approx. 500) – regardless of concentrations
  - ✓ HW from non-specific sources (F-Wastes)
  - ✓ HW from specific sources (K-Wastes)
  - ✓ Discarded commercial chemical products, off-specification species, container residues, and spill residues
    - Hazardous waste (U-Wastes)
    - Acute HW (AHW) that are particularly dangerous (P-Waste and six of F-Wastes) – lower regulatory thresholds and additional reporting requirements
- USEPA four classes of characteristics HW (D-Wastes)
  - ✓ Ignitability (D001)
  - ✓ Corrosivity (D002)
  - ✓ Reactivity (D003)
  - ✓ Toxicity (D004 – D043)
- Failure of the USEPA Toxicity Characteristic Leaching Procedure (TCLP) criteria for any HW that is subject to landfill disposal under the LDRs
- "Mixture and Derived-from" Rules – Most mixtures containing a HW, or that are derived from treatment of a HW, continue to be regulated as HW unless a determination is made that the material is no longer hazardous. After August 14, 2001, this rules excludes the following:
  - ✓ Mixtures containing/derived from reactive, corrosive, or ignitable wastes no longer exhibit the characteristic(s) for which the waste originally qualified
  - ✓ Mixtures resulted from the "extraction, beneficiation and processing of ores and minerals" – USEPA excluded 20 specific mineral processing waste
  - ✓ Mixtures is also qualified as a Low Level Mixed Waste (LLMW) and subject to the control and regulations of Atomic Energy Act (AEA)
  - ✓ Wastewaters contain specified wastes, but subject to discharge control under the Clean Water Act (CWA)

RCRA excludes "household HW," solids or dissolved material in domestic sewage, point source industrial discharges into the waterway (NPDES), medical waste (non-chemicals), and spent nuclear waste material. Additionally, USEPA has designated certain hazardous wastes that are extremely common in business and household use as "Universal Waste or UW" and encouraged recycling instead of treatment. These UW includes used oil/filters, waste recyclable lead-acid batteries (except auto batteries and those used for backup power) and Hg-containing batteries (except for small "button cell" batteries), waste pesticides (only recalled ones under the Federal Inscticied, Fungicide and Rodenticide Act (FIFR), waste mercury-containing thermostats, and waste light tubes or bulbs. Other wastes not included in these categories are still required to be handled and treated as hazardous wastes. To encourage recycling, USEPA also does not require small waste generator (SWG) and large waste generator (LWG, 5,000 kg at one time) to obtain hazardous waste permit for managing and handling UW activities.

California, as one of the delegated states by the USEPA, has also developed hazardous waste management and control laws equally if not more stringent than the federal laws. For example, under the 1972 Hazardous Waste Control Laws (HWCL, California Code of Regulations Title 26), California developed and promulgated more stringent regulatory criteria for California Hazardous Waste (CA HW).

Hazardous Waste by California (CA HW)

- RCRA HW – Listed or characteristic HW as defined by USEPA
- Non-RCRA HW - California HW
  - ✓ Four mercury-containing wastes (M-Wastes)
  - ✓ Additional listed HW
  - ✓ Expanded toxicity characteristics tests for persistent and bioaccumulative waste
    - Total Threshold Limit Concentrations (TTLCs)
    - Soluble Threshold Limit Concentrations (STLCs)
    - Aquatic bioassays
  - ✓ Used oils (exclude those can be recycled, described below)
    - Generator can transfer up to 20 gals each time to a commercial non-TSD facility in containers <5 gal, provided that the receiving facility receives no other HW (e.g., service station)
    - Maintenance operation may transfer up to 55 gal used oils to consolidation point each time
    - Milk-run program – Haulers picks up used oils from multiple sources and provides "receipts" containing info similar to HW manifests to generators. Under the 2002 Consolidated Manifest Process, haulers then fill up a single HW manifest (as both generator and transporter) and take the used oils to a facility in compliance with RCRA std. for used oil management
  - ✓ Waste Pesticides
  - ✓ Asbestos
  - ✓ Polychlorinated Biphenyls (PCBs)
  - ✓ Universal Waste (additional)
    - Cathode ray tube (CRT) material
    - Consumer electronic devices
    - Aerosol cans
    - Mercury-containing motor vehicle light switches
    - 10 additional mercury-containing waste streams (thermometers, dental amalgam
  - ✓ Perchlorate material and waste

The California Assembly Bill 2185 (AB#2185) in 1985 also clearly stated that hazardous materials include both hazardous substances and hazardous waste as defined by the following:

- Hazardous Substances Requiring a MSDS
- Hazardous Materials Regulated by USDOT
- Materials on CA Div. of Occupational Safety and Health Administration (CALOSHA) "Director's List"
- Hazardous and Extremely Hazardous Wastes (EHW) Regulated by the HWCL
- Radioactive Substances as defined by the Federal Nuclear Regulatory Commission (NRC)
- Perchlorate
- Other Materials that are Injurious to the Health and Safety of Persons or Harmful to the Environment

2.2 Emergency Planning and Community Right-to-Know

The Title III specifies processes and procedures for emergency planning and community right-to-know. Figure 1 shows major information flow as recommended under SARA, which includes

In addition to proving five (5) times the initial funding authorized under the CERCLA, strengthening cleanup standards, providing specific settlement procedures, increasing regulatory enforcement power through civil and criminal penalties, and setting deadlines for cleanup; the 1986 Superfund Amendment Reauthorization Act (SARA) also added Title III Community Right-to-Know through Emergency Planning and Community Right-to-Know Act (EPCRA) of 1986, which included the followings:

- Emergency planning for extremely hazardous substances (EHS) under SARA Sections 301 through 303, which requires the USEPA to define a list of EHS by revising the chemical list under chemical emergency preparedness program (CEPP, in which 355 EHS have been identified as of December 2004) and to establish threshold planning quantities (TPQ, ranged from 1 pound to 1,000 pounds).

- Establishment of state emergency response commission (SERC), local emergency planning districts (LEPD), and local emergency planning committees (LEPC) to develop and facilitate the implementation of emergency response plans for those facilities where extremely hazardous substances are present. The LEPC typically consists of state and local elected officials, law enforcement agencies, fire department, first aid/emergency medical service agencies, health organizations, local environmental groups, hospitals, transportation agencies, broadcast and print media, local government emergency services and disaster agencies, community groups, and facility owners/operators. The emergency response plan may include but is not limited to:

  - facility locations and routes of transportation for hazardous substances
  - notification procedures for facility owner, operator, and local emergency and medical personnel in the event of a release
  - methods for determining occurrence of a release and the likely population to be affected, and
  - evacuation plans and training programs

Facility that handles any EHS in quantities ≥ TPQ is required to submit annual inventory data to LEPC and SERC. Additionally, after the 911, the district plan must include community water systems.

- Reporting requirements for unauthorized releases/discharges of any EHS or any substances already subject to emergency notification requirements under Section 103(a) of CERCLA to National Response Center (NRC) under SARA sections 304.

- Reporting requirements for hazardous substances in workplace (10,000 lbs hazardous chemicals and the lesser of 500 lbs or TPQ for EHS). The facility is also required to (1) provide MSDS to state and district Title III agencies and local fire department (Section 311), and (2) submit Tiers I or II chemical inventory information to local agencies. Under Section 312, public can also request such information from the local agencies.

- Facility that handles the following chemicals, when exceeding their reporting quantities must file toxic chemical release inventory report annually under the Toxics Release Inventory Program (Section 313)
  - Over 600 USEPA Toxic chemicals and chemical "families"
  - USEPA persistent, bioaccumulative, and toxic (PBT) chemicals of special concern

Figure 1 shows a simplified diagram of emergency planning and reporting requirements under SARA Title III.

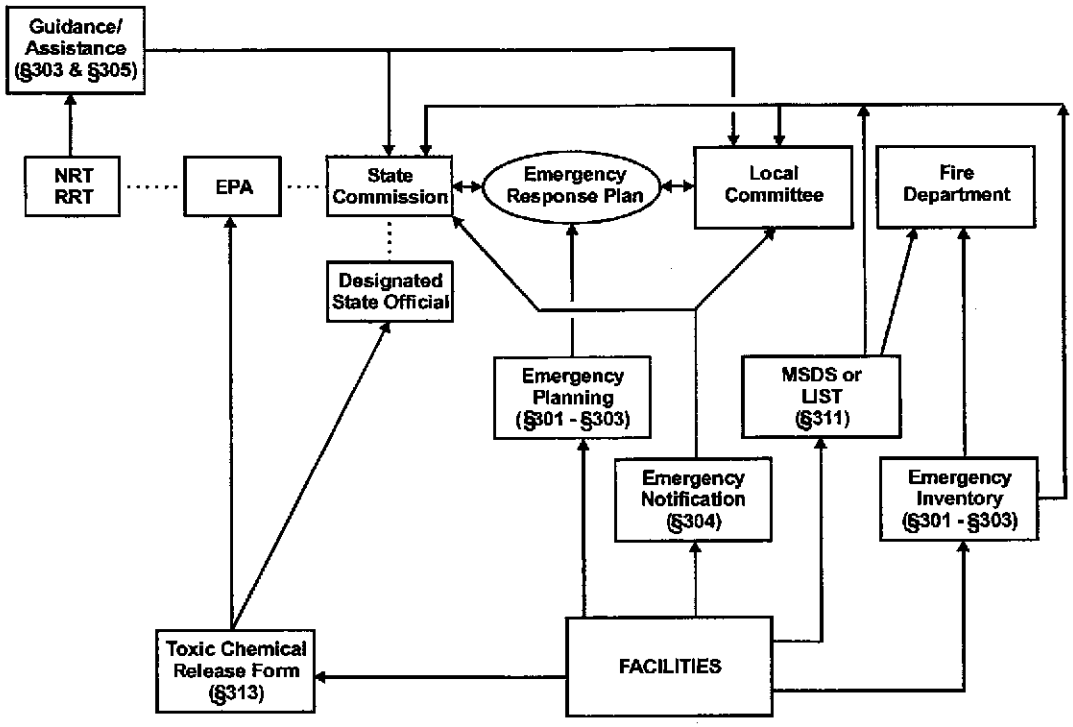

Figure 1. Simplified Schematic Diagram of Emergency Planning/Reporting Requirements under SARA Title III

The State of California also developed its own handling and emergency response legislation for hazardous materials via Assembly Bill 2185 (AB2185) in 1985. The following briefly summarizes the important contents of this bill.

AB2185 requires that any business handling hazardous materials exceeding the reporting thresholds (55 gallons for liquid, 500 lbs for solids, and 200 cubic feet for compressed gases) to prepare and submit a "Business Plan with hazardous material inventories" to the local administrative agency, Certified Unified Program Agency (CUPA). The following substances are exempted from the reporting threshold limits, including (1) consumer packages for direct distribution to the public; (2) up to 1,000 cubic feet of oxygen, nitrous oxide, and/or nitrogen in clinics, veterinarians, and pharmacists; and (3) up to 55 gallons of any lubricating oil, and up to 275 gallons of all lubricating oil stored by one business. AB2185 also requires CUPA to prepare an "Area Plan" for response to hazardous materials incidents. The State Office of Emergency Services (OES) is responsible for developing Business Plan reporting format, reviewing Area Plan, and coordinating State and federal SARA Title III activities.

Hazardous material inventories are to be documented in both State and Local Inventory Forms, and with a certification statement. The facility is required to notify CUPA within 30 days when a significant change of the inventory occurs. The information to be included in the hazardous material inventories and Business Plan includes

Contents of Hazardous Material Inventory

- Chemical common name and Chemical Abstracts Service (CAS) numbers
- Physical state (pure, mixed, solid, liquid, gas)
- Storage condition (P, T)
- Physical and health hazard categories (fire, reactivities, acute health hazards)
- Max. amount, ave. daily amount, number of days per years
- Total annual production of each hazardous waste

Contents of Business Plan (to be reviewed and amended or recertified every 3 years)

- Name of Owners/Operator
- Business Name, Phone Number, Address
- Standard Industrial Classification (SIC) Code
- Business Dun and Bradstreet Number
- Location of each Hazardous Materials from the Inventory (w/ a site map)
- 24-hr Emergency Response Contacts
- Any Trade Secretes
- On-site Emergency Response and Training Plans
- Each Business Reviews Its Business Plan Every 3 Years, Amend It or Certify No Changes

2.3 Hazardous Waste Operation and Emergency Response (HAZWOPER)

The 1989 HAZWOPER regulations set rules and regulations promulgated by OSHA for the protection of workers from health and safety risks posed by hazardous material incidences or hazardous waste. It sets forth requirements for hazard evaluation, training, medical surveillance,

monitoring, personnel protective equipment (PPE), container handling, safety, decontamination, and emergency response. The HAZWOPER (29 CFR 1910.120) also specifies health and safety training requirements as well as other qualifications for the emergency responders who may be the employees of the facilities or regulatory agencies.

- First responder awareness level – individuals who witness or discover a hazardous substance release and are trained to initiate an emergency response sequence by notifying the proper authority only (minimum requirement of OSHA 8-hr HAZWOPER training)
- First responder operations level – individuals who respond to releases or potential releases of hazardous substances in a defensive fashion by containing the release from a safe distance, rather than attempting to stop the release (minimum requirement of OSHA 24-hr HAZWOPER training)
- Hazardous materials technician – individuals who respond to releases or potential releases for the purpose of stopping the releases (minimum requirement of OSHA 40-hr HAZWOPER training).
- Hazardous materials specialist – individuals who respond with and provide support to hazardous materials technicians. Additionally, hazardous materials specialists are required to have specific knowledge towards various substances they may be called upon to contain (minimum requirement of OSHA 40-hr HAZWOPER training).
- On-scene incident commander – individual who will assume control of the incident scene beyond the first responder level with a minimum requirement of OSHA HAZWOPER training, preferably having an additional 8-hr supervisor training and is familiar with the Incident Command System (ICS) operation.

2.4 Incident Command System (ICS)

USEPA and OSHA have developed regulations that require the use of the Incident Command System (ICS) to provide managerial and reporting approach during an on-scene emergency response situation. With its basic common elements, it is simple enough for a small organization at a small incident, or it can be expanded to coordinate the activities of several organizations at a major incident. The ICS is designed so that an individual responder working within the system receives orders from only one person and reports to only one person. The ICS does not allow freelancing or actions be taken without the permission and knowledge of the incident commander or a member of his staff. Discipline is an essential element of the ICS. The ICS can be divided into five major functional areas as described below.

- Command – the incident commander (IC) is the official in charge and ultimately responsible for management of the entire response operation, which involves assessing the situation, establishing strategic goals, and ordering and allocating personnel, equipment, and other relevant resources. If required by the size or complexity of the emergency response, the IC may be assisted by command staff personnel as described below.
- Operations – responsible for directing all tactical operations to bring a hazardous material emergency under control. This involves a direct response at the hands-on level, such as

performing procedures intended to control, confine, and contain hazardous material releases.

- Logistics – provides equipment, supplies, and services needed to support the response operation; may range from procuring and transporting food to earth-moving equipment to the incident scene.
- Planning – responsible for collecting and evaluating information related to an incident and for developing action plans and alternative operations. Information provided by the planning group is utilized by command in decision-making.
- Finance – responsible for the financial aspects of an incident response. Financial concerns include supplies used in a response operation, procurement of materials required, timekeeping for response personnel, and other monetary matters

Figure 2 shows the chain-of-command reporting structure for the hazardous material emergency response ICS. The modular organization of the ICS allows the managerial system to shrink or expand as needed. In a simple response incident, the senior official of the team assumes the role of on-scene IC. However, in a more complex or severe response incident, the role of on-scene acting IC can be passed over as more senior officials arrive. As progressively larger numbers of personnel become involved, it will be necessary to delineate formally the functional sections subordinate to command and to assign individuals in charge of each section (e.g., planning section chief, operation section chief, logistics section chief, and financial section chief).

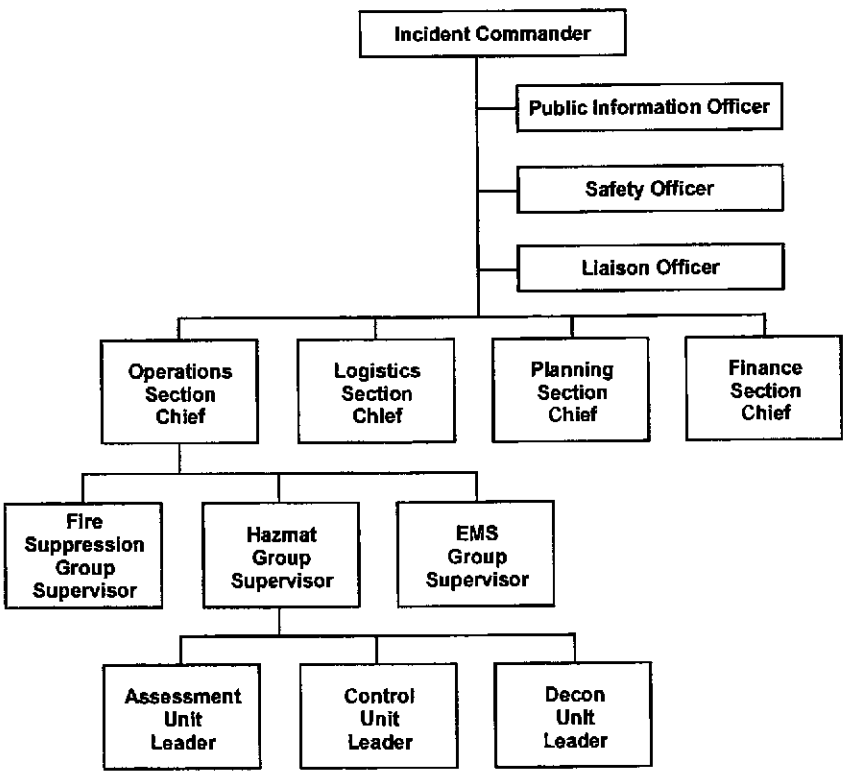

Figure 2. Hazardous Materials ICS Management Structure

3.0 EVOLUTION OF CHEMICAL/HAZARDOUS MATERIAL REGULATIONS IN PRC AND TIANJIN

This section reviews and summarizes relevant central and local (Tianjin) government policies/regulations on chemical and hazardous/toxic materials in PRC. In many cases, dangerous goods, toxic chemicals, hazardous materials, and toxic substances have synonymously used in these policies/regulations at different time. But they are all referred to chemical/hazardous materials.

3.1 PRC's National Policies/Regulations

Chemical production and consumption had traditionally played key factors in PRC's economic development. However, chemical management system, particularly for hazardous chemicals/materials, was not well developed in China, mainly because its complexity and involvements with various regulatory authorities governing public security, transportation, economic and trade, petrochemical, and environmental protection. Since the establishment of State Environmental Protection Administration (SEPA) Hazardous Chemical Environmental Management Division in 1985, PRC's chemical environmental management system has evolved from a simple information collection/exchange process to a standardized and systematic regulatory program.

In the 1980's and early 1990's, chemical environmental management systems were controlled by individual regulatory agencies, with little coordination and only on an as-needed basis. In 1982, PRC promulgated "Pesticides and Herbicides Registration Policy," which set precedent for chemical registration and management. The same year, the Ministries of Agricultures and Health published "Regulations for Safe Application of Herbicides and Pesticides." In February 1987, the State Council approved and promulgated "Chemical Hazardous Materials Safety Management Guidelines," which set the highest level of regulatory requirements for managing hazardous materials at the time. Nevertheless, this guideline did not provide sufficient details in managerial responsibilities and information related to environmental pollution prevention. In 1989, SEPA established Hazardous Chemical Environmental Management Office, responsible for developing and promulgating standards and regulations for chemicals/hazardous materials.

Since the 1990's, PRC has shown significant progress in environmental management and protection associated with chemical/hazardous materials as a result of the followings.

1. Clearly defined regulatory authorities and responsibilities as well as better coordination among different government agencies – The PRC State Council authorized SEPA as the central government agency in charge of environmental management for chemical/hazardous materials, including: (1) oversight and management responsibilities for environmental pollution prevention related to chemicals/hazardous materials, (2) development of environmental pollution prevention policies and regulations for chemical/hazardous materials, (3) development and promulgation of environmental management guidelines and technical standards for chemical/hazardous materials, and (4) publication of PRC's national and priority chemical/hazardous material lists. Other central government agencies were required to cooperate with SEPA, within their own jurisdictions, to properly manage their own chemical/hazardous materials environmental

pollution prevention programs. This is further solidified with the set up of Solid Waste and Chemical Management Division by the SEPA Department of Pollution Control in 1998, to take over the PRC's national environmental management responsibility for China's chemicals/hazardous materials. SEPA further established Inter-Agency Chemical Safety Coordination Committee, Pesticides/Herbicides Inventory Evaluation Committee, and Poisonous/Hazardous Chemical Evaluation Committee to strengthen policy/regulation development; coordination among agencies, technical committees, and NGOs; and PRC's international negotiation and information exchange position.

2. Improved and increasingly matured government policies and regulations – Development and promulgation of PRC's Chemical Substances Environmental Pollution Policy (Draft, 1995) and associated regulations (1997) by SEPA for (1) new chemicals, (2) priority chemicals with environmental significance, (3) Material Safety Data Sheet (MSDS for chemical classifications, labeling, and safety applications), (4) chemical incident emergency response, and (5) chemical environmental management technical support system.

3. Tightened regulatory control of chemical import/export activities – In March 1994, SEPA, China Custom, and Ministry of Foreign Economic Trade jointly announced the "Chemical First Time Import and Toxic/Hazardous Chemical Import and Export Environmental Management Guidelines," which was implemented in May 1, 1994. SEPA further established Chemical Record and Inventory Center to manage the documentation and approval of import and export trade of toxic/hazardous chemicals. At the same time, SEPA and China Custom prepared and published a detail list of regulated chemicals, including their chemical names and corresponding custom registration numbers. By 1999, SEPA published a list of forbidden and restricted toxic/hazardous chemicals and required mandatory registrations for the import and export of agricultural pesticides and herbicides to further protect the public health and environment.

4. Successful implementation of regional pilot test programs – In 1993, SEPA selected Tianjin and Nanchun to conduct pilot programs that focused on the strengthening of local chemical environmental management system, including regulatory infrastructure and legislations. As a result, Tianjin Municipal Government (TMG) promulgated "Tianjin Toxic/Hazardous Chemical Environmental Pollution Prevention Guidelines" in July 1999. Tianjin Environmental Protection Bureau (TEPB) also developed and implemented an electronic registration system for all imported and locally manufactured chemicals, which was linked to the Tianjin chemical computer management system.

5. Active participation of international chemical environmental management programs, such as the Intergovernmental Forum on Chemical Safety (IFCS), which was established by the joint effort of United Nations Environment Programme (UNEP), World Health organization (WHO), and International Labour Organization (ILO) pursuant to the 1994 United Nations Conference on Environment and Development (UNCED).

According to the State Council's "Chemical/Hazardous Material Safety Management Guidelines," the central government has the authority to: (1) regulate the manufacturing and commercial activities for toxic/hazardous chemicals by issuing permits; and (2) develop and enforce regulations associated with the application, storage, and transportation of toxic/hazardous chemicals. It addressed the following topics.

1. Permit (or license) to manufacturing and operating chemical/hazardous material businesses – The "Chemical/Hazardous Material Safety Management Guidelines" requires all chemical/hazardous material manufacturers to file manufacturing permit applications through provincial, special district, or special status city governments during the construction, expansion, and improvement or modification of their facilities. The application should include planning and design documents; chemical and physical properties of toxic chemicals/hazardous materials; methods and standards for chemical storage, transportation, and packaging; occupational health and safety evaluations, environmental impact assessments, and emergency response action plans. The 1984 "PRC Industrial Product Manufacturing Permit Guidelines (interim)" also authorized the PRC's Ministry of Petrochemicals (then) to approve and manage the issuance of petrochemical manufacturing permits, while the 1989 "Guidelines for Issuing Chemical and Hazardous Material Business Licenses" by the Ministry of Commerce provided specific administrative requirements for manufacturing and purchasing chemicals/hazardous materials. Similarly, the Ministry of Health, State Medicine and Pharmaceuticals Administration, and Ministry of Agriculture developed separate review and permitting processes for the manufacturing and commercial activities related to medicine, narcotics, and pharmaceutical products.

2. Registration of toxic chemicals/hazardous materials – Various PRC's central government agencies have developed and implemented registration systems for toxic chemicals or hazardous materials sine the early 1980's, including (1) agricultural pesticides and herbicides, (2) imported medicine and pharmaceutical products, and (3) toxic chemicals. The initial registration system for toxic chemicals was developed by the Ministry of Petrochemicals (then) in 1990 for 50 priority toxic chemicals under the "Toxic Industrial Chemicals Registration Requirements (Interim)." Facilities that manufacturing, processing, storing, or using these 50 priority toxic chemicals were required to register with the government according to the requirements of "Toxic Chemicals Registration/Filing System," which included the chemical names, chemical/physical properties, manufacturing or application processes, chemical distribution, occupational health and safety protection, toxicity, human health risks, and environmental and ecosystem impacts. For new chemicals developed after 1990, a different registration process would apply together with the MSDS system.

3. Transportation and storage control of toxic chemicals/hazardous materials – The "Chemical/Hazardous Material Safety Management Guidelines" set up specific facility and storage requirements for toxic chemicals/hazardous materials, including location, security, safety and fire prevention measures, communication, permissible quantities, and chemical classification/incompatibility. It also prohibited unauthorized shipment of chemical/hazardous materials by public and commercial trains, vessels, vehicles, and

airplanes. Transportation of chemicals/hazardous materials was regulated by the Ministries of Railways (Regulations for Railway Transportation of Dangerous/Hazardous Materials, 1962) and Transportation (Regulations for Transportation of Dangerous/Hazardous Materials by Ships/Waterway Vessels, 1982), which included specific registration and application requirements for transporting 609 listed toxic chemicals/hazardous materials.

4. Import and export control of toxic chemicals/hazardous materials – PRC has always maintained tight control of its import business through a licensing/permitting system administrated by the Ministry of Foreign Trade and Economic Development (then). However, other central government agencies also played an important role in the permitting/licensing processes for foreign goods and materials, including Ministries of Chemicals and Petrochemicals (then), Health, and Agriculture for imported agricultural chemicals and medicine/pharmaceutical products. In 1994, SEPA promulgated "Provisions on Environmental Administration of the First Import of Chemicals and the Import and Export of Toxic Chemicals" and "Catalogue of Toxic Chemicals Banned or Severely Restricted," which set new regulatory milestone for PRC's toxic chemical and hazardous material environmental management system.

Table 2 compiles PRC's major national regulations and guidelines associated with the management of toxic chemicals/hazardous materials. Appendix A contains copies of selected PRC's national regulations and policies.

In 1986, PRC promulgated its National Standards (GB6944-86) for Classifications and Identifications of Dangerous Goods/Merchandizes, which provided the following hazard classifications and divisions, similar to the US system:

- Class 1. Explosives
  - ✓ 1.1 Explosives with a massive explosion hazard
  - ✓ 1.2 Explosives with a projection, but without a massive explosion hazard
  - ✓ 1.3 Explosives with a fire and either a minor blast or a projection hazard, but without a massive explosion hazard
  - ✓ 1.4 Explosives with no significant hazard
  - ✓ 1.5 Very insensitive explosives
- Class 2. Compressed gases and liquefied gases (vapor pressure > 294 kPa when the critical temperature is at or lower than 50°C; or absolute pressure of a gas > 275kPa when the temperature is at 21.1°C, absolute pressure of a compressed gas > 715 kPa when the temperature is at 54.4°C, or Reid vapor pressure of a liquefied gases > 275 kPa when the temperature is at 37,8°C)
  - ✓ 2.1 Flammable gases
  - ✓ 2.2 Non-flammable gases
  - ✓ 2.3 Poisonous gases
- Class 3. Flammable liquids
  - ✓ 3.1 Flammable liquids with low flash points < -18°C
  - ✓ 3.2 Flammable liquids with intermediate flash points between -18°C and 23°C
  - ✓ 3.3 Flammable liquids with high flash points between 23°C and 61°C
- Class 4. Flammable solids
  - ✓ 4.1 Flammable solids
  - ✓ 4.2 Spontaneous flammable solids
  - ✓ 4.3 Water or moisture reactive flammable solids
- Class 5. Oxidizers and organic peroxides

Table 2. Compilations of PRC's National Guidelines/Policies on Chemical/Hazardous Substances

法规名称	Regulation Names	施行时间 /Year	负责机构	Responsible Entities	适用范围	Applied Field
中华人民共和国环境保护法	Environmental Protection Regulations of the People's Republic of China	1989	国家环保局	State Environmental Protection Administration	环境保护	General Environmental Protection
海洋环境保护法	Environmental Protection Regulations of Marine and Coastal Waters	1983	国家环保局、国家海洋局	State Environmental Protection Administration	海洋环境保护	Marine Environmental Protection
水污染保护法	Environmental Protection Regulations of Water Pollution	1984	国家和地方环保局	State and Local Environmental Protection Administration	有毒水污染物	Toxic Surface water Pollutants
大气污染防治法	Air Pollution Prevention Protection Regulations of the People's Republic of China	1988	国家和地方环保局	State and Local Environmental Protection Administration	有毒空气污染物	Toxic Air Pollutants
化学危险物品安全管理条例	Chemical Hazardous Materials Safety Management Regulations	1987	国务院有关部门	National People's Congress	有毒化学品	Toxic Chemical Substances
工业产品生产许可证试行条例	Industrial Product Manufacturing Licensing Regulations (Interim)	1984	国务院	National People's Congress related Departments	化学品生产	Chemical Manufacturers and Producers
化工产品生产许可证管理办法	Chemical Product Manufacturing Licensing Management Regulations	1987	化工部	Ministry of Chemical Industry	化学品生产	Chemical Manufacturers and Producers
化工毒物登记管理办法（试行）	Chemical/Toxic Substance Registration Management Regulations (Interim)	1990	化工部	Ministry of Chemical Industry	化工毒物	Industrial Chemical Toxic Substances
化学危险品经营许可证发放办法	Chemical Dangerous Goods Business Licensing Regulations	1989	商业部	Ministry of Commerce	化工毒物经营	Industrial Chemical Toxics Management
铁路危险货物运输规则	Railway Dangerous Goods Transportation Regulations	1961	铁道部	Ministry of Railroad	化学危险品铁路运输	Rail Transportation of Dangerous Chemicals
船舶装载危险货物监督管理规则	Waterway Shipment of Dangerous Goods Oversight and Management Regulations	1982	交通部	Ministry of Traffic Control	化学危险品船舶运输	Waterway Transportation of Dangerous Chemicals
农药登记规定	Agricultural Pesticide/Herbicide Registration Requirements	1982	农业部	Ministry of Agriculture	农药生产	Pesticide Production
药品管理法	Drugs Management Regulations	1984	卫生部	Ministry of Sanitary	医药品	Pharmaceutical Products
麻醉药品管理条例	Narcotic and Psychotropic Drugs Management Regulations	1978	卫生部	Ministry of Sanitary	麻醉药品	Anesthesia Pharmaceutical Products
兽药管理暂行条例	Veterinary Medical Product Management Regulations	1980	农业部	Ministry of Agriculture	兽药管理	Animal Medicine Management
食品卫生法（试行）	Food Safety and Sanitation Regulations (Interim)	1982	卫生部	Ministry of Sanitary	食品添加剂	Food Additives
进口药品许可证规定	Import Medical Product Licensing Regulations	1987	卫生部	Ministry of Sanitary	医药品进口	Import of Pharmaceutical Products

法规名称	Regulation Names	施行时间 /Year	负责机构	Responsible Entities	适用范围	Applied Field
进口货物许可制度暂行条例	Provisional Import Goods Licensing Regulations	1984	对外经济贸易合作部	Ministry of Foreign Trade and Economic Development	化学品进口	Import of Chemical Products
进口农药审批暂行办法	Evaluation and Approval Methods for Import Agricultural Pesticides/Herbicides of Pesticide Imports	1985	化工部	Ministry of Chemical Industry	农药进口	Import of Pesticides/ Herbicides
消防条例	Fire Prevention Regulations	1984	公安部	Ministry of Public Security	化学品安全防火	Chemical Fire Prevention
化学工业安全卫生工作条例	Chemical Industry Health and Safety Regulations	1984	化工部	Ministry of Chemical Industry	化工安全卫生	Chemical Industry Safety and Public Health
化工企业安全管理制度	Chemical Enterprise Occupational Safety Management Policies	1980	化工部	Ministry of Chemical Industry	化工生产安全	Chemical Safety Production
化工企业职业病中毒防治工作管理办法	Chemical Enterprise Occupational Disease/Poison Preventive Management Regulations	1984	化工部	Ministry of Chemical Industry	职业病防治	Occupational Disease Prevention and Treatment
化工健康监护管理办法	Chemical Industry Occupational Healthcare Management Regulations	1988	化工部	Ministry of Chemical Industry	健康监护	Health and Safety Monitoring and Care
城市发射性废物管理办法	Municipal Radioactive Waste Management Regulations	1987	国家环保局	State Environmental Protection Administration	发射性废物	RAD Waste
化工建设项目环境保护设计规定	Chemical Industry Development Project Environmental Protection Design Guidelines	1986	化工部	Ministry of Chemical Industry	化工污染防治	Chemical Industry Environmental Protection and Pollution Prevention
化工建设项目环境保护管理规定	Chemical Industry Development Project Environmental Protection Management Guidelines	1990	化工部	Ministry of Chemical Industry	化工污染防治	Chemical Industry Environmental Protection and Pollution Prevention
建设项目环境保护管理办法	Construction Project Environmental Protection Management Regulations	1986	国务院环委会、国家纪委、国家经委	National People's Congress Environmental, Principal, and Economics Councils	工业污染防治	Industrial Environmental Protection and Pollution Prevention
关于结合技术改造防治工业污染的几项规定	Rules on Combined Technologies to Improve Industrial Polltuon Prevention	1986	国务院	National People's Congress	工业污染防治	Industrial Environmental Protection and Pollution Prevention
海洋倾废管理条例	Ocean Dumping Management Regulations	1985	国家海洋局	State Ocean Administration	海洋倾废	Ocean Dumping
中华人民共和国防船舶污染海域管理条例	PRC Marine Vessels Pollution Management Guidelines	1983	港务监督	Port Affair Monitoring Bureau	有毒害物质的海上装运和排放	Marine Transportation and Discharge of Toxic Substances
中华人民解放军环境保护条例	PRC Military Environmental Protection Regulations	1990	中国人民解放军环境保护委员会	PRC Military Environmental Protection Council	全军环境保护	Military Environmental Protection
排放污染物申报登记管理规定	Waste Discharge Declaration and Registration Management Regulations	1992	国家环保局	State Environmental Protection Administration	污染物排放申报登记	Pollutant Discharge Declaration Registration
化学品首次进口及有毒化学品进出口环境管理规定	Environmental Management Regulations for First Time Imported Chemicals and Import/Export of Toxic Chemicals	1994	国家环保局	State Environmental Protection Administration	有毒化学品进出口	Toxic Chemicals Import and Export

法规名称	Regulation Names	施行时间 /Year	负责机构	Responsible Entities	适用范围	Applied Field
中华人民共和国治安管理处罚条例	PRC Public Security Management and Penalty Guidelines	1986	公安局	Public Security Bureau	违反危险物品管理规定的处罚	Dangerous Substances Management Rules and Fines
中华人民共和国民用爆炸物品管理条例	PRC Commercial Explosive Substances Management Guidelines	1984	公安局	Public Security Bureau	民用爆炸物品管理	Civilian Explosive Management
农药安全使用规定	Agricultural Pesticides/Herbicides Safety Application Regulations	1982	卫生部	Ministry of Sanitary	农药安全使用	Pesticides/Herbicides Safety Application
港口危险货物管理暂行规定	Harbor/Port Dangerous Goods Management Regulations (Interim)	1984	交通部	Ministry of Traffic Control	港口危险货物管理	Dangerous Goods Management in Harbors and Ports
化学工业环境保护管理规定	Chemical Industry Environmental Protection Management Regulations	1990	化工部	Ministry of Chemical Industry	化工环保	Chemical Industry Environmental Protection
医药工业环境保护管理办法	Pharmaceutical Industry Environmental Protection Management Regulations	1990	国家医药管理局	State Medicine Management Administration	医药工业环保	Pharmaceutical Product Environmental Protection
中华人民共和国固体废弃物污染环境防治法	PRC Solid Waste Environmental Pollution Prevention Regulations	1995	国务院环境保护行政主管部门	National Environmental Protection Administration	--	--
农药管理条例	Agricultural Pesticides/Herbicides Management Regulations	1997	国务院	National People's Congress	--	--
易燃易爆化学物质消防安全监督管理办法	Flammable and Explosive Chemicals Fire Prevention and Safety Oversight Management Regulations	1994	公安部	Ministry of Public Security	--	--
危险废物转移联单管理办法	Dangerous/Hazardous Waste Manifest Management Requirements	1999	国家环境保护总局	National Environmental Protection Bureau	--	--
危险物经营许可证管理办法	Dangerous Goods Business Licensing Managemenet Regulations	--	--	--	--	--

- ✓ 5.1 Oxidizers
- ✓ 5.2 Organic peroxides

- Class 6. Poisonous and infectious agents
  - ✓ 6.1 Poisonous substances with an oral $LD_{50} \leq 500$ mg/kg (solids) or 2,000 mg/kg (liquids); dermal $LD_{50} \leq 1{,}000$ mg/kg after 24 hrs of skin exposure, and inhalation $LC_{50} \leq 10$ mg/L Flammable liquids with low flash points < -18°C
  - ✓ 6.2 Infectious agents that could cause illness or death
- Class 7. Radioactive substances
- Class 8 Corrosives that could cause corrosion to metals (> 6.25 mm/year at 55°C) and human flesh (tissue damages within 4-hr contact time)
  - ✓ 8.1 Acidic corrosives
  - ✓ 8.2 Alkaline corrosives
  - ✓ 8.3 Other corrosives
- Class 9. Misc. dangerous substances
  - ✓ 9.1 Substances with magnetic properties (magnetic field $H \geq 0.159$A/m at a distance of 2.1 m)
  - ✓ 9.2 Other substances with narcotic or toxic properties

GB6944-86 also standardized a numerical identification system for dangerous/hazardous goods or merchandizes during their transportation and emergency response situations.

Based on GB6944-86, GB190-85 (replaced by 190-90, Labels for Packages of Dangerous Goods) and other relevant standards, the Ministry of Transportation published "Regulations for Transportation of Dangerous Goods by Automobiles (JT3130-88)," which provided explicit requirements on: packaging and signage, transport vehicles and equipment, licenses and paper work approval from various agencies (including but may not be limited to those in charge of transportation, public security, and public health), transferring and delivery of goods, transport and offloading of goods, maintenance and fire prevention, occupational health and safety, emergency response, and oversight and enforcement actions. JT3130-88 was further elaborated by the Ministry of Transportation in 1991 with the promulgation of "Regulations for Transportation, Loading, and Unloading of Dangerous Goods by Automobiles (JT3145-91)."

PRC's National Standard GB13690-92 provided classification and signage (according to national standard GB190) for frequently encountered dangerous/hazardous chemicals. The classification system used the same, but a simplified scheme of GB6944-86 by dividing chemicals into the following eight (8) general categories:

- Class 1. Explosives
- Class 2. Compressed and liquefied gases
- Class 3. Flammable liquids with flash point equal to or less than 61°C.
- Class 4. Flammable solids capable of spontaneous combustion or are water reactive
- Class 5. Oxidizers and organic peroxides
- Class 6. Poisonous with an oral $LD_{50} \leq 500$ mg/kg (solids) or 2,000 mg/kg (liquids); dermal $LD_{50} \leq 1{,}000$ mg/kg after 24 hrs of skin exposure, and inhalation $LC_{50} \leq 10$ mg/L.
- Class 7. Radioactive substances with activity > 7.4E4 Bq/kg
- Class 8. Corrosive substances that could cause corrosion to metals (> 6.25 mm/year at 55°C) and human flesh (tissue damages within 4-hr contact time)

GB13690-82 also summarized different hazard characteristics (145) and signage (16 primary and 11 supplemental) to be used in conjunction with the hazard classification system. In the appendices section, GB13690-82 listed 997 frequently encountered dangerous/hazardous

chemicals (including the chemical names, acronyms, chemical structure, hazard class, hazard characteristics, signage, etc.) and the signage (with pictures and explanations) of hazard classes.

National Standard GB12268-90 "List of Dangerous Goods" provided a list of dangerous goods. When used together with GB13690-82, one can determine if an unknown chemical or substance is regulated as dangerous goods and subject to the specific handling, transportation, and permitting requirements.

PRC's National Standard GB/T15098-94 specified three (3) classes of packaging requirements (Classes I, II, and III) for various classes of dangerous goods described in GB6499

In 1998, the SEPA, in conjunction with the State Economic and Trade Development Commission, Ministry of Foreign Trade and Development, and Ministry of Public Security, jointly developed and promulgated PRC's National Hazardous Waste List (published on January 4, 1998 and promulgated on July 1, 1998). This list was developed pursuant to the 1995 PRC Solid Waste Environmental Pollution Prevention Policy and included 47 types of national hazardous waste with specific designation numbers (from HW-01 to HW-47), classes (general names), sources, and common contents or specific names. SEPA is the interpretative authority for the hazardous waste list and the list is subject to change as deemed necessary.

3.2 Tianjin's Policies/Regulations

Tianjin Municipal Government (TMG) has developed and promulgated similar local regulations for toxic/hazardous chemical and materials.

TMG first promulgated "Tianjin Extremely Toxic Substances Safety Management Regulation" in 1984 (TMG Regulation No. 197), which authorized Tianjin Public Security Bureau (TPSB) as the lead safety management agency to oversee individuals/facilities engaged in the production, sales, purchasing, storage, transportation, and usage of extremely toxic substances by issuing business licenses or permits. Regulation No. 197 provided a list of 134 extremely toxic substances that included cyanide and its compounds, arsenic and its compounds, mercury and its compounds, narcotics, and others.

In 1991, TMG published and promulgated "Tianjin Roadway Dangerous Goods Transportation Management Requirements (TMG Regulation No. 36)," which authorized Tianjin Transportation Bureau (TTB) to oversee and manage transportation of dangerous goods. This regulation required dedicated transportation vehicles, drivers, assignments, protection equipment, and decontamination locations for transporting dangerous goods. Permit for transportation of dangerous goods would be issued by TTB after approvals by the Public Security Bureau, TTB, and TEPB. Regulation No. 36 also provided explicit requirements on evaluation and registration procedures for transporters of dangerous goods, application for transporting dangerous goods, delivery and acceptance of dangerous goods, vehicle and equipment requirements for transporting dangerous goods, ticketing requirements for transporting dangerous goods, safety and pollution prevention associated with transportation of dangerous goods, and enforcement and fines against violators. It required proper regulatory documentation and approval for explosives (public security), extremely dangerous/toxic chemicals or substances (public security), radioactive substances (TEPB, public security, and

health department), infectious substances (health department), narcotics (health department), and container with dangerous goods (any of the above plus the commerce department and port authority). Regulation No. 36 also required that individuals involved in transporting dangerous goods received training from the local transportation, labor, and public security bureaus.

TTB and TPSB jointly published "Tianjin Dangerous Good Transportation Vehicle, Placards/Signage/Lights, and Licensing Requirements" in 1992 (TTB regulation No. 10, July 7, 1992). This regulation specified the types and colors of warning lights and placards to be used and their placements on a vehicle transporting dangerous goods, lead agencies (TTB and TPSB) that approved the acquisition and placement of warning lights/signs, and other provisions associated with the uses of warning lights/signs.

The 1999 Environmental Pollution Prevention Regulation for Toxic/Hazardous Chemicals (TMG Regulation No. 13) authorizes TEPB as the lead oversight regulatory agency for toxic/hazardous chemical environmental pollution prevention in Tianjin. TMG Regulation No. 13 refers toxic/hazardous chemicals as those defined by the PRC's national regulations or policies. It also requires individuals/facilities that engage in the manufacturing, storing, selling, transporting, and applying toxic/hazardous chemicals develop pollution prevention program, promote clean technologies, and establish emergency response system to reduce public health and environmental impacts from chemical release incidents. The regulation requires that:

- Individuals/facilities participating in all activities related to toxic/hazardous chemicals register with the local environmental protection bureaus and obtain proper registration licenses from TEPB.
- Such registration licenses are to be renewed annually in March by submitting information such as the actual quantities of toxic/hazardous chemicals produced/used/sold in the past year and project quantities for the upcoming years to the local environmental protection bureau.
- Individual/facilities engaging in any activities related to new toxic/hazardous chemicals must submit to the TEPB, proper evaluation report and approval from relevant regulatory authorities as required by the PRC's national policies.
- New construction, expansion, modification, or relocation of a facility that engages in manufacturing, storing, selling, or application of toxic/hazardous chemicals must submit an EIR to TEPB for approval.
- Within two (2) months after closing business/manufacturing activities, merger, or business transaction, facilities and individuals engaging in toxic/hazardous chemical activities must notify TEPB and receive an environmental protection/safety evaluation conducted by TEPB.
- All activities related to the manufacturing, storing, selling, and application of toxic/hazardous chemicals are banned in the following special zones: drinking water protection, ecological/natural resources protection, scenic/tourist, cultural resources, and others.
- Facilities and individuals engage in importing/exporting toxic/hazardous chemicals must be filed with TEPB and present copies of national registration and approval from SEPA.

TMG Regulation No. 13 also establishes enforcement actions and legal penalties for violators.

In 1999, TEPB also developed and promulgated the following regulations pertaining to the management of toxic/hazardous chemicals.

- TEPB published a "Priority Chemical List for Environmental Management (TEPB Regulation No. 296, August 16, 1999)," which include 61 chemicals in 13 categories such as heavy metals and compounds, agricultural pesticides/herbicides, polycyclic aromatics, aromatic volatiles, chlorinated benzene, chlorinated ethanes and methanes, phenolic compounds, phthalates, nitrobenzene and nitrotoluene, anilines, ethylene oxide, alcohols, and others).

- TEPB promulgated "Tianjin Toxic/Hazardous Chemical Environmental Management Registration Requirements (TEPB Regulation No. 322, August 29, 1999)," which

  - ✓ Requires that individuals or facilities that participated in manufacturing, storing, selling, and application of toxic/hazardous chemicals register with TEPB.
  - ✓ Authorizes TEPB to publish and implement "Priority Chemical List for Environmental Management."
  - ✓ Authorizes TEPB to oversee and manage Tianjin's Toxic/Hazardous Chemical Environmental Management Registration Program as well as publish the following forms/licenses: "Tianjin Toxic/Hazardous Chemical Environmental Management Registration Form," "Tianjin Toxic/Hazardous Chemical Environmental Management Registration Annual Review Form," and "Tianjin Toxic/Hazardous Chemical Environmental Management Registration License."
  - ✓ Establishes the responsibilities, procedures, and timeline of the registration and annual review processes.

  The "Tianjin Toxic/Hazardous Chemical Environmental Management Registration Form" has no limitation to the quantity of toxic/hazardous chemicals produced/handled as long as the chemicals fall within the "Priority Chemical List for Environmental Management." The form has 13 pages with different businesses required to fill in certain specific pages. The registration form includes the following information:

  - Business/Enterprise Backgrounds: name, physical location, business type and code, district code, management organization, safety distances, business license type.
  - Emergency Response Management System.
  - Chemical Production Operations: names and locations, staff, work hours, chemical names and structures (including raw chemicals, intermediate chemicals, byproducts, final product chemicals), chemical classifications, hazardous (or dangerous) classifications, packaging/storage requirements, placards and signage, quality control/assurance methods, chemical mass balance calculations, operating procedures.
  - Chemical Application Operation: operating procedures, name and chemical structure of the waste.

- Chemical Production Flow Chart: including process flow charts for chemical production and/or application.
- Waste Discharge and Management: waste types, quantities, concentrations, treatment/recycling, discharge standards.
- Chemical Production/Usage Quantities: production, usage, and overstock quantities of each chemical.
- Chemical Sales: quantities and places of each chemical sold.
- Chemical Transportation: quantities and times of chemical transported, means of transportation, warning signs and placards used in transportation.
- Chemical Storage: chemical names and quantities stored, storage methods (chemical compatibility, isolation or mixed storage).
- Chemical Incident Report: type and number of incidents, causes, chemicals involved, amounts of chemical release, environmental monitoring data, recordkeeping, and conclusions.
- Emergency Response Contact: facility site map with proper coordinates, site features (production, storage, offices, waste treatment), safety distance, evacuation routes, and fire extinguishers.

Table 3 summarizes Tianjin's regulations/policies on chemical/hazardous material management and Appendix B contains copies of selected regulations/policies.

Table 3. Summary of Tianjin's Local Regulations/Policies on Chemical/Hazardous Material Management System

天津法规名称	Regulation Titles	Year	负责机构	Responsible Agencies
天津市有毒化学品污染环境防治办法	Tianjin Environmental Pollution Prevention Regulation for Toxic/Hazardous Chemicals	1999	天津市人民政府令	Tianjin Municipal Government
天津市有毒化学品环境管理登记实施办法	Tianjin Toxic/Hazardous Chemical Environmental Management Registration Requirements	1999	天津市环境保护局文件	Tianjin Environmental Protection Bureau
天津市优先环境管理化学品名录	Tianjin Priority Chemical List for Environmental Management	1999	天津市环境保护局文件	Tianjin Environmental Protection Bureau
天津市环境保护条例	Tianjin Environmental Protection Regulations	1994	天津市人大常委会	Tianjin Communist Party
天津市道路危险货物运输管理办法	Tianjin Roadway Dangerous Good Transportation Management Requirements	1991	天津市人民政府令	Tianjin Municipal Government
天津市剧毒物品安全管理办法	Tianjin Extremely Toxic Chemical Safety Management Regulation	1984	天津市人民政府令	Tianjin Municipal Government
天津市危险货物运输车辆装置、使用危险品标志灯、牌管理规定	Tianjin Dangerous Goods Transportation Vehicle, Placards/Signs/Warning Lights, and Licensing Requirements	1992	天津市交通局、公安局	Tianjin Transportation Bureau, Tianjin Public Security Bureau
天津市危险废物污染环境防治办法	Tianjin Hazardous Waste Environmental Pollution Prevention Regulation	1999	天津市人民政府令	Tianjin Municipal Government

3.3 Tianjin's Current Emergency Response System

According to TEPB, Tianjin currently implements an emergency incident response system as shown in Figure 2. As an emergency incident associated with hazardous materials/chemical release occurs, the responsible facility should attempt to control the incident according to its approved emergency response plan, which is part of the pre-requisite for obtaining the facility's business or manufacturing license/permit. The facility is required to report the incident to appropriate local agencies (public security, environmental protection, transportation bureaus, etc.) after successfully controlling and mitigating the incident so that any outstanding legal, labor and public safety, or environmental protection issues can be addressed. In the event that the facility is unable to control the incident or if the incident occurs in a public area (such as public roadways), the agency that receives the incident notification will assess the nature and conditions of the spill/release to determine follow-up actions. The agency may elect to take immediate emergency response actions if it has adequate resources and capabilities to handle the incident, or it may decide to report to the Tianjin Municipal Government (TMG). In the later case, TMG will organize an emergency response team that consists of one or more of the following local agencies as deemed necessary – public security (including fire and police departments), transportation, health, labor, and environment protection bureaus. Based on the type of incident, TMG will assign a lead agency in charge of the emergency response action. This structure is very similar to the ICS used in the U.S. as the number of agency and specialty levels involved in an emergency response action varies depending on the complexity of the incident.

Since in a chemical/hazardous material emergency response situation, the primary tactical operation is intended to bring a hazardous materials emergency under control, local fire department, as the first responder, is typically performing all tasks required under the operation aspects of the ICS to control and contain hazardous material releases. Other first responders, including police and emergency medical technicians may also be involved if there are issues related to site control and personnel injuries. TEPB will most likely be part of the planning group responsible for collecting environmental monitoring data to assess the impacts of the incident, developing environmental cleanup or restoration plan, and assessing environmental financial responsibility resulting from the incident. Therefore, the types of TEPB personnel required under a chemical/hazardous material emergency response action are defined as hazardous materials technicians and/or hazardous materials specialists. They will report to the Planning Section Chief who in turns will report to the Incident Commander.

Using the ICS frame work and considering the role and types of work to be performed by TEPB under an emergency response situation, a separate organizational structure focusing on environmental monitoring and restoration/cleanup has been developed and shown in Figure 3. Figure 3 identifies the leader, responsible personnel, lines of authority, and communication requirements. Table 4 describes the typical responsibilities of key personnel.

4.0 RECOMMENDED COMMUNICATION EQUIPMENT

This section of the FS discusses various communication equipment used in an emergency response operation. Since TEPB primarily plays a supporting role in the overall emergency response team structure and is not authorized to select or procure communication equipment for

Figure 2a Current Tianjin Emergency Incident Response System

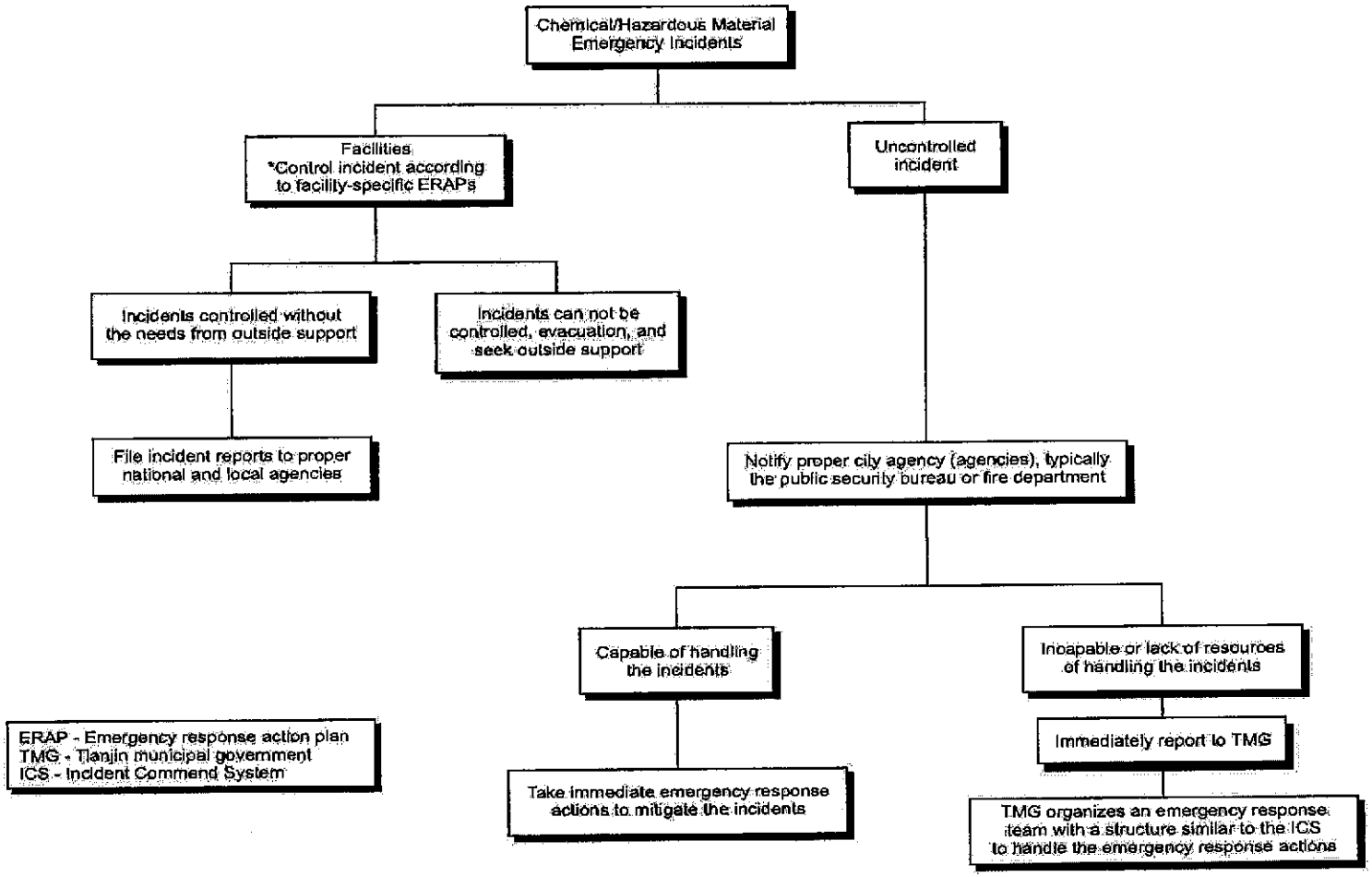

Figure 2b Tianjin Emergency Response ICS Structure

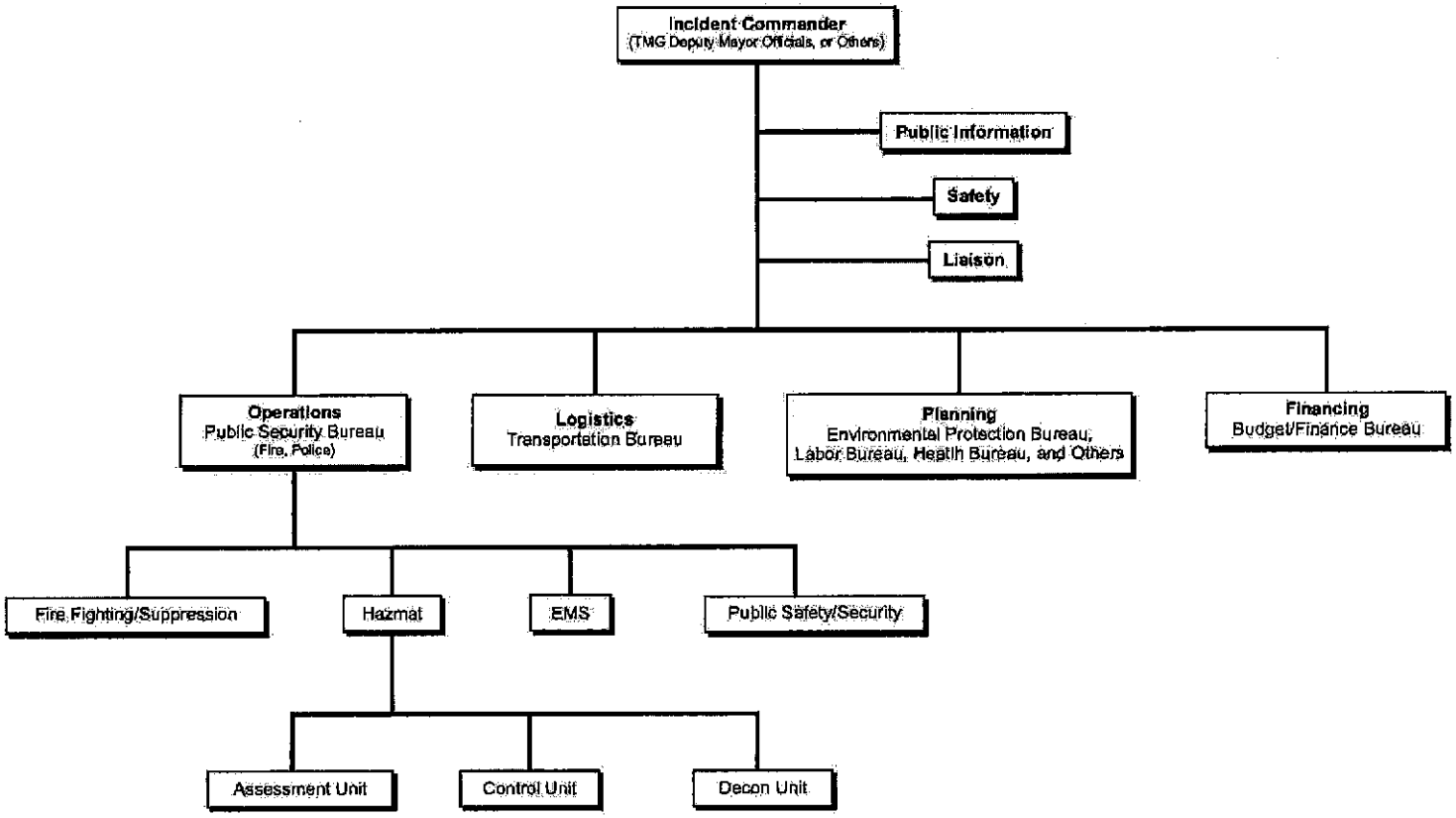

Figure 3. Proposed Emergency Response Organization Structure and Line of Communication for TEPB (Environmental Monitoring, Site Assessment, Cleanup/Restoration)

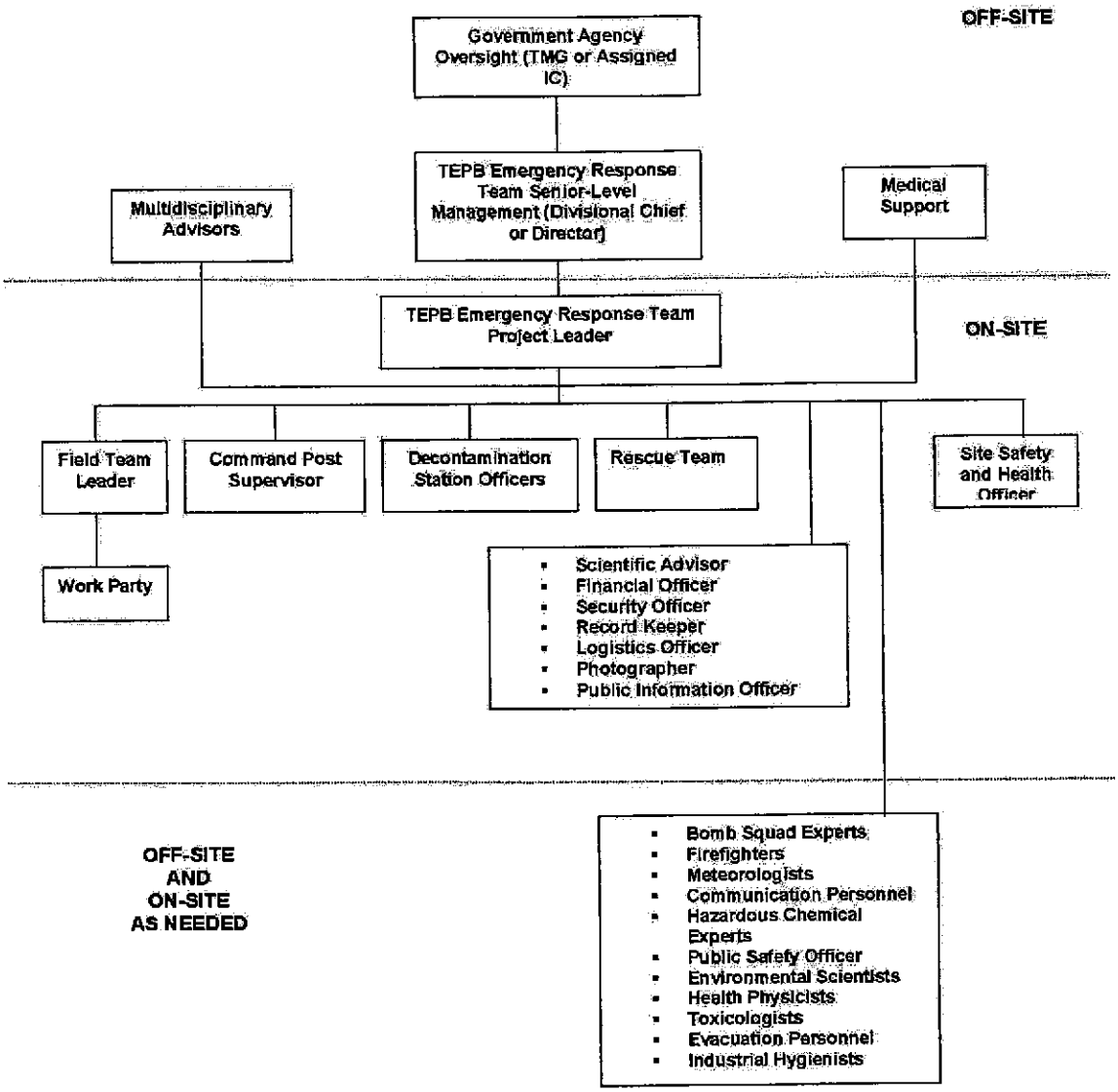

Table 4. Descriptions and Responsibilities of Proposed Emergency Response Personnel

Off-Site Personnel		
Title	**General Descriptions**	**Specific Responsibilities**
TEPB Senior Level management	Responsible for defining project objectives, allocating resources, determining the chain-of-command, and evaluating program outcome.	✓ Provide the necessary facilities, equipment, and money. ✓ Provide adequate personnel and time resources to conduct activities safely. ✓ Support the efforts of on-site management. ✓ Provide appropriate disciplinary action when unsafe acts or practices occur.
Mutil-Disciplinary Advisors	Includes representatives from upper-level management and on-site management, a field team member, and experts in such fields as: Chemistry — Law Engineering — Medicine Industrial hygiene — Pharmacology Information/Public relations — Physiology Radiation health physics — Toxicology	✓ Provide advice on the design of the Work Plan and the Site Safety Plan
Medical Support	Consulting Physicians Medical personnel at local hospitals and clinics. Ambulance personnel.	✓ Become familiar with the types of materials on site, the potential for worker exposures, and recommend the medical program for the site. ✓ Provide emergency treatment and decontamination procedures for the specific type of exposures that may occur at the site. ✓ Obtain special drugs, equipment, or supplies necessary to treat such exposures. ✓ Provide emergency treatment procedures, appropriate to the hazards on site.
On-Site Essential Personnel		
TEPB Project Team Leader	Reports to upper-level management. Has authority to direct response operations. Assumes total control over site activities.	✓ Prepares and organizes the background review of the situation, the Work Plan, the Site Safety Plan, and the field team. ✓ Obtain permission for site access and coordinates activities with appropriate officials. ✓ Ensures that the Work Plan is completed and on schedule. ✓ Briefs the field teams on their specific assignments. ✓ Uses the Site Safety and Health Officer to ensure that safety and health requirements are met. ✓ Prepares the final report and support files on the response activities. ✓ Serves as the liaison with public officials.
Site Safety and Health Officer (hereinafter referred to as Site Safety Officer in accordance with common usage).	Advises the Project Team Leader on all aspects of health	✓ Selects protective clothing and equipment. ✓ Periodically inspects protective clothing and equipment. ✓ Ensure that protective clothing and equipment are properly stored and maintained. ✓ Controls entry and exit at the Access Control Points. ✓ Coordinates safely and health program activities with the Scientific Advisor. ✓ Confirms each team member's suitability for work based on a physician's recommendation.Monitors the work parties for signs of stress, such as cold exposure, heat stress, and fatigue. ✓ Monitors on-site hazards and conditions. ✓ Participates in the preparation of and implements the Site Safety Plan. ✓ Conducts periodic inspections to determine if the Site Safety Plan is being followed. ✓ Enforces the "buddy" system. ✓ Knows emergency procedures, evacuation routes, and the telephone numbers of the ambulance, local hospital, poison control center, fire department, and police department. ✓ Notifies, when necessary, local public emergency officials. ✓ Coordinates emergency medical care.

On-Site Essential Personnel		
Title	**General Descriptions**	**Specific Responsibilities**
Command Post Supervisor	May be the same person as the Field Team Leader. Responsible for communications and emergency assistance.	✓ Notifies emergency response personnel by telephone or radio in the event of an emergency. ✓ Assists the Site Safety Officer in a rescue, if necessary. ✓ Maintains a log of communication and site activities. ✓ Assists other field team members in the clean areas, as needed. ✓ Maintains line-of-sight and communication contact with the work parties via walkie-talkies, signal horns, or other means.
Decontamination Station Officer(s)	Responsible for decontamination procedures, equipment, and supplies.	✓ Sets up decontamination lines and the decontamination solutions appropriata for the type of chemical contamination on site. ✓ Controls the decontamination of all equipment, personnel, and samples from the contaminated areas. ✓ Assists in the disposal of contaminated clothing and materials. ✓ Ensures that all required equipment is available. ✓ Advises medical personnel of potential exposures and consequences.
Rescue Team	Used primarily on large sites with multiple work parties in the contaminated area.	✓ Stands by, partially dressed in protective gear, near hazardous work areas. ✓ Rescuers any worker whose health or safety is endangered.
Work Party	Depending on the sizes of the field team, any or all of the field team may be in the Work Party, but the Work Party should consist of at least two people.	✓ Safely completes the on-site tasks required to fulfill the Work Plan. ✓ Complies with Site Safety Plan. ✓ Notifies Site Safety Officer or supervisor of unsafe conditions.
On-Site Optional Personnel		
Scientific Advisor	Guides the Project Team Leader in scientific matters.	✓ Provides advice for: Field monitoring Scientific studies Sample collection Data interpretation Sample analysis Remedial plans
Logistics Officer		✓ Plans and mobilizes the facilities, materials, and personnel required for the response.
Photographer		✓ Photographs site conditions. ✓ Archives photographs.
Financial/Contractin g Officer		✓ Provides financial and contractual support.
Public Information Officer		✓ Releases information to the news media and the public concerning site activities.
Security Officer		✓ Manages site security.
Record-keeper		✓ Maintains the official records of site activities.
As-Needed Personnel		
Bomb Squad Explosion Experts		✓ Advise on methods of handling explosive materials. ✓ Assist in safely detonating or disposing of explosive materials.
Communication Personnel	Civil Defense organizations; local radio and television stations. Local emergency service networks.	✓ Provide communication to the public in the event of an emergency. ✓ Provide communication links for mutual aid.
Environmental Scientists	Consultants from industry, government, universities, or other groups.	✓ Predict the movement of released hazardous materials through the atmospheric, geologic, and hydrologic environment. ✓ Assess the effect of this movement on air, groundwater, and surface water quality. ✓ Predict the exposure of people and the ecosystem to the materials.
Evacuation Personnel	Federal, state, and local public safety organizations.	✓ Help plan for public evacuation. ✓ Mobilize transit equipment. ✓ Assist in public evacuation.

As-Needed Personnel (cont'd)		
Title	**General Descriptions**	**Specific Responsibilities**
Firefighters		✓ Respond to fires that occur on site. ✓ Stand by for response to potential fires. Perform rescue.
Hazardous Chemical Experts	Consultants from industry, government, universities, or other groups.	✓ Advise on the properties of the materials on site. ✓ Advise on contaminant control methods. ✓ Advise on the dangers of chemical mixture that may result from site activities. ✓ Provide immediate advice to those at the scene of a chemical-related emergency.
Health Physicists		✓ Evaluate radiation health hazards and recommend appropriate action.
Industrial Hygienists		✓ Conduct health hazard assessment. ✓ Advise on adequate health protection. ✓ Conduct monitoring tests to determine worker exposures to hazardous substances.
Meteorologists		✓ Provide meteorological information.
Public Safety Personnel	The Country Sheriff, industrial security forces, National Guard, police, etc.	✓ Control access to the site.
Toxicologists		✓ Advise on toxicological properties and health effects of substances on site. ✓ Provide recommendations on protection of worker health.

the first responders, the FS only provides information of communication equipment that may be recommended by TEPB to the emergency response team for considerations in the future. Additionally, since communication equipment in PRC is tightly controlled by the Ministry of Public Security and that the U.S. government also imposes export restrictions for communication equipment due to national security reasons, US vendors are not likely to sell their equipment without prior approval from both domestic (U.S.) and foreign (PRC) governments.

Communication equipment is critical to the ICS under a chemical/hazardous materials emergency response situation. A communication system is made up of devices that employ wired or wireless communication method, different types of equipment (portable radios, mobile radios, base/fixed station radios, and repeaters), and various accessories and/or enhancements (encryption, digital communications, security measures, and interoperability/networking) to meet the user's specific needs. Table 5 summarizes different communication systems that are available for the emergency response incidents and their advantages/disadvantages.

Table 5. Comparison of Communication Technologies

Communication Technologies			
Wired: hard-line system that uses wires (cables) to operate over a limited area		Wireless: uses radio frequencies (RF's, between 0.05 MHz and 900 MHz are dedicated to public service use) to connect users over a much larger geographical area	
Advantages	**Disadvantages**	**Advantages**	**Disadvantages**
✓ Capeble of providing communications from underground, confined spaces, shielded enclosure, and explosive environment ✓ Totally secured and outside eavesdropping is not possible	✓ Constraints in distance and mobility by the cables ✓ Time and difficulties to setup at an incident site ✓ Limited number of users supported by the system	✓ Capable of providing communications over long distances, through some obstacles, and to almost unlimited number of users	✓ Range of signal may be affected by atmospheric disturbances (electrical storms) or high power RF sources ✓ Can be blocked by water ✓ Transmission quality affected when approaching the edge of coverage area ✓ Shared system is subject to saturation by the number of users

Due to the constraint of needing a cable to transmit information, most of the communication equipment used in an emergency response incident is the RF system, which may include the following:

Conventional Radio System – Each user group in this system is assigned a discrete radio channel (frequency) that is independent of other user groups. The users within the group transmit and receive only on that channel, on a first-come-first-serve basis. Transmissions may occur with or without the assistance of a repeater. A major advantage of this system is that users equipped with radios from different manufacturers can communicated with one another provided they are programmed to the same frequency, which includes the appropriate CTCSS (continuous Tone Coded Squelch System) or DSC (Digital Code Squelch) programming. The disadvantages include user accessibility delays when the channel is occupied and security concerns because of the ease of "eavesdropping" on potentially sensitive communications by the public or media equipped with scanner radios.

Trunked Radio Systems – The system typically allocate 20 or more talk groups (logical channels) to a particular radio frequency channel. A radio system's computer assigns a user (officer assigned to the emergency response team or ICS Commander) and the user group (fire department, police precinct) to a frequency when the push-to-talk (PTT) button is pressed. This resulted in a single conversation occurring over several channels, eliminating the need to manually change frequencies, thus maximizing the system efficiency and channel capacity. The system suffers the same common disadvantages of all RF radio system. Additionally, it is more complex to operate, relies heavily on the computer system and software that controls the trunked system, and depends on the equipment of one manufacturer for guaranteed operation.

Five different types of RF communication equipment are available in the market, they are (1) portable radios, (2) mobile radios, (3) base/fixed station radios, (4) repeaters, and (5) base station repeaters.

Portable Radios – These are lightweight, handheld, wireless communication units that contain both a transmitter and a receiver, a self-contained microphone and speaker, an attached power supply (rechargeable battery), and antenna. Portable transceivers such as walkie-talkies have relatively low power transmitters (1W to 5W), need to be recharged, and may be combined in a wireless communication system with other portable, mobile, and base station radios.

Mobile Radios – They are larger than the portable radios and are designed to be mounted in a fixed location inside a vehicle such as a police cruiser or fire engine. Mobile radios are similar to the portable radios, except that they are powered by the vehicles, have higher transmitter output power (typically 5W to 50W), and an external antenna. As such the effective communication range of a mobile radio is greater than that of a portable radio, especially if a repeater is used. The receiver in a mobile radio is also more sensitive than that of a portable radio. Personnel who do not need to communicate with others when away from the vehicle typically use mobile radios. Mobile radios can also be used in combination with other wireless communication equipment such as portable radios, mobile radios, and base station radios.

Base/Fixed Station Radios – A base (or fixed) station radio also contains a transmitter and a receiver. The radio is powered by an external electrical power source (typically 110V AC) and is connected to an antenna typically on top of a building or tower at tens to hundreds feet away. This system has the most powerful transmitter (5W to hundreds of watts) and sensitive receiver compared to portable and mobile radios. Microphones can either be handheld or desktop models, and the speaker can either be external to internal to the radio.

Repeaters – This is a special radio that contains both a receiver and a transmitter. Repeaters are used to increase the effective communications coverage area for portable, mobile, or base station radios that otherwise may not be able to communicate with one another. By tuning its receiver to other RF radio's transmitter for incoming signal and its transmitter to the frequency of other RF radio's receiver, the repeater can rebroadcast the incoming signal to the radio network on a different frequency, usually with higher power and from a better location (tall building, tower or mountain top).

Base Station/Repeaters – Several manufacturers offer base station/repeater radios, which can be configured to operate as either a base station or a repeater.

In addition to the standard communication equipment, manufacturers also developed aftermarket accessories and enhancements (ranging from optional batteries, optional trunking accessory boards, to optional encryption modules for secure communications) to maximum user's flexibility and allow for system modifications for specific purposes. Examples of some of the accessories and enhancements are shown in Table 6.

Table 6. Summary of Accessories and Enhancements for RF Radios

Type of Communication Equipment	Accessories
Portable Radios	Optional batteries, speaker-microphone, carrying case, vehicular adapters
Mobile Radios and Base Station/Repeater Radios	Transmitter power amplifiers, special computer/data terminal connectors, remote mounting systems, external mounted speakers, specialized microphones provide flexibility for the user to change channels or transmitter output power
System Enhancements	
✓ Encryption module or electronics for secured communications ✓ Digital communication for enhanced signaling and control options, more consistent audio quality, greater radio spectrum efficiency, and a broader range of encryption capabilities ✓ Security measures including digital encryption, voice inversion, digitizing of voice/data and transmitted with digital cellular or PCS telephone circuits ✓ Interoperability and networking that allows different radio systems and communication technologies to communicate with each other using interface modules	

The U.S. Department of Justice National Institute of Justice Law Enforcement and Corrections Standards and Testing Program published Guide for the Selection of Communication Equipment for Emergency First Responders (NIJ Guide 104-00, February 2002). In this document, it lists 14 selection factors (excluding weight since this factor has been used to define portable radios, mobile radios, and repeaters) that are recommended for consideration by the emergency first responder community when selecting and purchasing communication equipment that can be used in conjunction with chemical and biological PPE. These factors are summarized below.

1. Maximum transmitter output power (portable radios only) – too high an output power leads to a shortened battery use cycle, while too low output may endanger the life of the responder as the signal may not be picked up by a repeater or another receiver.
2. Secure communications capability – the ability to encrypt and decrypt communication signals. Once properly encrypted, the communication equipment can transmit ay signal.
3. Programmability – it defines the ability to program or reprogram a radio, primarily on the ability to add or delete channels.
4. User capability – it refers to the ability of the communication system to simultaneously support different types of users (e.g., fire, EMS, Command, and law enforcement). Three levels of capabilities have been assigned based on communication flexibility: unlimited, fixed, and restrictive capabilities.
5. Line of sight – the distance that transmission can occur in a clear area without a repeater.
6. Power requirements – the flexibility for an equipment to operate under different power sources (battery and/or electrical power)
7. Battery life (portable radio only) – the ability of the portable radio equipped with an approved battery to operate at maximum transmitter power for an 8-hr duty shift when in a 5/5/90 operating mode (5% of the time transmitting, 5% of the time receiving with the squelch being broken, 90% of the time receiving with the squelch not being broken or standby).
8. Battery locking ability (portable radio only) – how securely the battery is attached to the radio.
9. Vehicular Adapter (portable radio only) – whether the portable radio has an optional vehicular adapter that allows the radio to be operated as a mobile radio.
10. Digital communication compatibility – whether the radio is capable of digital communication with/without an adapter (including adaptability to different manufacturer or third party modules).
11. Durability – the ruggedness of the equipment.
12. Cost – includes cost of the radio equipment and all support equipment and consumables, without the accessories.
13. Operator skill requirements – refers to the skill and training required to operate the equipment.
14. Training requirements – the amount of training/instruction time required for the operator to become proficient in the operation of the equipment.

Using these selection factors, NIJ evaluated 100 portable radios, 54 mobile radios, 27 base/repeater systems, four (4) base stations, and six (6) base station/repeater systems. Table 7a shows how to use these selection factors to determine the capabilities and rating of communication equipment, while Tables 7b and 7c demonstrate the overall ratings of selected portable and mobile equipment that have both conventional and trunked capabilities. A list of questions (Table 8) developed by the U.S. National Domestic Preparedness Office (NDPO) in a report titled "Domestic Preparedness Program in Defense of Weapons of Mass Destruction

Table 7a. Selection Criteria for Communication Equipment (Source: Guide for the Selection of Communication Equipment for Emergency First Responders, NIJ Guide 104-00, February 2002)

Selection factor key for communication equipment

February 2001

	Maximum Transmitter Power Output	Secure Communications Compatibility	Programmability	User Capability	Line of Sight	Power Requirements (Portable)	Power Requirements (Mobile and Repeater)	Battery Life (Portable)	Battery Locking Ability (Portable)	Vehicular Adaptor (Portable)	Digital Communications Compatibility	Durability	Unit Cost	Operator Skill Level	Training Requirements (Portable)	Training Requirements (Mobile and Repeater)
●	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
◕						[illegible]										
◑	Power output of more than 1.5 W but less than 3 W	Capable of secure transmissions with an accessory	Can be programmed/reprogrammed by vendor only	Fixed capability	Transmission can travel 5 miles to 10 miles	Operates off battery pack or ac adapter	Uses 110/220 V ac	Greater than 4 h but less than 8 h			Capable of digital transmissions with an adaptor	Designed for rugged use but is not submersible in water	Greater than $500 but less than $1000 per unit	No special [illegible] training required	Less than 60 min training required	Less than 8 h training required
○	Power output of less than 1.5 W	Not capable of secure transmissions	Can be programmed/reprogrammed by the end user	Restrictive capability	Transmission can travel less than 5 miles	Operates off battery pack only	Uses voltage other than standard 12 V dc to 15 V dc or 110/220 V ac	Less than 4 h	Battery not locked into place	Does not have optional vehicle adaptor	Not capable of digital transmissions	Designed for standard use only	Greater than $1000 per unit	Technical background required to operate equipment	More than 60 min training required	More than 8 h training required

The gray cells designate that the symbol is not applicable for the selection factor.

Table 7b Comparison of Conventional and Trunked Portable Communication Equipment (Source: Guide for the Selection of Communication Equipment for Emergency First Responders, NIJ Guide 104-00, February 2002)

Portable communication equipment (conventional and trunked)

February 2001

ID #	Equipment Name	Maximum Transmitter Power Output	Secure Communications Compatibility	Programmability	User Capability	Line of Sight	Power Requirements	Battery Life	Battery Locking Ability	Vehicular Adapter	Digital Communications Compatibility	Durability	Unit Cost	Operator Skill Level	Training Requirements
5	EDACS™ LPE-200™ Portable 800 MHz, 900 MHz	●	◑	●	●	●	○	●	●	●	◑	●	○	◑	◑
9	ProVoice™ Jaguar™ 700P, 800 MHz	●	●	●	●	●	○	●	●	●	●	●	○	◑	◑
10	ComNet Ericsson Jaguar Transceiver, Portable; Jaguar 700P, 800 MHz	●	●	●	●	●	○	●	●	TBD	◑	◑	○	◑	◑
11	ComNet Ericsson M-RK™ Analog Portable, M-RK I	●	◑	●	●	●	○	●	●	●	◑	◑	◑	◑	◑
12	ComNet Ericsson M-RK™ Analog Portable, M-RK II	●	◑	●	●	●	○	●	●	●	●	◑	○	◑	◑
13	ComNet Ericsson M-RK™ Analog Portable, M-RK II Scan	●	●	●	●	●	○	●	●	●	◑	◑	○	◑	◑
23	ProVoice™ LPE-200™ Portable 800 MHz	●	●	●	●	●	○	●	●	●	●	●	○	◑	◑
32	EF Johnson Transceiver, Portable; 77xx-800 MHz	◑	○	●	●	TBD	●	●	●	○	○	○	◑	◑	◑
33	EF Johnson Transceiver, Portable; 98xx-800 MHz	●	○	●	●	●	●	NA	NA	NA	○	◑	◑	◑	◑
34	EF Johnson Transceiver, Portable; 501x VHF	●	●	●	●	TBD	●	●	●	○	●	◑	○	◑	◑

*TBD (to be determined) - there is currently no data available to support that selection factor.
'NA' - data field is not applicable for this piece of equipment.

Portable communication equipment (conventional and trunked)

February 2001

ID #	Equipment Name	Maximum Transmitter Power Output	Secure Communications Compatibility	Programmability	User Capability	Line of Sight	Power Requirements	Battery Life	Battery Locking Ability	Vehicular Adapter	Digital Communications Compatibility	Durability	Unit Cost	Operator Skill Level	Training Requirements
35	EFJohnson Transceiver, Portable; 504x UHF	●	●	●	●	TBD	●	●	●	○	●	◑	○	◑	◑
36	EFJohnson Transceiver, Portable; 508x-800 MHz	◑	●	●	●	TBD	●	●	●	○	●	◑	○	◑	◑
39	Icom VHF Transceiver, Portable; IC-F3	●	●	●	●	●	○	●	●	○	○	◑	●	●	●
40	Icom VHF Transceiver, Portable; IC-F3S	●	○	●	●	●	○	●	●	○	○	◑	●	●	●
41	Icom VHF Transceiver, Portable; IC-F3GT/ IC-F3GTS	●	◑	●	●	●	○	●	●	○	○	◑	●	●	●
42	Icom UHF Transceiver, Portable; IC-F4	●	◑	●	●	○	○	●	●	○	○	◑	●	●	●
43	Icom UHF Transceiver, Portable; IC-F4S	●	○	●	●	○	○	●	●	○	○	◑	●	●	●
44	Icom UHF Transceiver, Portable; IC-F4GT/ IC-F4GTS	●	◑	●	●	●	○	●	●	○	○	◑	●	●	●
49	Icom VHF Transceiver, Portable; IC-F30GS/ IC-F30GT	●	●	●	●	●	○	●	●	○	○	◑	◑	◑	◑
50	Icom VHF Transceiver, Portable; IC-F30LT Land Use; IC-F30LT Marine Version	●	◑	●	●	●	○	●	●	○	○	●	◑	◑	◑

'TBD (to be determined) - there is currently no data available to support that selection factor.
'NA' - data field is not applicable for this piece of equipment.

Portable communication equipment (conventional and trunked)
February 2001

ID #	Equipment Name	Maximum Transmitter Power Output	Secure Communications Compatibility	Programmability	User Capability	Line of Sight	Power Requirements	Battery Life	Battery Locking Ability	Vehicular Adapter	Digital Communications Compatibility	Durability	Unit Cost	Operator Skill Level	Training Requirements
51	Icom UHF Transceiver, Portable; IC-F40GS/ IC-F40GT	●	●	●	●	●	○	●	●	○	○	◑	◑	●	●
52	Icom UHF Transceiver, Portable; IC-F40LT Land Use; IC-F40M/IC-F40LT Marine Version	●	◑	●	●	●	○	●	●	○	○	●	●	●	●
55	Kenwood Synthesized FM Portable Radio; TK-260/G	●	○	●	●	○	○	●	●	●	◑	◑	●	◑	◑
56	Kenwood Synthesized FM Portable Radio; TK-270/G	●	○	●	●	○	○	●	●	●	◑	◑	●	◑	◑
57	Kenwood Synthesized FM Portable Radio; TK-360/G	●	○	●	●	○	○	●	●	●	○	◑	●	◑	◑
58	Kenwood Synthesized FM Portable Radio; TK-370/G	●	○	●	●	○	○	●	●	●	○	◑	◑	◑	◑
80	Kenwood Synthesized FM Portable Radio/Trunked System; TK-280	●	◑	●	●	○	○	●	●	●	◑	◑	◑	◑	◑
81	Kenwood Synthesized FM Portable Radio/Trunked System; TK-380	●	◑	●	◑	○	○	●	●	●	◑	◑	◑	◑	◑
82	Kenwood 800/900 MHz FM Transceiver; TK-480 and TK-480 NPSPAC	◑	◑	●	●	○	○	●	●	●	◑	◑	◑	◑	◑
84	Kenwood Trunked Portable Radios; TK-930HDK2 NSPAC	●	◑	●	●	◑	●	NA	NA	NA	◑	◑	◑	◑	◑

'NA' - data field is not applicable for this piece of equipment.

Portable communication equipment (conventional and trunked)

February 2001

ID #	Equipment Name	Maximum Transmitter Power Output	Secure Communications Compatibility	Programmability	User Capability	Line of Sight	Power Requirements	Battery Life	Battery Locking Ability	Vehicular Adapter	Digital Communications Compatibility	Durability	Unit Cost	Operator Skill Level	Training Requirements
90	Motorola Astro Transceiver, Portable: Saber I	●	◑	●	◑	TBD	◕	TBD	TBD	●	●	○	○	◑	◑
91	Motorola Astro Transceiver, Portable: Saber 2	●	◑	●	◑	TBD	◕	TBD	TBD	●	◑	○	○	◑	◑
92	Motorola Astro Transceiver, Portable: Saber 3	●	◑	●	◑	TBD	◕	TBD	TBD	●	◑	○	○	◑	◑
93	Motorola Astro Transceiver, Portable; XTS 3000 Model I	●	◑	●	◑	TBD	○	TBD	TBD	●	◑	◑	○	◑	◑
94	Motorola Astro Transceiver, Portable; XTS 3000 Model 2	●	◑	●	◑	TBD	○	TBD	TBD	●	◑	◑	○	◑	◑
95	Motorola Astro Transceiver, Portable; XTS 3000 Model 3	●	◑	●	◑	TBD	○	TBD	TBD	●	◑	◑	○	◑	◑
96	Motorola Astro Transceiver, Portable; XTS 3000R Series Models 1, 2, & 3	●	◑	●	◑	TBD	◑	TBD	TBD	●	◑	●	○	◑	◑
108	Motorola Transceiver, Portable: MT 2000 VHF	●	○	●	◑	TBD	◑	●	TBD	●	TBD	◑	○	◑	◑
109	Motorola Transceiver, Portable: MTS 2000 Model I	●	◑	●	◑	TBD	◑	●	TBD	○	TBD	◑	○	◑	◑
110	Motorola Transceiver, Portable: MTS 2000 Model II	●	◑	●	◑	TBD	◑	●	TBD	○	TBD	◑	○	◑	◑

'TBD (to be determined) - there is currently no data available to support that selection factor

'NA' - data field is not applicable for this piece of equipment.

Portable communication equipment (conventional and trunked)

February 2001

ID #	Equipment Name	Maximum Transmitter Power Output	Secure Communications Compatibility	Programmability	User Capability	Line of Sight	Power Requirements	Battery Life	Battery Locking Ability	Vehicular Adapter	Digital Communications Compatibility	Durability	Unit Cost	Operator Skill Level	Training Requirements
167	Vertex VX Series; VX-400U (UHF Model)	●	◑	●	●	○	○	◑	TBD	TBD	TBD	◑	◑	●	●
168	Vertex VX Series; VX-500	●	◑	●	●	◑	○	◑	TBD	TBD	TBD	◑	TBD	●	●
169	Vertex VX Series; VX-510LX (Low Band VHF)	●	◑	●	●	◑	○	●	TBD	TBD	TBD	◑	◑	●	●
170	Vertex VX Series; VX-510V (VHF Model)	●	◑	●	●	○	○	●	TBD	TBD	TBD	◑	◑	●	●
171	Vertex VX Series; VX-510U (UHF Model)	●	◑	●	●	○	○	●	TBD	TBD	TBD	◑	◑	●	●

'TBD (to be determined) - there is currently no data available to support that selection factor.
'NA' - data field is not applicable for this piece of equipment

Table 7c Comparison of Conventional and Trunked Mobile Communication Equipment (Source: Guide for the Selection of Communication Equipment for Emergency First Responders, NIJ Guide 104-00, February 2002)

Mobile communication equipment (conventional and trunked)

February 2001

ID #	Equipment Name	Maximum Transmitter Power Output	Secure Communications Compatibility	Programmability	User Capability	Line of Sight	Power Requirements	Battery Life	Battery Locking Ability	Vehicular Adapter	Digital Communications Compatibility	Durability	Unit Cost	Operator Skill Level	Training Requirements
15	Comnet Ericsson Orion Mobile Radio	●	●	●	●	●	●	NA	NA	NA	◑	◑	○	◑	◑
25	Provoice™ Orion™ Mobile 800 MHz	●	●	●	◑	●	●	NA	NA	NA	●	●	○	◑	◑
37	EF Johnson Transceiver 5311 VHF	●	●	●	◑	●	●	NA	NA	NA	TBD	TBD	TBD	◑	◑
38	EF Johnson Transceiver 5300-800 MHz	●	●	●	◑	●	●	NA	NA	NA	TBD	TBD	TBD	◑	◑
45	Icom VHF Mobile Transceiver, IC-F1020	●	○	●	●	●	●	NA	NA	NA	○	◑	◑	●	●
46	Icom UHF Mobile Transceiver, IC-F2020	●	○	●	●	●	●	NA	NA	NA	○	◑	◑	●	●
47	Icom VHF Mobile Transceiver, IC-F320/ IC-F420	●	○	●	●	●	●	NA	NA	NA	○	◑	●	●	●
48	Icom UHF Mobile Transceiver, IC-F320S/ IC-F420S	●	◑	●	●	●	●	NA	NA	NA	○	◑	●	●	●
59	Kenwood Compact Synthesized FM Mobile Radio, TK-760G	●	◑	●	●	●	●	NA	NA	NA	◑	◑	●	◑	◑
60	Kenwood Compact Synthesized FM Mobile Radio, TK-860G	●	◑	●	●	●	●	NA	NA	NA	◑	◑	◑	◑	◑

'TBD (to be determined) - there is currently no data available to support that selection factor.
'NA' - data field is not applicable for this piece of equipment

Mobile communication equipment (conventional and trunked)

February 2001

ID #	Equipment Name	Maximum Transmitter Power Output	Secure Communications Compatibility	Programmability	User Capability	Line of Sight	Power Requirements	Battery Life	Battery Locking Ability	Vehicular Adapter	Digital Communications Compatibility	Durability	Unit Cost	Operator Skill Level	Training Requirements
61	Kenwood Compact Synthesized FM Mobile Radio; TK-7620	●	◑	●	●	●	●	NA	NA	NA	◑	◑	●	◑	◑
62	Kenwood Compact Synthesized FM Mobile Radio; TK-8620	●	◑	●	●	●	●	NA	NA	NA	◑	◑	●	◑	◑
72	Kenwood VHF/UHF Mobile Radio; TK-780	●	◑	●	●	●	●	NA	NA	NA	◑	◑	◑	◑	◑
73	Kenwood VHF/UHF Mobile Radio; TK-880	●	◑	●	●	●	●	NA	NA	NA	◑	◑	◑	◑	◑
85	Kenwood Trunked Compact Mobile Radio; TK-980	●	◑	●	●	◑	●	NA	NA	NA	◑	◑	◑	◑	◑
86	Kenwood Trunked Compact Mobile Radio; TK-81	●	◑	●	●	◑	●	NA	NA	NA	◑	◑	◑	◑	◑
97	Motorola Dual Mode Mobile; MCS 2000 Mobile Model II	●	◑	●	◑	●	●	NA	NA	NA	○	○	○	◑	◑
98	Motorola Dual Mode Mobile; MCS 2000 Mobile Model II	●	◑	●	◑	●	●	NA	NA	NA	TBD	○	◑	◑	◑
99	Motorola Dual Mode Mobile; MCS 2000 Mobile Model III	●	◑	●	◑	●	●	NA	NA	NA	TBD	○	○	◑	◑
100	Motorola Transceiver; Astro Digital Spectra W3	●	◑	●	◑	●	●	NA	NA	NA	◑	○	○	◑	◑

'TBD (to be determined) - there is currently no data available to support that selection factor.
'NA' - data field is not applicable for this piece of equipment.

Mobile communication equipment (conventional and trunked)

February 2001

ID #	Equipment Name	Maximum Transmitter Power Output	Secure Communications Compatibility	Programmability	User Capability	Line of Sight	Power Requirements	Battery Life	Battery Locking Ability	Vehicular Adapter	Digital Communications Compatibility	Durability	Unit Cost	Operator Skill Level	Training Requirements
101	Motorola Transceiver, Astro Spectra W4	●	◑	●	◑	●	●	NA	NA	NA	TBD	○	○	◑	◑
102	Motorola Transceiver, Astro Spectra W5	●	◑	●	◑	●	●	NA	NA	NA	◑	○	○	◑	◑
103	Motorola Transceiver, Astro Spectra W7	●	◑	●	◑	●	●	NA	NA	NA	◑	○	○	◑	◑
104	Motorola Transceiver, Astro Spectra W9	●	◑	●	◑	●	●	NA	NA	NA	◑	○	○	◑	◑
147	Vertex FTL Series, FTL-1011 (VHF LowBand)	●	◑	●	◑	●	●	NA	NA	NA	◑	◑	TBD	◑	◑
148	Vertex FTL Series, FTL-1011H (VHF LowBand HiPower)	●	◑	●	◑	●	●	NA	NA	NA	◑	◑	TBD	◑	◑
149	Vertex FTL Series, FTL-2011 (VHF Highband)	●	◑	●	◑	●	●	NA	NA	NA	◑	◑	TBD	◑	◑
150	Vertex FTL Series, FTL-7011 (UHF)	●	◑	●	◑	●	●	NA	NA	NA	◑	◑	TBD	◑	◑
172	Vertex VX Series, VX-2000V Mobile Radio (VHF)	●	◑	●	◑	●	●	NA	NA	NA	◑	◑	TBD	◑	◑
173	Vertex VX Series, VX-2000U Mobile Radio (UHF)	●	◑	●	◑	●	●	NA	NA	NA	○	◑	TBD	◑	◑

'TBD (to be determined) - there is currently no data available to support that selection factor.
'NA' - data field is not applicable for this piece of equipment.

Mobile communication equipment (conventional and trunked)

February 2001

ID #	Equipment Name	Maximum Transmitter Power Output	Secure Communications Compatibility	Programmability	User Capability	Line of Sight	Power Requirements	Battery Life	Battery Locking Ability	Vehicular Adapter	Digital Communications Compatibility	Durability	Unit Cost	Operator Skill Level	Training Requirements
174	Vertex VX Series VX-5000L (VHF Lowband)	●	○	●	◑	●	●	NA	NA	NA	◑	◑	TBD	◑	◑
175	Vertex VX Series VX-5000V (VHF)	●	○	●	◑	●	●	NA	NA	NA	◑	◑	TBD	◑	◑
176	Vertex VX Series VX-5000U (UHF)	●	○	●	◑	●	●	NA	NA	NA	◑	◑	TBD	◑	◑

'TBD (to be determined) - there is currently no data available to support that selection factor.
'NA' - data field is not applicable for this piece of equipment.

Table 7d Comparison of Base Station and/or Repeater Communication Equipment (Source: Guide for the Selection of Communication Equipment for Emergency First Responders, NIJ Guide 104-00, February 2002)

Base station and/or repeater communication equipment

February 2001

ID #	Equipment Name		Maximum Transmitter Power Output	Secure Communications	Programmability	User Capability	Line of Sight	Power Requirements	Digital Communications Compatibility	Durability	Unit Cost	Operator Skill Level	Training Requirements
24	ProVoice™ MASTR™ III Base Station 800 MHz	Mobile Base Station or Repeater (Trunking is the primary operating mode)	NA	●	●	●	NA	●	●	●	○	◑	◑
30	EF Johnson Aurio Digital Repeater/Basestation; RS-5604 (Single Channel)/5614 (Dual Channel) UHF	Digital Base Station (Conventional)	NA	●	●	●	NA	●	●	○	○	◑	◑
115	Motorola Station/Repeater; QUANTAR	Functions as a Base Station or Repeater (Conventional or Trunking)	NA	●	●	●	NA	●	◑	○	○	◑	◑
116	Motorola Station/Repeater; QUANTRO	Base Station/Repeater (Conventional/Trunking)	NA	●	●	●	NA	●	◑	○	○	◑	◑
180	Vertex Repeaters or Base Station; VXR-5000 (UHF)	Mobile Base Station or Repeater (Conventional; Trunking Capable with Optional Accessory Board)	NA	●	●	●	NA	●	TBD	NA	TBD	○	○
181	Vertex Repeater or Base Station; VXR-7000 (VHF)	Mobile Base Station or Repeater (Conventional; Optional VX-Trunk Operation)	NA	●	●	●	NA	●	TBD	NA	TBD	○	○

'TBD (to be determined) - there is currently no data available to support that selection factor.
'NA' - data field is not applicable for this piece of equipment.

Table 8. Questionnaires for Selecting Communication Equipment (Source: Domestic Preparedness Program in Defense of Weapons of Mass Destruction Report on Communication Equipment, CON-SPACE Communication, Inc., October 26, 1999)

Portable Radio Capabilities

1. In voice communication continuous?
2. What is the level of intrinsic safety?
3. What materials are used in the construction of the equipment?
4. Is the equipment waterproof? Immersion proof?
5. What is the power source?
6. What is the battery life? Is there a low battery warning?
7. Can it be used while wearing breathing apparatuses or PPE?
8. What kinds of accessories are available?
9. Are system components and accessories interchangeable?
10. How quickly can the equipment be deployed?
11. Is the equipment shielded against RF or electromagnetic interference?
12. How easy is it to use? How much training is required?
13. How many people can be on the communication system at once?
14. What type of warranty does it come with?
15. Is the equipment built to a quality standard and what?

Portable Radio Accessories

1. Can the equipment and accessory be used with or without a facemask?
2. Can the equipment and accessory be used with an encapsulated suit?
3. What radios are compatible with the unit?
4. How does the equipment function in high noise (a lot of electrical or environmental interference) surroundings?
5. Does the equipment require batteries? What type? How many? Battery life?
6. Is the equipment waterproof?
7. Is the equipment spark proof, intrinsically safe, or explosion proof?
8. Is the product voice activated? Push-to-talk (PTT)? Both? How big is the PTT switch?
9. Can the PTT be activated through a suit? How tactile is the switch?
10. What receiver options are available?
11. Can the unit be decontaminated?
12. Does other protective equipment affect the clarity of communication?
13. Will communication capability be affected by the removal or addition of PPE?
14. Is the product ruggedly constructed? What is the warranty period and condition?
15. Who uses the product now? Where? For what application?
16. How much does a complete unit with radio interface cable cost?
17. What is the cost of ownership over time (i.e., batteries, additional components, etc.)?
18. Report on Communication Equipment" can be used by TEPB to determine and select appropriate communication equipment from the large number of products present in the marketplace.

The types and costs of communication systems vary based on the scales and complexity of the emergency incidents and organization that tasked to respond to the emergencies. The following are communication systems and equipment recommended for an ICS operation that require effective communication and collaboration within a large number of personnel from various organizations or a typical environmental monitoring and investigation project related to chemical/hazardous material incident and conducted by TEPB.

- First responders (fire department, on-scene hazmat workers and emergency rescuers, etc.) and the main ICS for controlling and managing incidents – One (1) conventional or conventional and trunked repeater such as a ProVoice™ MASTR III Station, EF Johnson Auris Digital Repeater/Base Station, or equivalent for a remote command center; multiple numbers of conventional and trunked portable radios such as ProVoice™ P7100^{IP} portables, EFJohnson Ascend™ portables, or equivalent for field staff (not associated with a vehicle); and one (1) or multiple mobile radios such as ProVoice™ M7100^{IP} mobile radios or EF Johnson Ascend™ mobile radios for the mobile command center or staff in vehicles.

- TEPB (planner and post-incident hazmat workers) – Conventional and trunked portable radios and mobile radios (optional, not essential). Table 9 shows the recommended communication system for TEPB. It should be pointed out that if TEPB intends to acquire its own emergency response communication equipment, it should consult the Public Security or Communication Bureau to ensure that the equipment is compatible and/or communicable with those currently used or intended to be used by the TMG emergency response program.

Table 9. Recommended Emergency Response Communication Equipment for TEPB

Type	Make/Model	Main Features	Unit Price ($)	Number Recom'd
Conventional and Trunked Portable Radios	ProVoice™ Jaguar™ 700P/700Pi 800 MHz	Digital (EDAC® and project 25) and analog (voice/conventional) modes, 0.8 kg, frequency range (806-825, 851-870 MHz for transmitter and 851-870 MHz for receiver), rated RF power trunked/talkaround (1, 3/1, 3 W), frequency stability (±1.5 ppm), modulation deviation ±5 kHz), frequency separation (full bandwidth), receiver channel spacing (25 kHz), rated audio output (500 mW), battery life (9 hrs for NiCd, 11 hrs for NiMH), EDACS® security key features, stores up to 800 trunked system/group combinations and up to 200 conv. channels, US/Canada certified, intrinsically safe	$4,500	10
	ProVoice™ P7100^{IP} 800 MHz	Digital (EDAC® and project 25) and analog (voice/conventional) modes, <0.7 kg, frequency range (806-825, 851-870 MHz for transmitter and 851-870 MHz for receiver), rated RF power trunked/talkaround (1, 3/1, 3 W), frequency stability (±1.5 ppm), modulation deviation ±5 kHz), frequency separation (full bandwidth), receiver channel spacing (25 kHz), rated audio output (500 MW), battery life (8 hrs for NiCd, 11 hrs for NiMH), encryption features, stores up to 800 trunked system/group combinations and up to 400 conv. Channels, US/Canada certified, intrinsically safe	$4,500	
	EFJohnson 51 SL 700/800 MHz series	Digital and analog modes, applications, <0.7 kg, frequency range (762-806, 806-870 MHz), rated RF power trunked/talkaround (2.5/1, 3/1 W), frequency stability (±1.5 ppm), frequency separation (full bandwidth), receiver channel spacing (12.5/25 kHz), rated audio output (500 MW), battery life (12 hrs for NiCd, 12 hrs for NiMH, 14-16 hrs for alkaline battery clamshell), encryption features, intrinsically safe, US/Canada certified	$3,250	
	EFJohnson 5100 700/800 MHz series	Digital and analog modes, applications, <0.7 kg, frequency range (762-806, 806-870 MHz), rated RF power trunked/talkaround (2.5/1, 3/1 W), frequency stabllity (±1.5 ppm), frequency separation (full bandwidth), receiver channel spacing (12.5/25 kHz), rated audio output (500 MW), battery life (12 hrs for NiCd, 12 hrs for NIMH, 14-16 hrs for alkaline battery clamshell), encryption features, intrinsically safe, US/Canada certified	$3,800	
	EFJohnson Ascend™ 700/800 MHz series	Digital and analog modes, applications, <0.7 kg, frequency range (762-806, 806-870 MHz), rated RF power trunked/talkaround (2.5/1, 3/1 W), frequency stability (±1.5 ppm), frequency separation (full bandwidth), receiver channel spacing (12.5/25 kHz), rated audio output (500 MW), battery life (12 hrs for NiCd, 12 hrs for NiMH, 14-16 hrs for alkaline battery clamshell), intrinsically safe, US/Canada certified	$3,500	

Conventional and Trunked Mobile Radios	EFJohnson Ascend™	Digital and analog features, 512 channels/talkgroups, dash/trunk mount, 2 control heads, compatible with Motorola Astro® and System v6.5, frequency (762-806 MHz), channel capacity (25/12.5 KHz for analog and 12.5 KHz for P25 digital), frequency separation (full bandwidth), weight (2.3 kg), RF output (10-30/35 W), transmitter frequency (762-776, 792-806, 806-825, 851-870 MHz), frequency modulation (±1.5 ppm), receiver frequency (762-776, 851-870 MHz)	$5,500	2
	EFJohnson 5300 series	Digital and analog features, 512 channels/talkgroups, dash/trunk mount, 2 control heads, compatible with Motorola Astro® and System v6.5, frequency (762-806 MHz), channel capacity (25/12.5 KHz for analog and 12.5 KHz for P25 digital), frequency separation (full bandwidth), weight (2.3 kg), RF output (10-30/35 W), transmitter frequency (762-776, 792-806, 806-825, 851-870 MHz), frequency modulation (±1.5 ppm), receiver frequency (762-776, 851-870 MHz), DES, DES-OFB, AES encryption options	$5,000	
	EFJohnson 53SL series	Digital and analog features, 512 channels/talkgroups, dash/trunk mount, 2 control heads, compatible with Motorola Astro® and System v6.5, frequency (762-806 MHz), channel capacity (25/12.5 KHz for analog and 12.5 KHz for P25 digital), frequency separation (full bandwidth), weight (2.3 kg), RF output (10-30/35 W), transmitter frequency (762-776, 792-806, 806-825, 851-870 MHz), frequency modulation (±1.5 ppm), receiver frequency (762-776, 851-870 MHz), DES, DES-OFB, AES encryption options	$4,000	
	ProVoice™ M7100^{IP} 800 MHz	Digital and analog features, 255 channels/800 talkgroups, dash/remote mount, dual control units, frequency (806-825, 851-870 MHz), channel spacing (25/12.5 KHz), frequency separation (full bandwidth), RF output (10-30/35 W), frequency modulation (±1.5 ppm), receiver frequency (851-870 MHz), DES and AES encryption	$4,200	
	ProVoice™ Jaguar™ 725M 800 MHz	Digital and analog features, 255 channels/800 talkgroups, dash/remote mount, dual control units, frequency (806-825, 851-870 MHz), channel spacing (25/12.5 KHz), frequency separation (full bandwidth), RF output (10-30/35 W), frequency modulation (±1.5 ppm), receiver frequency (851-870 MHz), DES encryption	$4,200	

Note: Equipment brands and models provided in the above table are only part of a large pool of similar communication equipment available in the market (please refer to Tables 7b and 7c). They are provided as references and examples for TEPB

5.0 RECOMMENDED EMERGENCY MONITORING METHODS AND EQUIPMENT

There are various job hazards associated with personnel handling chemical/hazardous material emergency response, namely biological, chemical, and physical hazards. Biological hazards are caused by biological agents capable of producing infection or disease in exposed individuals. They are viral, bacterial, rickettsial, fungal, chlamydial, and parasitic. Similar to chemical agents, biological agents can be dispersed in the environment via water and wind. Personal protection equipment (PPE) used against chemical agents, such as coverall and respiratory protection equipment, can typically be applied to biological hazards. Personal cleanliness and proper immunization offer additional protection against biological hazards by wind.

Physical hazards are generally associated with noise, radiation, heat stress, or cold stress. Excessive noise or prolong exposure to noise can result in hearing loss. An 8-hr, time-weighted average (TWA) noise level of 85 decibels (dB) or greater is considered by the occupational safety organizations as requiring hearing conservation/protection. Ear foam plugs and ear muffs are effective hearing protection devices for emergency response or hazmat workers.

Radiation in the forms of alpha particles, beta particles, and gamma waves can damage living organisms by imparting energy that ionizes molecules in the cells. Alpha particles are hazardous primarily when introduced internally through ingestion or inhalation to the body, but its harmful effects can be readily stopped by a sheet of paper and clothing. Beta particles can penetrate skin and cause skin burns. It can be blocked with a light metal such as aluminum or water. Gamma rays are similar to x-ray. Its wave-like properties can cause deep penetration of skin tissues and result in severe damages to the skin and internal body organs. Common materials used to shield against gamma ray exposure are usually steel or lead. Since radiation has no apparent warning properties, preventing the radioactive materials from entering the body or protecting against external radiation is the best protection.

Heat and cold stresses are driven by the work environment and can be easily prevented in the field by administrative measures and observations of weather conditions.

Chemical hazards are the most frequently encountered job hazards for emergency response/hazmat workers. They are typically classified into several groups, including fire, toxic, corrosive, and reactive hazards. A chemical/hazardous material may elicit more than one chemical hazard during an incident. For example, toxic vapor can be released during chemical fires. The hazards can be a result of the physical/chemical properties of a material or its chemical reactivity with other materials or the environment to which it is exposed. Discussed below are some of the typical chemical hazards.

- Oxygen deficiency is referred to a drop of atmospheric oxygen level to below 19.5% by volume in a work environment. Oxygen deficiency can be protected by wearing atmosphere-supplying respiratory equipment.
- Combustibility is the ability of a material to act as a fuel. Since combustion will require four essential elements: heat, fuel, free radicals, and oxygen, controlling these elements also controls combustion.
- Flammability is the ability of a material to generate a sufficient concentration of combustible vapors under normal conditions to be ignited and produce a flame. Flammable range (FR) is a range of fuel concentrations in air for each material that is optimal for the ignition and the sustenance of combustion. FR is defined by lower flammable limit (LFL) and upper flammable limit (UFL), as the fuel concentrations are either too lean or too rich beyond these two limits. A flammable material is considered highly combustible if it can burn at ambient temperature. But a combustible material is not necessarily flammable because it may not be easily ignited or the ignition maintained.
- Flash point (FP) is the minimum liquid temperature at which sufficient vapors are present above the liquid to ignite. The lower the flash point, the greater the fire hazard of a chemical.
- Gas/vapor explosion is a very rapid and violent release of energy, which is also the most dangerous of all chemical hazards. Explosive gas /vapors also exhibit an explosive range, similar to the flammable range. The upper explosive limit (UEL) and lower explosive limit (LEL) are the UFL and LFL but in confined areas. Fires and explosions require fuel, air (oxygen), and an ignition source (heat). At a chemical/hazardous material incident, the first two are not easily controlled. Consequently, while working onsite where a fire hazard may be present, the concentration of combustible gases in air must be monitored and any potential ignition source must be kept out of the areas.
- The most dangerous flammable chemicals/substances are those (1) easily ignited (pyrophorics), (2) requiring little oxygen to support combustion, and (3) having low LFL/LEL and a wide flammable/explosive ranges.
- Explosion refers to a very rapid chemical transformation that produces large amount of gases and heat, creating both a shockwave and noise. There are four types of explosive hazards: high or detonating, primary high, secondary high, and low or deflagrating. High or low does not indicate the explosive hazard or power, but only the rate of chemical transformation. Explosion can occur as a result of reactions between many

chemicals not ordinarily considered as explosive. Ammonium nitrate, a fertilizer, can explode under the right conditions. Alkali metals and water explode; as will water and peroxide salts. Gases, vapors, and finely divided particulates, when combined, can also explode if an ignition source is present.

- Corrosion can be caused by halogens, acids, or bases. The effects range from skin irritation to severe chemical burns. Corrosivity is defined by (1) $2 \leq pH \leq 12.5$, or (2) corrosion of steel at greater than ¼" per year as determined by the ASTM standard method.
- Reactivity defines the interactions of two or more substances under certain specified conditions resulting in a chemical change. Examples are generation of toxic fumes/gases or explosion when in contact with water (water reactive) or with other chemicals (cyanide and sulfide).
- Toxicity is the relative ability of a substance to cause injury to biological tissues. Toxicity is generally dose-responsive and some of the typical terms are Toxic Dose Low (TD_{Lo}), Toxic Concentration Low (TC_{Lo}, air), Lethal Dose Ten (LD_{10}), Lethal Dose Fifty (LD_{50}), Lethal Concentration Low (LC_{Lo}, air), and Lethal Concentration Fifty (LC_{50}, air). Since some substances exhibit a threshold toxicity level, chemical exposure limits have been used to protect worker health, including Threshold Limit Value [TLV, in time weighted average (TWA, typically an 8-hr average concentration) and short-term exposure level (STEL, the maximum 15-min average concentration)], Permissible Exposure Limits (PEL, an enforceable occupational and health concentration in 8-hr TWA), and Recommended Exposure Limits (REL, generally a 10-hr TWA concentration). Factors that could affect chemical toxicity include roué of exposure, sex, age, and chemical interactions (synergism, antagonism, and potentiation), genetic, and species variations. Human bodies that are susceptible to toxic effects include respiratory tract, skin, eyes, central nervous system, liver, kidneys, and blood. Based on their toxic effects, chemicals may be considered teratogenic (birth detect), mutagenic (genetic or DNA mutation), carcinogenic (cancer-causing).

Exposure pathways refer to the entry route(s) of a chemical/hazardous material into the worker's body, which includes ingestion, inhalation, and dermal contact. Since ingestion and dermal contact can easily be controlled by administrative measures and protective clothing/gloves, these two exposure pathways are less of a concern than inhalation.

In general, airborne contaminants present the most significant threat to worker health and safety during an emergency response situation. Thus, identification and quantification of these contaminants through proper monitoring equipment is essential for the selection of personal protective equipment (PPE), delineation of protection areas, and assessment of potential exposure health risks. There are two approaches for identifying and/or quantifying airborne contaminants: on-site direct-reading equipment and laboratory analyses of air samples obtained by gas-sampling bag filters, sorbents, or wet-contaminated collection methods. The focus of this FS is field direct-reading monitoring equipment. Table 10 briefly summarizes the pros and cons of this type of monitoring equipment.

Table 11 lists some of the most frequently used emergency monitoring equipment, their operating principals, and limitations.

A spreadsheet of various field emergency monitoring equipments, together with the manufacturer names, locations and contact, models, application, and technical specifications (sensitivity, operation range) has been prepared and shown in Appendix C.

Table 10. Attributes and Constraints of Direct-Reading Field Instruments

Direct-Reading Monitoring Equipment/Instruments	
Attributes	**Constraints**
1. Readily detects hazardous conditions (flammable or explosive atmosphere, oxygen deficiency, presence of toxic gases/vapor/ionizing radiation) 2. Useful in initial site characterization 3. Provides adequate data for selecting PPE	1. Detects and/or measures specific classes of chemicals 2. Generally not designed to measure and/or detect low levels of contaminant 3. Subject to produce false positive or negative results due to interference from other co-existing substances

Table 11. Air Monitoring Field Equipment and Instruments for Emergency Response Actions/Health and Safety Monitoring

Type of Monitoring Equipment	Monitoring Target and operating Principal	Limitations
Hazmat Survey Equipment		
Flame Ionization Detector (FID)	Monitor organic gases and vapors, uses hydrogen flame to ionize organic compounds with an ionization potential (IP) of 15.4 eV or less, display concentrations in parts per million (ppm)	1. does not detect inorganic gases/vapors and some synthetics 2. sensitivity is compound-dependent 3. should not be used at temp. <4°C 4. system modifications are required for high contaminant concentrations or oxygen-deficient atmosphere 5. all responses are relative to methane 6. cannot differentiate methane from other organic gases/vapors
Photoionization Detector (PID)	Monitor total concentrations of many organic and inorganic gases/vapors, uses UV radiation (9.2, 10.2, 11.2 eV) to measure IP of chemical compounds, display concantrations in parts per million (ppm)	1. does not detect methane 2. detects only compounds within the limits of probe IP capability 3. different response to mixed gas 4. interference from other voltage sources 5. response is affected by humidity and particulate 6. more sensitive to complex compounds than simpler ones
Infrared Spectrophotometer (IR)	Measures concentrations of many gases and vapors, uses different frequencies of IR radiation to determine the amount of absorption by each compound under specific frequencies, designed to quantify one or two compound mixtures	1. repeated measurements are required to achieve reliable results 2. requires 115-v AC 3. not approvad for potentially flammable or explosive atmospheres 4. sensitivity affected by water vapor and carbon dioxide
Combustible Gas Indicator (CGI)	Measures the concentration of a combustible gas/vapor, uses a heated filament to burn the gas/vapor then measures the increase in heat, air concentrations are measured in percent of the Lower Explosive limit (LEL) from 0 to 100%	1. temp. reading dependent on the calibration and sampling temp 2. proper calibration to a known concentration of specific combustible gas is required 3. chemicals(tetraethyl lead, silicones, halides and oxygen atmospheres enriched) may shorten the life of filament
Oxygen Meters	Measures the percent of oxygen in tha air by electrochemical sensors	1. must be calibrated prior to use to compensate for altitude and barometric pressura 2. affected by certain gases (e.g., Ozone) 3. high concentrations of carbon dioxide shortens the life of detector cell
Colorimetric Tube Apparatus Detectors	Measures concentrations of specific gases and vapors in ppm by color change from chemical reactions, accuracy is usually rated ±25%	1. sensitivity and accuracy may vary among different manufacturers' tubes 2. many similar chemicals interfere 3. affected by high humidity 4. results are more qualitative than quantitative

Radiation Survey Instruments		
Scintillation Counters	Excellent for alpha radiation detection, uses a photo multiplier tube to detect photons released in the vacuum detection chamber after an alpha particle strikes a thin photo reactive membrane such as mylar, the result is expressed as counts/min.	1. will not measure beta or gamma 2. the membrane on the exterior of the probe is easily damaged
Ionization Chamber	Excellent for gamma and x-radiation, extremely accurate and capable of measuring down to micro-RADS, uses an ionization chamber to measure electrons displaced by radiation	1. must be calibrated properly 2. delicate, requires care in handling and operation
Geiger-Mueller Counters	Similar principal as the Ionization Chamber, except for the special gas used in the chamber and greater voltage between the electrodes, extremely sensitive to beta radiation and the meter is very rugged and portable	1. the instrument's chamber can be saturated and produces false negative result (zero reading) 2. does not produce a uniform response for different radiation energy levels 3. only accurate for the type of radiation energy for which it is calibrated

Conditions to be monitored under an emergency response may include, but are not limited to: oxygen deficiency, combustible gases, organic vapors/gases, inorganic vapors/gases, and potential radiation. Monitoring is conducted during the initial entry of an emergency response incident, as well as during the response incident (for periodic continuous monitoring and perimeter monitoring). In order to perform effective field or on-scene monitoring, the instruments or equipment must meet the following requirements: sensitive, selective, durable, portable, inherently safe (explosion proof), reliable (with high repeatability), and economical.

Sensitivity is the ability of the instrument to sample and analyze appropriate chemical concentration range. To obtain an instrument capable of measuring very low concentration is only appropriate if such low concentration is required due to health and safety concern as sensitivity is directly related to cost. Sensitivity defines the lowest concentration an instrument can accurately analyzed. It is a function of the detecting ability of the instrument, and does not address the electronic amplifier, if the unit is equipped with one. The operating range establishes the upper and lower use limits of the instrument. It encompasses the sensitivity limit at its lower end and the overload point at its upper. Amplification, often used synonymously (and incorrectly) with sensitivity, deals with an electronic amplifier's ability to increase very small electrical signals emanating from the detector. This capacity may be fixed or variable. However, changing the amplification of the detector does not change its sensitivity. For optimal field usefulness, an instrument should possess high sensitivity, wide range, high selectivity, and the ability to vary the amplification of detector signals.

Selectivity establishes what contaminants will elicit a response on the instrument. Additionally, selectivity mandates which, if any, interferences may produce a similar response. Selectivity and sensitivity must be reviewed and interpreted together. Many devices have high selectivity but widely varying sensitivities for a given family of chemicals (for example, aromatics, aliphatics, and amines).

Repeatability means that an instrument should be able to deliver accurate and repeatable data. A variety of factors can impact a device's ability to provide the same result over and over again. These factors including instrument response time, sensor life, recovery time, zero drift or span drift, calibration requirements, and ambient conditions. Another consideration is that the

instrument must give results that are immediately usable, or direct reading with little or no need to interpolate, integrate, or compile large amounts of data.

Durability is a prime consideration for field instruments. Transportation shocks resulting from frequent movements, together with unintentional abuse, ranks high in shortening the usable life of an instrument. To reduce this trauma, instruments selected should have reinforced shells or frames, shock-mounted electronic packages, or padded container for shipment. Exposure to the elements and the test atmosphere itself is of concern for those instrument repeatedly used in adverse conditions or long-term monitors. Anodized or coated finishes, weather-resistant packaging and remote sensing are effective in reducing downtime and increasing portability. The portable instrumentation used to evaluate hazardous material releases must be demonstrated as being safe to use in these hostile environments. Electronic devices, such as the monitoring instruments, must be constructed in such a fashion as to eliminate the possibility of igniting a combustible atmosphere.

Economy is a consideration as the cost of an instrument increases with increasing sensitivity, selectivity, and reliability. Therefore, selecting the most sensitive and most selective instrument when not really necessary may result in an unnecessary economic burden.

In addition to field monitoring instrument/equipment, personnel involved in chemical/hazardous material emergency response activities should also wear proper PPE to protect the body against contact with known or anticipated toxic chemicals. Standard PPE for hazmat workers may consist of respirators, goggles/glasses, gloves, coveralls, ear plug/muff, and steel-toe boots. Selection for respiratory protection should consider (1) the nature of the hazard; (2) characteristics of the hazardous situation; (3) the location of the hazardous area in relation to a safe area having respirable air; (4) the period of time required for respiratory protection; (5) the activities of workers; (6) the physical characteristics, functional capabilities, and limitation of respirators of various types; and (7) the respirator-protection factors and respirator fit. All individuals wearing respirators should have their dedicated respirators and passed quantitative or qualitative fit test. Based on its functionality and how the air is supplied, respirators can be divided into:

- Air-purifying respirators (APR) – quarter mask, half mask, and full face piece with particulate filters, gases/vapors cartridges and canister, and combination devices. APR should only be used when: (1) the identity and concentration of the contaminant are known, (2) the oxygen content in air is at least 19.5%, (3) the contaminant has adequate warning properties, (4) approved canisters/cartridges for the contaminant/concentration are available, and (5) a fit test has been conducted.

- Self-contained breathing apparatus (SCBA, full facepiece and emergency escape hood type) – open circuit and close circuit SCBA. Open circuit SCBA is the only respirator that can be used in immediate danger to life and health (IDLH) situations, oxygen deficient atmosphere, and when either the air contaminants or their concentrations are unknown.

- Airline supplied respirators (ASR) – ASR cannot be used by itself under the IDLH condition.

Table 12 shows various protective clothing/accessories, types of protection offered, and use considerations. Table 13 shows the four (4) different levels of PPE ensembles to be worn by hazmat workers. Level A PPE should be worn when the highest level of respiratory, skin, and eye protection is needed. Level B PPE should be worn when the highest level of respiratory protection is needed, but a lesser level of skin protection. Level C PPE should be worn when the criteria for using APR are met, and Level D PPE should be worn only as a work uniform and not on any site with respiratory or skin hazards, as it provides no protection against chemical hazards.

Table 12. Protective Clothing and Accessories

Body Part Protected	Type of Clothing or Accessory	Descriptions	Type of Protection	Use Consideration
Full Body	Fully-encapsulating suit	One-piece garment. Boots and gloves may be integral attached and replaceable, or separate.	Protects against splashes, dust, gases, and vapors.	Does not allow body heat to escape. May contribute to heat stress in wearer, particularly if worn in conjunction with a closed-circuit SCBA; a cooling garment may be needed. Impairs worker mobility, vision, and communication.
	Non-encapsulating suit	Jacket, hood, pants, or bib overalls, and one-piece coveralls.	Protects against splashes, dust, and other materials but not against gases and vapors. Does not protect parts of head or neck.	Do not use where gas-tight or pervasive splashing protection is required. May contribute to heat stress in wearer. Tape-seal connections between pant cuffs and boots and between gloves and sleeves.
	Aprons, leggings, and sleeve protectors	Fully sleeved and gloved apron. Separate coverings for arms and legs. Commonly worn over non-encapsulating suit.	Provide additional splash protection of chest, forearms, and legs.	Whenever possible, should be used over a non-encapsulating suit (instead of using a fully-encapsulating suit) to minimize potential for heat street. Useful for sampling, labeling, and analysis operations. Should be used only when there is a low probability of total body contact with contaminants.
	Proximity garment (approach suit)	One- or two-piece over garment with boot covers, gloves, and hood of aluminized nylon or cotton fabric. Normally worn over other protective clothing, such as chemical-protective clothing, firefighters' bunker gear, or flame-retardant coveralls.	Protects against brief exposure to radiant heat. Does not protect against chemical permeation or degradation. Can be custom-manufactured to protect against some chemical contaminants.	Auxiliary cooling and an SCBA should be used if the wearer may be exposed to a toxic atmosphere or needs more than 2 or 3 minutes of protection.
	Blast and fragmentation suit	Blast and fragmentation vests and clothing, bomb blankets, and bomb carriers.	Provides some protection against very small detonations. Bomb blankets and baskets can help redirect a blast.	Does not provide hearing protection.
	Firefighters' protective clothing	Gloves, helmet, running or bunker coat, running or bunker pants (NFPA No. 1971, 1972, 1973), and boots.	Protects against heat, hot water, and some particles. Does not protect against gases and vapors, or chemical permeation or degradation. NFPA Standard No. 1971 specifies that a garment consist of an outer shell, an inner liner, and a vapor barrier with a minimum water penetration of 25 lba/in^2 (1.8 kg/cm^2) to prevent the passage of hot water.	Decontamination is difficult. Should not be worn in areas where protection against gases, vapors, chemical splashes, or permeation is required.
	Radiation-contamination protective suit	Various types of protective clothing designed to prevent contamination of the body by radioactive particles.	Protects against alpha and beta particles. Does NOT protect against gamma radiation.	Designed to prevent skin contamination. If radiation is detected on site, consult an experienced radiation expert and evacuate personnel until the radiation hazard has been evaluated.

Full Body	Cooling garment	One of three methods: (1) A pump circulates cool dry air throughout the suit or portions of it via an air line. Cooling may be enhanced by use of a vortex cooler, refrigeration coils, or a heat exchanger. (2) A jacket or vest having pockets into which packets of ice are inserted. (3) A pump circulates chilled water from a water/ice reservoir and through circulating tubes, which cover part of the body (generally the upper torso only).	Removes excess heat generated by worker activity, the equipment, or the environment.	(1) Pumps circulating cool air require 10 to 10 ft3 (0.3 to 0.6 m3) of reparable air per minute, so they are often uneconomical for use at a waste site. (2) Jackets or vests pose ice storage and recharge problems. (3) Pumps circulating chilled water pose ice storage problems. The pump and battery add bulk and weight.
	Flame/fire retardant coveralls	Normally worn as an undergarment.	Provides protection from flash fires.	Adds bulk and may exacerbate heat stress problems and impair mobility.
	Flotation gear	Life jackets or work vests (commonly worn underneath chemical protective clothing to prevent flotation gear degradation by chemicals.)	Adds 15.5 to 25 lbs (7 to 11.3 kg) of buoyancy to personnel working in or around water.	Adds bulk and restricts mobility. Must meet USCG standards (46 CFR Part 160).
Head	Safety helmet (hard hat).	For example, a hard plastic or rubber helmet.	Protects the head from blows.	Helmet shall meet OSHA standard 29 CFR Part 1910.135.
	Helmet liner		Insulates against cold. Does not protect against chemical splashes.	
	Hood	Commonly worn with a helmet.	Protects against chemical splashes, particulates, and rain.	
	Protective hair covering		Protects against chemical contamination of hair. Prevents the entanglement of hair in machinery or equipment. Prevent hair from interfering with vision and with the functioning of respiratory protective devices.	Particularly important for workers with long hair.
	Face shield	Full-face coverage, eight-inch minimum.	Protects against chemical splashes. Does not protect adequately against projectiles.	Face shields and splash hoods must be suitably supported to prevent them from shifting and exposing portions of the face or obscuring vision. Provides limited eye protection.
	Splash hood		Protects against chemical splashes. Does not protect adequately against projectiles.	
	Sweat bands		Prevents sweat-induced eye irritation and vision impairment.	

Eyes and Face	Safety glasses		Protect eyes against large articles and projectiles.	If lasers are used to survey a site, workers should wear special protective lenses.
	Goggles		Depending on their construction, goggles can protect against vaporized chemicals, splashes, large particles, and projectiles (if constructed with impact-resistant lenses).	
Ears	Ear plugs and muffs		Protect against physiological damage and psychological disturbance.	Must comply with OSHA regulation 29 CFR Part 1910.95. Can interfere with communication. Use of ear plugs should be carefully reviewed by a health and safety professional because chemical contaminants could be introduced into the ear.
	Headphones	Radio headset with throat microphones.	Provide some hearing protection while enabling communication.	Highly desirable, particularly if emergency conditions arise.
Hands and Arms	Gloves and sleeves	May be integral, attached, or separate from other protective clothing.	Protect hands and arms from chemical contact.	Wear jacket cuffs over glove cuffs to prevent liquid from entering the glove. Tape-seal gloves to sleeves to provide additional protection.
	Gloves and sleeves	Over gloves.	Provide supplemental protection to the wearer and protect more expensive undergarments from abrasions, tears, and contamination.	
	Gloves and sleeves	Disposable gloves	Should be used whenever possible to reduce decontamination needs.	
Foot	Safety boots	Boots constructed of chemical-resistant material.	Protect feet from contact with chemicals.	
	Boots constructed with some steel materials (e.g., toes, shanks, insoles).	Protect feet from compression, crushing, or puncture by falling, moving, or sharp objects.	All boots must at least meet the specifications required under OSHA 29 CFR Part 1910.136 and should provide good traction.	
		Boots constructed from nonconductive, spark resistant materials or coatings.	Protect the wearer against electrical hazards and prevent ignition of combustible gases or vapors.	
	Disposable shoe or boot covers.	Made of a variety of materials. Slip over the shoe or boot.	Protect safety boots from contamination. Protect feet from contact with chemicals.	Covers may be disposed of after use, facilitating decontamination.
General	Knife		Allows a person in a fully-encapsulating suit to cut his or her way out of the suit in the event of an emergency or equipment failure.	Should be carried and used with caution to avoid puncturing the suit.

General	Flashlight or lantern		Enhances visibility in buildings, enclosed spaces, and the dark.	Must be intrinsically safe or explosion-proof for use in combustible atmosphere. Sealing the flashlight in a plastic bag facilitates decontamination. Only electrical equipment approved as intrinsically safe, or approved for the class and group or hazard as defined in article 500 of the National Electrical Code, may be used.
	Personal dosimeter		Measures worker exposure to ionizing radiation and to certain chemicals.	To estimate actual body exposure, the dosimeter should be placed inside the fully-encapsulating suit.
	Personal locator beacon	Operated by sound, radio, or light.	Enables emergency personnel to locate victim.	
	Two-way radio		Enables field workers of communicate with personnel in the Support Zone.	
	Safety belts, harnesses, and lifeline		Enable personnel to work in elevated areas or enter confined areas and prevent falls. Belts may be used to carry tools and equipment.	Must be constructed of spark-free hardware and chemical-resistant materials to provide proper protection. Must meet OSHA standards in 29 CFR Part 126.104.

Table 13. Sample Protective Ensembles

Protection Level	Equipment	Protection Provided	Should be Used When	Limiting Criteria
A	**Recommended:** Pressure-demand, full face piece SCBA or pressure-demand supplied-air respirator with escape SCBA ▪ Fully-encapsulating, chemical-resistant suit ▪ Inner chemical-resistant gloves ▪ Chemical-resistant safety boots/shoes. ▪ Two-way radio communications **Optional:** ▪ Cooling Unit ▪ Coveralls ▪ Long cotton underwear ▪ Hard hat ▪ Disposable gloves and boot covers	The highest available level of respiratory, skin, and eye protection	▪ The chemical substance has been identified and requires the highest level of protection for skin, eyes, and the respiratory system based on either: - measured (or potential for high concentration of atmospheric vapors, gases, or particulates; or - site operations and work functions involving a high potential for splash, immersion, or exposure to unexpected vapors, gases, or particulates of materials that are harmful to skin or capable of being absorbed through the intact skin ▪ Substances with a high degree of hazard to the skin are known or suspected to be present, and skin contact is possible ▪ Operations must be conducted in confined, poorly ventilated areas until the absence of conditions requiring Level A protection is determined	▪ Fully-encapsulating suit material must be compatible with the substances involved
B	**Recommended:** ▪ Pressure-demand, full-face piece SCBA or pressure-demand supplied-air respirator with escape SCBA ▪ Chemical-resistant clothing (overalls and long-sleeved jacket, hooded, one- or two-piece chemical splash suit; disposable chemical-resistant one-piece suit) ▪ Inner and outer chemical-resistant safety boots/shoes ▪ Hard hat ▪ Two-way radio communications **Optional:** ▪ Coveralls ▪ Disposable boot covers ▪ Face shield ▪ Long cotton underwear	The same level of respiratory protection but less skin protection than level A It is the minimum level recommended for initial site entries until the hazards have been further identified	▪ The type and atmospheric concentration of substances have been identified and require a high level of respiratory protection, but less skin protection. This involves atmospheres: - with IDLH concentrations of specific substances that do not represent a severe skin hazard; or - that do not meet the criteria for use of air-purifying respirators ▪ Atmosphere contains less than 19.5 percent oxygen ▪ Presence of incompletely identified vapors or gases is indicated by direct-reading organic vapor detection instrument, but vapors and gases are not suspected of containing high levels of chemicals harmful to skin or capable of being absorbed through the intact skin	▪ Use only when the vapor or gases present are not suspected of containing high concentrations of chemicals that are harmful to skin or capable of being absorbed through the intact skin ▪ Use only when it is highly unlikely that the work being done will generate either high concentrations of vapors, gases, or particulates or splashes of material that will effect exposed skin

C	**Recommended:** ▪ Full-face piece, air-purifying, canister-equipped respirator ▪ Chemical-resistant clothing (overalls and long-sleeved jacket; hooded, one-or two-piece chemical splash suit; disposable chemical-resistant one-piece suit) ▪ Inner and outer chemical-resistant gloves. ▪ Chemical-resistant safety boots/shoes. ▪ Hard hat. ▪ Two-way radio communications. **Optional:** ▪ Coveralls. ▪ Disposable boot covers. ▪ Face shield. ▪ Escape mask. ▪ Long cotton underwear.	The same level of skin protection as Level B, but a lower level of respiratory protection.	▪ The atmospheric contaminants, liquid splashes, or other direct contact will not adversely affect any exposed skin. ▪ The types of air contaminants have been identified, concentrations measured, and a canister is available that can remove the contaminant. ▪ All criteria for the use of air-purifying respirators are met.	▪ Atmospheric concentration of chemicals must not exceed IDLH levels. ▪ The atmosphere must contain at least 19.5 percent oxygen.
D	**Recommended:** ▪ Coveralls. ▪ Safety Boots/Shoes ▪ Safety glasses or chemical splash goggles. ▪ Hard hat. **Optional:** ▪ Gloves ▪ Escape mask ▪ Face Shield	No respiratory protection. Minimal skin protection.	▪ The atmosphere contains no known hazard. ▪ Work functions preclude splashes, immersion, or the potential for unexpected inhalation of or contact with hazardous levels of any chemicals.	▪ This level should not be worn in the Exclusion Zone. ▪ The atmosphere must contain at least 19.5 percent oxygen.

It is our understanding that currently TEPB has limited environmental monitoring equipment to be used in an emergency response incident. Therefore, it is important for this FS to recommend some of the essential field monitoring equipment capable of detecting various hazardous constituents and providing appropriate warnings to the hazmat workers. Table 14 lists the recommended field monitoring equipment/instruments commonly used in the U.S. In most cases, several similar equipment/instruments have been provided as additional option to TEPB. It should be pointed out that all of the recommended/optional equipment shown in Table 13 have been in the market for an extended period and proven effective. All of them come with self-explanatory manufacturing manuals and/or service hotlines for customer assistance. No other training programs are required for operating these instruments/equipment.

6.0 POST-EMERGENCY ENVIRONMENTAL CLEANUP AND RESTORATION

Another area that TEPB has expressed strong interest in is post-emergency environmental restoration or cleanup. This typically involves the following steps:

- Investigation/characterization of chemical of concerns, including determination of proper backgrounds, the types and levels of chemicals/contaminants, and full extent of chemically-impacted environmental media (soil, soil gas, groundwater surface water)

- Feasibility study (FS) to assess various remedial/cleanup alternatives based on (1) cleanup objectives as determined by regulatory criteria or risk assessment focusing on the protection of human health, ecological resources, and water/air quality; (2) other general and site-specific considerations. The outcome is one or a combination of more than one of the best (or most appropriate) remedial alternative. Sometime a bench-scale treatability study or a field pilot test can be conducted as part of the FS to verify the effectiveness of an individual or a group of remedial alternative(s).

- Remedial or removal action plan describes the selected remedial actions that may involve the design, procurement, installation of a remediation system(s) or a soil/contamination source removal actions.

- Remedial design involves the preparation of engineering designs, bid specs, and/or bid document for the selected remedial alternative(s) so that qualified contractors can be chosen to perform the remediation.

- Remediation implementation typically refers to the implementation and actual operation of the selected remedial alternative(s).

- Site closure, post-remediation risk assessment, or monitoring. A site closure means that contamination in the affected environmental media has been properly treated to meet the remedial objectives (protection of human health, environment, and ecological resources) and no further regulatory actions are required. In the event that the site contamination can not be reasonably treated (after a demonstrated effort) to meet the remedial objectives, a post-remediation risk assessment may be conducted to assess the potential effects of "residual contamination" on human/ecological health and the environment. The results

Table 14. Recommended Environmental and Occupational Monitoring Instruments/Equipment

Brand Name	Detection (Operation) Range	Field Battery Time	Dimensions	Weights	Est. Cost*
Multi-Gas Monitoring (Confined Space or General Worker Safety)					
INNOVA Four-Gas Monitors (GT402)	O_2 (0 to 30%), LEL (0 to 100%), CO (0 to 300 ppmv), H_2S (0 to 200 ppmv), and HC (0 to 10,000 ppmv)	10 hrs	6" x 5" x 10"	5 lbs	$2,875
TMX412 Four-Gas Monitor	O_2 (0 to 30%), LEL (0 to 100%), CO (0 to 999 ppmv), and H_2S (0 to 999 ppmv)	10 hrs	5" x 3" x 2"	1.7 lbs	$4,070
MSA Orion Multigas Detector	O_2 (0 to 25%), LEL (0 to 100%), CO (0 to 1,000 ppmv), and H_2S (0 to 200 ppmv)	16 (w/ pump) to 20 hrs (w/o pump)	NA	NA	$3,250
MultiRAE Four-Gas Monitor with PID	O_2 (0 to 30%), LEL (0 to 100%), CO (0 to 500 ppmv), H_2S (0 to 100 ppmv), and VOCs (PID 10.6 eV lamp, 0 to 2,000 ppmv))	10 hrs	2" x 3" x 4.65"	1 lbs	$5,025
Neotronics Impact Pro Multi-Gas Monitor	O_2 (0 to 25%), LEL (0 to 100%), CO (0 to 500 ppmv), and H_2S (0 to 50 ppmv)	12 hrs	2" x 3.3" x 5.3"	1.2 lbs	$2,000
QRAE Plus Four-Gas Monitor	O_2 (0 to 30%), LEL (0 to 100%), CO (0 to 500 ppmv), and H_2S (0 to 100 ppmv)	20 hrs	2" x 3" x 4.5"	0.9 lbs	$2,020
Volatile Organic Compounds (VOCs) Monitoring					
AreaRAE Wireless Gas Detector (Model 5020 w/ built-in RF Modem for data transmission)	O_2 (0 to 30%), LEL (0 to 100%), CO (0 to 500 ppmv), H_2S (0 to 100 ppmv), and VOCs (PID 10.6 eV lamp, 0 to 2,000 ppmv))	24 hrs	4.5" x 6" x 7.25"	4.5 lbs	$9,600
Foxboro TVA 1000 Portable Vapor Analyzer with both PID and FID	VOCs (FID, hydrogen flame, 0 to 50,000 ppmv; PID, 10.6 eV lamp, 0 to 2,000 ppmv)	8 hrs	10.3" x 13.5" x 3.2"	12 lbs	$13,620
MiniRae 2000 Handheld VOC Monitor	VOCs (PID, 10.6 eV lamp, 0 to 10,000 ppmv)	10 hrs	2" x 3" x 8.2"	1.2 lbs	$5,060
Photovac Model 2020 VOC monitor with built-in data loggers for 1,000 data points	VOCs (PID, 10.6 eV lamp, 0.5 to 2,000 ppmv isobutylene equivalent)	10 hrs	9.75" x 3" x 2.6"	1.75 lbs	$4,890
Photovac MicroFID with built-in datalogger	VOCs (FID, hydrogen, 0.1 to 50,000 ppmv methane equivalent)	8 hrs	7.4" x 3.85" x 17.1"	8.1 lbs	$10,670

Thermo 580B Organic Vapor Meter	VOCs (PID with 10.6 eV and optional 11.8 eV lamp, 0 to 2,000 ppmv)	8 hrs	6.75" x 5.75" x 10"	6 lbs	$6.005 (Add $400 for 11.8eV Lamp)
Thermo Environmental Hydrocarbon Analyzer Model 680 with built-in datalogger (4,000 readings)	VOCs (FID, 0 to 20,000 ppmv, autoranging)	10 hrs	12.5" x 11.5" x 2.6"	10.5 lbs	$11,675
UltraRAE Benzene Monitor (Model PGM-7200)	Benzene (PID, 9.8 eV lamp, 0 to 200 ppmv)	10 hrs	7.75" x 2.75" x 1.5"	1 lbs	$6500 (5 bx of benzene tubes)
Health and Safety/Compliance Monitoring (Dust, Radiation, Toxic Gases, Heat Stress, Noise)					
Met One 227 Particle Counter with built-in datalogger for 200 records	Two channel sizes (0.3 and 0.5, 1, 3, or 5 μm particulate)	8 hrs	6.9" x 4" x 2.3"	2.1 lbs	$3,360
TSI DustTrak Aerosol Monitor Model 8520 with built-in datalogger	Multiple particle sizes from 0.1 to 10 μm, measurement range from 0.001 to 100 mg/m^3	16 hrs	8.7" x 5.9" x 3.4"	3.3 lbs	$4,440
MIE Personal DataRAM Model PDR 1000 with integral datalogger 91,300 data points)	Dust, smoke, mists, and fumes (0.001 to 400 mg/m3 for particles ranged from 0.1 to 10 μm)	24 hrs	6" x 3.6" x 2.5"	1.1 lbs	$4,404
Questemp II Personal Heat Stress Monitorersonal Heat Stress with datalogger	Body temp. (32 to 40°C)	60 hrs, 12 hrs (datalogging)	5.1" x 2.5" x 1"	0.63 lbs	$2,125
Questemp 34 Area Heat Stress Monitor with datalogger (group protection)	Temp. (-5°C to 100°C)	150 hrs	9.2" x 7.2" x 3"	2.6 lbs	$2,875
Vaisala Humidity and Temperature Meter	Temp. (-4°F to 140°F) and humidity (0 to 100%)	50 hrs	6.3" x 2.2" x 1.1"	0.5 lbs	$960
Drager Hazardous Material Kit and Organic Vapor Simultaneous Test Set	Accuro hand pump, 17 boxes of detector tubes, 3m extension hose; detector tubes for ketone, alcohols, aromatics, aliphatic, and chlorinated hydrocarbons, tube opener and manifold	NA	Case (15.5" x 12.25" x 7.5")	NA	$2,500
Foxboro Miran SapphiRe XL Ambient Air Analyzer	Over 100 compounds in wavelength region from 7.7 to 14.1 microns, display in ppm, ppb, or %	8 hrs	NA	18 lbs	$23,220
Ludlum 2241 Digital Radiation Survey Meter with 44-9 Pancake Probe	Alpha > 4 MeV, beta > 70 keV, and gamma > 6 keV	200 hrs	Meter (6.5" x 3.5" x 8.5") and probe (1.8" x 2.7" x 10.7")	Meter (3.5 lbs) and probe (1 lb)	$1,750
Victoreen 190 Radiation Survey and Count Rate Meter with 489-110D probe	Alpha > 3.5 MeV, beta > 35 keV, and gamma > 6 keV	NA	NA	NA	$1,750

CEL-254 Type 2 Sound Level Meter w/ Model 282 Calibrator	30 to 135 dB(A) Type 2 measurement	20 hrs	258 mm x 70 mm x 21 mm	230 grams	$1,000
CEL-360 Noise Dosimeter	70 to 140 dB, 50 to 120 dB, peak over top 40 dB of range	40 hrs	4.8" x 2.6" x 1.2"	0.5 lbs	$1,875
NoisePro DLX Datalogging Noise Dosimeter	40 to 110 dB, 70 to 140 dB	48 hrs	5.5" x 2.8" x 1.4"	1 lb	$2,340
Novalynx Weather Station Model 110-WS-16	Barometric pressure (28.25 to 30.75 in Hg), wind speed (0 to 99 mph), wind direction (0 to 360°), temp. (-40 to 140°F), relative humidity (0 to 100%)	NA	NA	NA	$3,500
ToxiRAE II Personal Gas Monitor for Chlorine and Ammonia	0 to 2,999 ppmv	10 hrs	6" x 1.75" x 1"	0.4 lbs	$1,050 each
Drager PAC III Single Gas Monitor	Toxic gas - H_2S (0 to 100 ppmv), NH_3 (0 to 300 ppmv), SO_2 (0 to 50 ppmv)	600 hrs	4.3" x 2.6" x 1.3"	0.43 lbs	$1,250 each
Interscan Toxic Gas Analyzer 1000 Series Dual-Range Portables	CO (Model 1144 - 0 to 600 ppmv, 1146 - 0 to 100 ppmv), Cl_2 (Model 1340 - 0 to 10 ppmv), HCHO (Model 1163 - 0 to 5 ppmv), N_2H_4 (Model 1183A - 0 to 2 ppmv), HCl (Model 1360 - 0 to 10 ppmv), HCN (Model 1280 - 0 to 10 ppmv, 1280SP - 0 to 100 ppmv), H_2S (Model 1170SP - 0 to 10 ppmv, 1176 - 0 to 100 ppmv), NO_X (Model 1545 - 0 to 50 ppmv), NO_2 (Model 1152 - 0 to 10 ppmv), SO_2 (Model 1240A - 0 to 10 ppmv, 1240SP - 0 to 20 ppmv)	10 hrs	7.25" x 6" x 11.5"	7.6 lbs	$3,180 to $4,745 each
Zellweger ChemKey TLD Toxic Gas Monitor	Amines, diisocyanates, hydrazines, hydrides, hydrogen cyanide, hydrogen sulfide, mineral acids, oxidizers, phosgene, sulfur dioxide	8 hrs	6.5" x 8.4" x 7"	9 lbs	$7,500 plus individual ChemKeys for $300/gas
Jerome Mercury Vapor Analyzer Model 431	0 to 0.999 mg	6 hrs	4" x 13" x 6"	7 lbs	$6,600
Water Quality Monitoring					
Heron H.O1L Oil and Water Interface Meter	Depths (100, 200, 300 ft), product thickness (0.06 inches), fluid depth (to within 0.12 inches)	NA	NA	NA	Prices range from $1,500 TO $1,850

Solinst Model 121 Oil and Water Interface Meter	Depths (100, 200 ft), product thickness (0.06 inches), fluid depth (to within 0.12 inches)	NA	NA	NA	Prices range from $1,680 TO $1,920
Geotech ORS Oil and Water Interface Probe	Product thickness (0.06 inches), fluid depth (to within 0.12 inches)	NA	12" x 12" x 4"	9 lbs	$3,000
Solinst Model 101 Water Level Meter	Depths (100, 200 ft), fluid depth (to within 0.12 inches)	NA	NA	NA	Prices range from $600 TO $780
Horiba U-22 Water Quality Monitoring System with built-in datalogger for 2,880 data points	Depths (2, 10, 30 m), pH (0 to14), DO (0 to 19.9 mg/L), conductivity (0 to 9.99 S/m), salinity (0 to 4%), TDS (0 to 100 mg/L), temp. (0 to 50°C), turbidity (0 to 800 NTU), ORP (±1,999 mV)	NA	6.7" x 3.5" x 2.2"	probe (3.3 lbs), meter (1 lb)	$6,750
Myron 6P Ultrameter	pH (0 to14), conductivity (0 to 9,999 mS), TDS (0 to 9,999 mg/L), temp. (32 to 160°F), resistivity (10 KW to 30 MW), ORP (±999 mV)	100 hrs	2.5" x 2.7" x 7.7"	0.8 lbs	$975
YSI Model 600 QS Water Quality System with built-in datalogger for 150 data sets	Depths (0 to 200 ft), pH (0 to14), DO (0 to 500%, 0 to 50 mg/L), conductivity (0 to 100 mS/cm), salinity (0 to 70 ppt), temp. (-5 to 45°C), ORP (±999 mV)	30 hrs	sonde (1.65" OD x 14" long), meter (4.7" x 9")	sonde (1.1 lbs), meter (2.1 lbs)	$6,250
Global Water Flow Probe/Digital Water Velocity Meter	Flow velocity from 0.3 to 25 ft/sec	12 months	3 to 15 ft long	2 lbs	$1,000
Masterflex 0757100 Peristaltic Environmental Sampling Pump	Suction lift (27 ft), flow rate (0.06 to 680 mL/min), rpm (70 to 400)	2.5 hrs	16" x 10.25" x 11"	16.5 lbs	$1,650

Note: NA – Not Available, * Est. costs cited in this table is based on various sources from manufacturers, distributors, and/or equipment rental companies with a 20 to 30% inflation from the US prices to account for international pricing

of post-remediation risk assessment coupled with environmental monitoring data (soil, soil gas, groundwater) may allow a conditional site closure or other regulatory decision to be made.

The above environmental restoration process has been used extensively in the U.S. since the late 1980's, beginning with the Superfund sites. Today, similar process is used to handle contaminated sites, hazardous waste sites, and/or brownfields sites containing chemicals/hazardous constituents. This process is typically overseen by a lead environmental regulatory agency such as TEPB and sometimes with public participation. Table 15 summarizes frequently used environmental restoration/remediation techniques and estimated unit costs.

7.0 OTHER TRAINING RECOMMENDATIONS

Although the TEPB staff is not likely to participate in a chemical/hazardous material emergency response incident as first responders, they can be exposed to various hazards and chemical contaminants during the subsequent environmental monitoring, investigation, and cleanup activities. Based on the typical roles that a TEPB staff may be assigned to support a chemical/hazardous material emergency response incident (e.g., as hazardous materials technician, hazardous materials specialist, or on-scene incident commander), it is recommended that at a minimum, all TEPB staff take appropriate health and safety training similar to the HAZWOPER 40-hr and annual 8-hr refresher training courses in the U.S. The trainees are required to maintain current and valid training certificates and copies of training certificates should be included as part of the personal file of the staff together with his or her medical surveillance records.

The HAZWOPER training should cover but may not be limited to the following topics:

- Regulations, Rights, and Responsibilities – including laws and regulations for environmental quality and worker health & safety protections, as well as specific requirements involve hazardous materials/waste operations.

- Hazard Identifications – including basic concepts of job hazards, specific discussions of biological, physical (electrical, radiation, vehicular, noise, heat/cold stress), chemical (reactivity, combustibility/flammability, explosivity, toxicity, and information sources) hazards, and other hazardous conditions and environments such as confined space or trench/excavation.

- Hazard Risk Assessment – including basic concepts, discussions of various exposure limits (immediate danger to life and health or IDLH, TWA) and action levels.

- Hazard Recognition – including basic concepts and various personal and perimeter monitoring programs for the protection of worker and public health.

Table 15. Summary of Frequently Used Environmental Remediation/Restoration Techniques for Contaminated Sites (Cost Est. in US$)

Soil Cleanup/Remediation Alternative		
Treatment Technologies	**Type of Contamination**	**Process Summary, Pros/Cons, Treatment Cost**
Removal and Off-Site Disposal (Landfills)/Treatment	Universal waste contamination	Excavation, engineering controls (shoring, VOC and dust emission control, surface water runoff control), waste profiling, transportation, offsite disposal (optional treatment for Land Ban waste) or treatment, short treatment time, extensive site disruption – Cost range US $35/ton (Non-Hazardous) to $180/ton (RCRA Land Ban Hazardous)
Soil Washing	Both organic compounds and inorganic metals	In-situ (both soil and groundwater contamination): Infiltration gallery, biodegradable surfactant delivering system, contaminated groundwater capture system, groundwater monitoring network, medium to long treatment, minimum site disruption – Cost range $45/CY to $85/CY
		Ex-situ (soil contamination only): Excavation, engineering controls, mobile treatment unit with surfactant washing, liquid-solid separation and liquid collection/recycling/treatment, space for treatment and soil drying, no quantity limits, short to moderate treatment time – Cost range $65/ton to $85/ton
Low Temperature Thermal Desorption	Typically VOCs and fuel petroleum hydrocarbons	Ex-situ (soil contamination only): Excavation, engineering controls, mobile rotary kiln treatment unit (350 to 650°F, thermal desorption), off-gas burners and bag house, water quenching, space and natural gas req'd, short to medium treatment time, treated soil w/ low organic content, large quantity – Cost range $85/ton to $100/ton
Vapor Extraction	VOCs only	Typically in-situ (but can be for covered static piles): Soil lithology (unsuitable for low permeability soil), pilot test (vapor conc., zone of influence), extraction well/induction well network, vacuum blower, emission controls (activated carbons, thermal or catalytic oxidizer, IC engine), other enhancements (clay fractionation, steam/hot air injection, radiofrequency ground heating), long-term, least soil disturbance, does not affect land use during treatment, no quantity limits – Cost range from $40/cy to $65/cy
Bioremediation (Bioventing)	Organic compounds (typically fuel petroleum hydrocarbons)	In-situ: Developed by USAF, Assumed Oxygen-Limited, Field Pilot Test (Oxygen Consumption Rates), Air Blower, Air Injection Well (Low Q and Low P) Network, Soil Gas Monitoring for O_2 and CO_2, Low Maintenance Low Cost (Enhanced Natural Attenuation), Long-Term, least Soil Disturbance, Does not Affect land Use During Treatment, No Quantity Limits – Cost Range $15/cy to $25/cy
Bioremediation (Enhanced)	Organic Compounds	In-situ (Best if Both Soil and GW Contaminated): Infiltration Gallery, Nutrient and Oxygen (or Nitrogen for Anaerobic Dehalogenation of Solvents) Delivering System, Groundwater Monitoring Network for Plume and Nutrients, Contaminated Groundwater Capture System (Recycle or Treatment, Only if Plume Migrates), Medium to Long Treatment Time, No Quantity Limits, Minimum Site Disturbance, Does not Affect Land Use During Treatment – Cost Range $35/CY to $65/CY
	Organic Compounds (Typically Low to Non-Volatile Petroleum Hydrocarbons)	Ex-situ (Biopiles): Excavation, Dust Control, Treatment Cells with Nutrient Delivery/Spraying Network System, Earth-Moving Equipment for Soil Tilling, Maintain Proper Moisture and Nutrient Levels, Space for Treatment Cells, Small to Medium Quantities, Short to Moderate Treatment Time – Cost Range $25/ton to $35/ton
		Co-Composting (Windrows): Excavation, Dust Control, Compost Materials (Municipal Sludge, Wood Chips), Earth-Moving and Mixing Equipment, Moisture/Temperature/Pathogen Controls, Stabilized Treatment Product as Landscape Top Soil, Space for Windrows, Short Treatment Time (2 to 3 Wks), Small to Medium Quantities (1 to 5 ratio), Soil Amendments – Cost Range $15/ton to $25/ton with Re-Sale Value
Containment	Universal Waste	Capping with Impervious Materials (Liners, Concrete, Clay Covers): Engineering Designs and Construction, Surface Water Diversions and Collection, VOCs and Gas Collection and Controls (If Necessary), On-Site and Off-Site GW Monitoring Well Network, GW Plume Capture System If Necessary, Long-Term, Land Use Restrictions, No Quantity Limits – Cost Range $40/sq ft to $120/sq ft

Fixation	Soluble Heavy Metals	Ex-situ (Chemical Chelation): Excavation, Dust Control, Mobile Treatment Unit with Chemical Chelaing Agent Dilution and Spraying System, Space for Treatment and Soil Drying, Small to Medium Quantities, Short to Moderate Treatment Time, Treated Soil may be Toxic to Aquatic/Wild Life – Cost Range $75/ton to $90/ton
Stabilization/Solidification	Soluble Heavy Metals	Ex-situ (Fly Ash or Cement): Pilot Test (Optimal Soil-to-Chemical Ratio and Moisture Content, Metal Leaching Test), Excavation, Mobile Treatment Unit or Earth-Moving Equipment for Mixing Stabilization Chemicals with Soils, Compaction, Soil Cover or Asphalt Pavement to Minimize Water Infiltration, Space for Treatment, No Quantity Limits, Short to Moderate Treatment Time, pH between 9 and 11 – Cost Range $60/ton to $75/ton
		In-situ: Pilot Test and Special Mixing Auger – Cost Range $90/ton to $120/ton
Phytoremediation	Heavy Metals and Some Organic Compounds	In-situ: New Concept Old Process, Uptake of Contaminants by Plants, Selected Plant Species are Geographically Specific, Uptake could render Plants/Crops Hazardous or Threaten the Food Chain (Bioaccumulation), Successful Pilot Tests But No Known Full-Scale Applications
Incineration	Universal Waste	Ex-situ: Excavation, Incinerator with Emission Controls, Typically in Permitted, Off-Site Central Treatment Facilities, Short Treatment Time, Expensive – Cost Range $90/ton to $190/ton
Vitrification	Universal Waste, Typically Low Level Mixed Waste or Extremely Hazardous Waste	Mostly In-situ or Batch Treatment: High Temp. Plasma Torch or Electrical Current Process Over 3000°C, VOC Emission Control, Batch Treatment in Specially-Permitted Off-Site Facilities, Vitrified Glass Product is Geologically Stable with No Leaching Potentials, Very Expensive – Individual Quotation

Groundwater Cleanup/Remediation Alternatives			
Technology	**Process Description**	**Contamination**	**Pros and Cons and Est. Cost**
Subsurface Barriers	Slurry wall, sheet piling, grout curtains, reactive wall (gate-and funnel method using ferric iron for dehalogenation of solvent contamination) – direct GW flow for treatment or GW containment	Most organic and inorganic contaminants	Linear zones where barrier is to be installed must be cleared, excavation depends on GW depth, special construction equipment required, not a treatment technology, contaminant remains in media, maintenance req'd, cost typically high and varies, range from $55/cy to $110/cy
Groundwater Capture (Pump-and-Treat)	Groundwater extraction to maintain hydraulic control of the dissolved plume movement	Typically dissolved organic compounds	Active remediation, reduce plume impact and migration, fate-and-transport/ hydrogeological modelings to design and optimize capture efficiency, need GW treatment technologies, cost varies (see below)
Precipitation	Metallic solutes in an aqueous matrix are brought out of solution as suspended solids	Inorganic metals, especially metals with insoluble sulfides	Limited application and space requirement, cost varies from $0.07 to 0.15/ga for throughput rates from 1 to 10 gpm
Activated Carbon Adsorption	Contaminants adsorbed from water onto carbons	Non-polar and volatile organics, aromatics, chelated heavy metals, solvents	Simple, in series or parallel connection, no air emissions, versatile, demonstrated high removal efficiency (adsorption isotherm, Iodine Index), req's on-site or off-site regeneration, GAC ranges from $0.7 to $1/pound, complete system typically between $50,000 to $100,000
Air Stripping	Volatilization of contaminants from water to air	VOCs with high Henry's Law Constant	Simple, low cost, req's air emission controls, modified versions including hot air stripping or change of packing material configurations to enhance air-water contact, stripper tower cost from $7,000 to $50,000, capital cost (including air emission control) from $50,000 to $300,000, O&M from $5,000 to $15,000/month
Air Sparging	Injection of compressed air or oxidant (Ozone) into or below water table to cause volatilization or destruction of organic compounds	VOCs with low polarity, molecular weight, and solubility	Targets saturated zone to volatilize VOCs in dissolved and adsorbed phases, may mobilize the contamination plume if not carefully controlled, micro-bubbles is essential, cost is relatively low unless oxidant (ozone, on-site generation) is used

Bioremediation	Addition of nutrients, oxygen/hydrogen, or special bacterial strains (bioaugmentation) to water and enhance biodegradation of organic compounds	A wide variety of organic compounds	Low cost treatment for cleaning up dissolved and adsorbed organic compounds, either in-situ or ex-situ treatment, oxygen releasing compound (ORC, magnesium peroxide, $MgO_2 + H_2O \rightarrow 1/2O_2 + Mg(OH)_2$) to enhance extended aerobic biodegradation, or hydrogen releasing compounds (HRC, lactic acid) to speed up anaerobic (reductive) dehalogenation of solvents, remediation cost generally low compared to others
Chemical Oxidation	Dissolved contaminants are oxidized in the presence of hydrogen peroxide and UV or simply by hydroxide free radicals produced by cavitation force	Aromatic and halogenated organic compounds	Break down organic contaminants into safe compounds or water and carbon dioxide, no emissions, high destruction efficiency, simple to operate, UV oxidation unit is sensitive to fouling and suspended solids (turbidity), UV/hydrogen peroxide cost $0.15 to $0.20/1000 gal, cavitation system capital cost $80,000 (5 gpm) to $250,000 (50 gpm)

- Hazard Control – including basic concepts, personal protective equipment (PPE), different levels of PPE and upgrade/downgrade requirements, respiratory protection, standard operation procedures and work practices, and work zone site control.

- Emergency Responses – including planning for emergencies, development and element of ERAP, and examples of emergency responses to fire-explosion, spills/releases, medical situations.

An important practice of the HAZWOPER training is for the TEPB staff to develop a hypothetical health and safety plan to respond to a chemical/hazardous material release incident. The health and safety plan should include

- Background information such as incident location and name, site description, maps, site features, topography, hydrology, surface drainages, surrounding land uses as well as human and ecological receptor groups, prevailing winds and speeds, types and quantities of chemical/hazardous materials released, and the dispersion and behavior of the chemical/hazardous materials.
- Objectives and scope of the work that discusses the timing of the action and type of work to be performed
- Key personnel and management structure that identifies key personnel assigned to various site operations and site safety as well as the organization structure, responsibilities, and contact information of the project team.
- Hazards and risks identification that lists all known or potential physical, chemical, and biological hazards associated with the emergency response action, presents all available monitoring data, discusses exposure pathways and resulting potential health impacts of all hazards to the workers, public, and ecological receptors.
- Hazards monitoring and action levels that specifies monitoring method and equipment used to protect the workers and action levels for making proper field decisions (such as upgrade PPE or stop work).
- Designated levels of protection (or PPE) based on the results of hazards and risks identification as well as hazards monitoring.
- Delineation of various work areas (such as exclusion, contamination reduction, and support zones). The size and boundaries of each zone and its access control point should be clearly defined and shown in the map.
- Site control procedures (such as fences, signs, security patrols, and check-in procedures) that establishes methodology to prevent unauthorized entry or access without proper PPE.
- Personnel and equipment decontamination procedures used during the routine and emergency conditions.
- Emergency contacts and routes to hospital that contains emergency contact numbers for key project personnel, Fire, Police, Chemical Control Center/Hotline, other relevant technical support groups, and hospitals (the nearest and alternative ones). A map depicting the routes from the site to the nearest and alternative hospital should also be prepared and incorporated into this section.

- Emergency response for chemical spill and/or release during the performance of the work.
- Special training or medical surveillance program required
- References and technical documents used to prepare the plan.
- Other forms to be used in the field, such as an "acknowledge form" for others who will work at the site and adhere to the conditions of the plan, "tailgate health and safety meeting sign in form" for the worker to sign after each day's tailgate health and safety meeting, and field monitoring equipment calibration forms.

8.0 EMERGENCY RESPONSE PLANNING AND RECOMMENDED EMERGENCY RESPONSE ACTION PLAN

Prior to effectively developing an emergency response management structure, emergency planning must be conducted. Emergency planning typically involves the development and implementation of an emergency response action plan (Plan) and procurement of appropriate emergency response equipment. In general, the following should be considered to determine what an emergency response is. First, if there is no potential safety or health hazard, there is no emergency. This applies whether the release is cleaned up by personnel within or outside the immediate work area. Second, if there is a potential safety or health hazard, there may be an emergency and hence an emergency response. This applies whether the release is responded by employees from outside the work area, by outside groups such as the fire department, or by employees who has been designated by the employer to respond to emergencies from the immediate work area. Based on these, the following situations would generally result in emergency responses:

- The response comes from outside the immediate release area
- The release requires evacuation of employees in the area
- The release poses, or has the potential to pose, conditions that are immediately dangerous to life and health
- The releases poses a serious threat of fire or explosion
- The release requires immediate attention because of imminent danger
- The release may cause high levels of exposure to toxic substances
- There is uncertainty associated with the adequacy of personal protective equipment (PPE) towards the severity of the hazard and the exposure limit may be exceeded
- The situation is unclear or data is lacking on important factors

An emergency response action plan (ERAP) should be developed and implemented to handle anticipated emergencies prior to the commencement of emergency response operations for chemical/hazardous materials. ERAP must addresses all site emergencies - occurrences that require immediate actions to prevent additional problems or harms to workers, the public, properties, or environment. During routine operations, risk is minimized by establishing good work practices and using PPE. However, unpredictable events such as fires, chemical exposure, or physical injury may occur during chemical/hazardous material releases and must be

considered in the ERAP.

Although ERAP may vary in its content based on the organizations involved in a chemical/hazardous material emergency response scenario [e.g., facilities manufacturing or handling (including storing) chemicals/hazardous materials versus local agencies responding to a chemical/hazardous material incident], it is necessary to meet the following requirements.

- The ERAP may either be a section of the overall Site safety and Health Plan or a separate plan for emergencies.
- The ERAP must be available for inspection and copying by all individuals involved in the emergency response action.
- The ERAP must be rehearsed regularly as a part of the overall training program for site operation.
- The ERAP must be compatible and as part of the local or regional government's emergency plan.
- Alarming system must be developed for emergency warning.
- The ERAP must be reviewed and updated to include new information.

It is recommended that the ERAP includes (1) policies and procedures for responding to site emergencies, and (2) emergency response telephone numbers as outline below. Table 16 provides a checklist, Planning for Emergencies, which should be used to facilitate the development and preparation of an ERAP:

1) Pre-emergency planning and coordination with outside agencies – This may include identifications of all potential worker-, waste-, and environmental-related causes for emergency; decision-making in emergencies (a suggestive process is the Ludwin Benner's DECIDE guide used by the U.S. National Fire Academy – **D**etect the presence of hazardous materials, **E**stimate likely harm without intervention, **C**hoose response objectives, **I**dentify options, **D**o best option, and **E**valuate progress); and information flow process for reporting chemical/hazardous materials inventory data (including MSDS forms), facility ERAP, and emergencies to the local responding agency.

   Hazard analysis including hazards identification (types of potential hazards involved), vulnerability analysis (susceptibilities and deficiencies in handling these potential hazards), and risk analysis (worker and public health risks or ecological risks associated with susceptibilities/deficiencies or improvements during the incidents) is a critical part of the pre-emergency planning. Detailed information, assumptions, and technical references used to prepare hazard analysis for known or unknown chemical/hazardous materials should be included. Public and commercial computer programs can be used to facilitate the planning process. Additionally, technical support and a list of specific technical experts to contact during an incident should also be included in this section or reference section of the ERAP.

Table 16. Planning for Emergencies Checklist

Questions	Yes	No
1, Has a Contingency Analysis been conducted to determined what emergencies might arise?		
2, Have emergency plans and procedures been developed for potentially catastrophic events such as:		
a. Fires?		
b. Blasts and explosions?		
c. Leaks and spills?		
d. Extreme weather?		
e. Floods?		
f. Earthquakes?		
3, Do these plans provide for procedures for extinguishing different types of fires which might occur in the plant?		
4, Do these plans have adequate evacuation and recovery procedures for each type of emergency?		
5, Have responsibilities been assigned in the plan to specific personnel to direct operations to counter emergencies? Are these persons aware of their responsibilities? Are they qualified to lead in the necessary actions which might be required?		
6, Are emergency crews qualified, designated, and on station?		
7, Are different communications channels assigned to support emergency operations? Is the emergency phone number widely and prominently displayed?		
8, Are there plans to evacuate personnel from each work area in the event of emergencies?		
9, Are evacuation route and warning signals information posted in each work area?		
10, Are the evacuation routes and exits marked?		
11, Are the emergency plans and procedures posted in prominent areas?		
12, Have personnel received training in emergency procedures:		
a. Workers?		
b. Supervisory personnel?		
c. Firefighter?		
d. Medical personnel?		
e. Communications personnel?		
13, Are there drills on simulated emergencies being conducted periodically for personnel?		
14, Is there a procedure to ensure that all personnel have been alerted to the emergency and those who will not combat it have been evacuated?		
15, Are the egress provisions adequate (i.e., doors, stairways, elevators) for the evacuation in the event of an emergency?		
16, Do all doors open in the proper direction to facilitate egress of personnel in emergencies?		
17, Are there procedures to preclude obstructions to personnel or equipment in critical evacuation or emergency equipment access routes or areas?		
18, Can egress routes from work areas be followed by personnel in the dark or in smoke?		
19, Is the emergency equipment called out in the emergency procedures available at the facility, and is it operational? Can the equipment be reached easily if an emergency occurs?		
20, Are warning systems installed (sirens, loudspeakers, etc.) and are they tested periodically? Are all personnel familiar with the meanings of warning signals and required action to be taken?		
21, Is there a fire detection system at each facility? Are fire extinguishers sized, located, and of the types required by OSHA standards, and are they suitable for the types of fires which might occur?		
22, Is there fire-fighting equipment located near flammables or hazardous areas?		

2) Emergency response telephone numbers such as technical and response personnel, participating agencies (Fire, Public Security or Police, Health, local HazMat unit, Rescue, Transportation, etc.), chemical emergency information center, and other public and private sector supporting groups.

3) Job descriptions, line of authority, and communication methods for personnel responsible for emergency response – An ICS or similar organization will streamline the individuals and their responsibilities. Examples of communication methods are shown in Table 17.

Table 17. Example of Communication Methods

Emergency Communication Equipment/Signals	Example of Application
Hand held two-way radios Mobile phone	Established code words
Noisemakers Bell Compressed air horn Megaphone Siren Whistles	 One long blast: Evacuate area by nearest emergency exit Two short blasts: Localized problem (not dangerous to the workers) Two long blasts: All clear
Visual Signals Hand signals Whole body movements Sign board Flags Lights	 Hand clutching throat: Out of air/Can't breathe Hands on top of head: Need assistance Thumbs up: OK/I'm all right/I understand Thumbs down: No/Negative Grip partners wrist or both hands around wrist: Leave area immediately
Note: All devices and equipment used in the hot zone must be intrinsically safe and not capable of sparking under a flammable environment	

4) Emergency plan training – This should include the names of all staff or organizations involved in the emergency response incident, types of training, training schedule, and content of the training. Drills and various exercises should be planned carefully and practiced, which may include tabletop/classroom exercises and/or actual drills simulating incident control, evacuation, and transport of victims to hospitals via ambulance. Once the exercise or drill is completed, a review or critique should be conducted to improve deficiencies.

5) Communication procedures for alerting all workers in an emergency and reporting incidents to local and national agencies – A written step-by-step communication procedure, and by whom, should be developed and described in this section. This includes when and how an emergency incident should be communicated both internally (facility employees) and externally (local and national agencies).

6) Site mapping including topography, facility layout, and prevailing weather conditions – Facility ERAP should contain all relevant site maps containing facility layout, chemical/hazardous material storage locations, site topography, meteorological data, evacuation routes. These facility ERAPs should be archived, updated, and electronically incorporated as part of the TEPB ERAP. Additionally, topographic map, and prevailing wind directions for the entire Tianjin city should be in file with TEPB and provided as part of the TEPB's ERAP.

7) Safe distances and places of refuge (safety stations) – Safe distances should be determined based on the types of chemicals/hazardous materials under a hypothetical condition (as a practice), with the actual distances determined at the time of an emergency based on a combination of site- and incident-specific factors (toxicology, physical state, quantity, rate and method of release, vapor characteristics, wind speed and direction, height of release, temperature, and local topography). Onsite refuges (safe stations) should be set up for localized emergencies that do not require site evacuation, which can be used for short rest breaks, emergency response strategy meetings, or temporary relief purposes.

8) Site security and control – Specific security measures including onsite security personnel, procedures, and responsibilities should be established prior to the arrival of public security officers or police.

9) Evacuation routes and procedures – Alternative evacuation routes should be established, marked, and cleared at all time. Routes should be directed (1) from exclusion Zone through an upwind Contamination Reduction Zone to the Support Zone, and (2) from the Support Zone to an offsite location. Other considerations may include accessibility, mobility of workers (especially those wearing PPE), other facilitated equipment such as ladders and ropes.

10) Emergency medical treatment and first aid – This include information such as the location of the nearest medical or emergency care facility and its capability to handle chemical exposure cases; procedures for admitting and transporting injured or exposed workers; and the locations, travel time, directions, and phone numbers of the medical/emergency care facilities.

11) Decontamination procedures – Decontamination zone and procedures need to be established for personnel (both regular and injured workers) and equipment should be established. Examples are steam-cleaning for heavy equipment or triple-rinsed technique (washed with a non-phosphorous detergent, rinsed with tap water, and final rinsed with distilled water) for hand tools/equipment. Collection and disposal methods for contaminated PPE and decontamination fluids should also be described.

12) Personal protective equipment and emergency equipment – Hazard analysis is essential in determining proper PPE and equipment used, which includes hazards identification, vulnerability analysis, and risk analysis. Table 18 provides a comprehensive list of PPE and emergency equipment recommended for TEPB during the handling of non-specific chemical/hazardous material incidents.

13) Emergency response – This includes notification, size-up, hazardous material controls, rescue, procedures, and training. A major component to be discussed is control (diking, diversion, inlet blockage for controlling land releases, overflow/underflow dames, catch basins, booms for controlling water release, and source termination and dispersion for controlling air releases) and collection (pumping/vacuuming, sorbent, solidification, gelation) techniques to be used under various releases or inspection and handling (repair, overpack, and transport) of unidentified or leaking drums/containers. Another component is the training (including refresher training) requirements for various staff handling the emergency response incidents, including but may not be limited to: first responders (awareness and operation levels), hazardous material technicians, hazardous material specialist, and on-scene incident commander.

14) Record keeping (documentation) and medical surveillance program – This includes procedures and structure for maintaining records, data logs, and documentation when responding to an incident; as well as follow-up investigation reports that used to document how the releases occur, what equipment and supplies are used, and which

Table 18 Summary of Emergency Response Equipment

The following list of equipment encompasses the entire range available for responding to incidents involving hazardous substances. Not all of this equipment may be needed on any given	
COMMUNICATION GEAR	
Hand-held radios and mobile phone	
PERSONNEL CLOTHING AND EQUIPMENT	
See Schedule A	
FIELD EQUIPMENT	
Combustible gas indicator	Photovac Portable Vapor Analyzer (PID)
Foxboro TVA 1000 Portable Vapor Analyzer (OVA, FID)	Oxygen meters
Colorimetric indicator tubes	Specific gas indicators
Radiation detector	Metal detector
Pressure-demand, self-contained breathing apparatus with extra air	Full face, air-purifying respirators with appropriate canisters
Cylinders	Fit testing kit
Photographic equipment	Film badges
Dosimeters	Organic Vapor badges
First aid kit (See schedule B)	Hand tool kit (See Schedule C)
Reference materials (See schedule D)	Field support kit (See Schedule E)
Soil sampling set (See schedule F)	Water sampling set (See Schedule G)
Air sampling set (See schedule H)	Other field equipment (See Schedule I)
Emergency oxygen inhalator	Portable wash unit
Fire extinguisher	
MISCELLANEOUS ITEMS	
See Schedule J	
SCHEDULES	
SCHEDULE A: PERSONNEL CLOTHING AND EQUIPMENT	
Fully encapsulating suit	Chemical-resistant splash suit
Chemical-resistant, steel-shank and toe boots	Safety work boots, leather
Work gloves	Rain suit
Windbreaker	Medium weight jacket
Appropriate winter clothing	Coveralls (work)
Coveralls (Nomex)	Uniform pants and shirts
Socks (regular)	Socks (heavy)
Underclothes	Earplugs
Clipboard	Hard hat with and without face shield
Hardhat for cold weather	Safety goggles, soft sides for full eye protection
Safety glasses	
SCHEDULE B: FIRST AID KIT	
A medical first aid kit consisting of	
First aid guide	Scissors
Aspirin	Forceps (Dumont 5 in.)
Pain aid	Tweezers
Cold tables	Cotton swabs
EEZ lozenges	Clean wipe alcohol swabs
Trail antacid	Antiseptic swabs
Gelusil tablets	Antiseptic spray
Ex-lax	Bum septic spray
Syrup of icecac	Spray-on bandage

Vaseline	Eye drops
Antibiotic ointment	Eye/skin neutralizer
Insect repellent	Eye wash
SCHEDULE B: FIRST AID KIT (cont.)	
Sting relief	Adhesive Tape
Chigger/tick remover	Cohesive Tape
Poison ivy treatment	Telfa sterile pads
Snake bite kit	Band aids
Ammonia inhalants	Curad bandage (2-1/4 x 3-1/2 in.)
Blood clotter	Finger tip bandages
Tourniquet	Knuckle bandages
Ice pack	Elastic strip bandage
Ice pack (large)	Triangle bandage
Salt tablets	Carlisle compress dressing
Gauze bandage (1 in. x 18 ft.)	Butterfly closure (medium)
Gauze bandage (1 in. x 12 ft.)	Traction splints (arm and leg)
Finger splint	Gauze bandage (3 x 3 in.)
Blanket	Gauze bandage (2 x 2 in.)
Powdered charcoal	Litter
SCHEDULE C: HAND TOOL KIT	
Wood mallet	Rubber mallet
Ballpeen hammer	Claw hammer
Hand hammer (nonsparking, 2 doubleface, berylliu-cooper)	Hacksaw
Lumberjack's knife	Duckbill snips (12 in.)
Rod and bolt cutter (24 in.)	Diagonal cutting pliers (8 in.)
Lineman's pliers (8 in.)	Slipjoint pliers (8 in.)
Locking plier wrench (10 in.)	Pipe wrench (non sparking)
Wrench set (combination)	Screwdrivers (5 slotted, 4 phillips)
Heavy-duty stapler and staples	Pressure gauge
Lock-type measure tape	Winding reel tape
Electrical tape	Strapping tape
Duct tape	
SCHEDULE D: REFERENCE MATERIALS	
NIOSH/OSHA Pocket Guide to Chemical Substances	CHRIS Condensed Guide to Chemical Hazards
SAX Dangerous Properties of Industrial Materials	Toxic and Hazardous Industrial Chemical Safety Manual
Matheson Gas Data Book	TLVs for Chemical Substances and Physical Agents in the Work Environment
NFPA Guide on Hazardous Materials	
SCHEDULE E: FIELD SUPPORT KIT	
Binoculars (x 35mm wide angle) (2)	Rangefinder (2)
Spotting scope	Stereoscopes
Compass (2)	Hand level (2)
Hand calculator (2)	Cassette recorder (1-hour tape)
SCHEDULE F: SOIL SAMPLING SET	
Soil auger (cork screw, tube)	Auger extensions
Power head (electric)	Soil sample tubes (1-1/2 x 6-5/ in.)
Replacement tips for tube samplers (regular)	Wet, heavy-duty tips
Scoops for bottom sediments	Stainless steel pipe section (2 in. ID/taper on penetrating end)
Electrical resistivity apparatus	labels

Logbook for soil profile	Stainless steel spoons
Post hole digger	Pick-ax
Shovel	Stainless steel pans
SCHEDULE G: WATER SAMPLING SET	
Weighted bottle sampler	Pond sampler
Glass and polyethylene container	Scoops and dippers
Suction devices (hand pumps)	Water level indicator
Teflon bailer	Cased thermometers/thermistors
Conductivity meter with 50 ft cord	Dissolved oxygen meter
SCHEDULE H: AIR SAMPLING SET	
Colorimetric indicator tubes and pre-weighed filters	Hi-vol sampler
Impinger tubes	Carbon adsorption tubes
Particulate samplers	Wind direction indicator
Wind speed indicator	Barometric pressure indicator
Temperature indicator	
SCHEDULE I: OTHER FIELD EQUIPMENT	
Rope (300 ft, polypropylene, 16-lb) (1)	Heavy-duty extension cord (100 ft) (1)
Heavy-duty two chain (15 ft) (1)	Garden hose (50 ft, 5/8 in. ID) (1)
Scrub brushes (4)	Large log book (1)
Plastic buckets (4)	Safety flares (vehicle use) (2)
Rechargeable lanterns (2)	Spud bar (2)
Shovel (D handle, square point, nonsparking) (2)	Shovel (D handle, round point, nonsparking) (2)
Shovel (Long handle, round point, nonsparking) (2)	PVC disposable gloves (5)
Sledge hammer (4-lb) (2)	Buna N gloves (5)
Jasper work gloves (5)	Wrecking bar (nonsparking, 30 x 3/4 in.) (1)
Neoprene gloves (5)	Solvex gloves (5)
Natural rubber gloves (5)	PVC disposable boots (5)
Life vests (5)	Rain suits (5)
Hip/chest wader (5)	
SCHEDULE J: MISCELLANEOUS ITEMS	
Redwood plugs (various sizes)	Valve packing
Revere miracle seal (synthetic rubber)	Nylon wire
Paper clips and alligator clips	Magnetic hangers
Rubber bands	Paper and note pads
Pens, pencils, markers	Clipboards
Kimwipes	Kleenex
Detergent (large)	Plastic drop sheet
Black spray paint	Yellow spray paint
Green marking tape (perimeter)	Color coding DOT security tags (red, yellow, green)
Restricted area signs	Rubber tarp tie-down straps
Electric power outlet strip (8 outlets)	Air-tight container for sample storage
Clean water supply	Anti-fog solution

15) equipment works or not work. A medical surveillance program provides documentations of the physical and health conditions of hazmat workers, which should start prior to engaging in any emergency response actions (baseline or entry physical examination), annually during active services (annual physical examination), and prior to retirement or termination of services (exit physical examination). The procedures, types,

contents, confidentiality, and recordkeeping of medical surveillance program should be provided to protect the welfare of the facility/organization and individuals.

A variation of the standard ERAP outline is also provided below, which can be prepared easily by extracting or re-arranging data from the above.

1) Initial notification of response agencies
2) Direction and control
3) Communications among responders
4) Warning system and emergency public notification
5) Public information/community relations
6) Resources management
7) Health and medical services
8) Response personnel safety
9) Personal protection of citizens (indoor, protection, evacuation procedures, and other public protection strategies)
10) Fire and rescue
11) Law enforcement
12) Ongoing incident assessment
13) Human services
14) Public works
15) Other site-specific involvements

9.0 ECONOMIC AND FINANCIAL ANALYSIS

As stated previously, TEPB is not authorized or responsible for the recommendation and procurement of communication/monitoring equipment for Tianjin's emergency response program. TEPB's primary functions in an emergency response incident are to perform environmental monitoring, assess environmental impacts of chemicals/hazardous materials, conduct cleanup and environmental restoration, and assess responsibility for environmental contamination. Therefore, the number and type of environmental monitoring equipment/instruments needed to support its functions are limited. Consequently, the cost involved in procuring the field communication and monitoring instruments/equipment is also relatively small, with a total estimated budget of approximately US $200,000 (see equipment costs in Tables 8 and 14 as well as Section 10. Implementation Schedule). The source of funding is primarily out of TEPB's annual operating budget, instead of a loan. The only exception is that TEPB may recommend TMG to standardize its monitoring equipment/instruments for the entire emergency response team and set aside a special budget either at the TMG municipal government level or combine emergency response operating budgets from all relevant regulatory agencies. In that case, other financial options such as a loan may become viable due to substantial procurement and

maintenance costs associated with a large pool of monitoring equipment for the entire emergency response program. Although this option has been discussed with TEPB the likelihood for this to occur is very low at foreseeable future, primarily due to difficulty in inter-agency coordination and cooperation. As such, this could only be accomplished through an order from the upper management of TMG.

10.0 IMPLEMENTATION SCHEDULE

Table 19 shows the proposed equipment purchase plan for TEPB's chemical/hazardous material emergency response program, inclusive of communication and environmental/health and safety monitoring equipments. The budget has been divided into fiscal years 2007 and 2008 for planning purpose. Table 19 also includes the types and number of equipment recommended (for communication equipment, all portable radios and one mobile radio will be purchased in 2007 and one additional mobile radio will be purchased in 2008). Please be advised that equipment brands and models listed are for reference. Vendors manufacturing or marketing similar or better equipment are encouraged to contact TEPB directly. Additional equipment may be purchased at the sole discretion of TEPB.

Table 19. Communication/Monitoring Equipment Purchase Plan

Brand Name	No. of Equipment Recommended for Purchase		
	Fiscal Yr 2007	Fiscal Yr 2008	Est. Budget
Communication Equipment			
Conventional/Trunked Portable and Mobile Radios	11	1	$70,000
Multi-Gas Monitoring (Confined Space or General Worker Safety)			
INNOVA Four-Gas Monitors (GT402)		1	$2,875
TMX412 Four-Gas Monitor	1	1	$8,140
QRAE Plus Four-Gas Monitor	1		$2,020
Volatile Organic Compounds (VOCs) Monitoring			
AreaRAE Wireless Gas Detector (Model 5020 w/ built-in RF Modem for data transmission)	1		$9,600
Foxboro TVA 1000 Portable Vapor Analyzer with PID/FID	1		$13,620
MiniRae 2000 Handheld VOC Monitor		1	$5,060
Photovac Model 2020 VOC monitor with built-in data loggers for 1,000 data points	1	1	$9,780
Photovac MicroFID with built-in datalogger		1	$10,670
UltraRAE Benzene Monitor (Model PGM-7200)	1		$6,500
Health and Safety/Compliance Monitoring (Dust, Radiation, Toxic Gases, Heat Stress, Noise)			
TSI DustTrak Aerosol Monitor Model 8520 with built-in datalogger	1		$4,440
MIE Personal DataRAM Model PDR 1000 with integral datalogger 91,300 data points)		1	$4,404
Questemp II Personal Heat Stress Monitorersonal Heat Stress with datalogger		1	$2,125
Questemp 34 Area Heat Stress Monitor with datalogger (group protection)	1		$2,875
Drager Hazardous Material Kit and Organic Vapor Simultaneous Test Set	3	2	$12,500
Foxboro Miran SapphIRe XL Ambient Air Analyzer		1	$23,220
Ludlum 2241 Digital Radiation Survey Meter with 44-9 Pancake Probe	1		$1,750
Victoreen 190 Radiation Survey and Count Rate Meter with 489-110D probe		1	$1,750
CEL-360 Noise Dosimeter		1	$1,875
NoisePro DLX Datalogging Noise Dosimeter	1		$2,340
Novalynx Weather Station Model 110-WS-16	1	1	$7,000
ToxiRAE II Personal Gas Monitor for Chlorine and Ammonia	Pending	Pending	$1,050 each
Drager PAC III Single Gas Monitor (H2S, NH3, SO2)	Pending	Pending	$1,250 each

Interscan Toxic Gas Analyzer 1000 Series Dual-Range Portables (CO, Cl2, HCHO, N2H4, HCl, HCN, H2S, NOX, NO2, SO2)	Pending	Pending	$3,180 to $4,745 each
Zellweger ChemKey TLD Toxic Gas Monitor (amines, diisocyanates, hydrazines, hydrides, hydrogen cyanide, hydrogen sulfide, mineral acids, oxidizers, phosgene, sulfur dioxide)	1		$9,500
Jerome Mercury Vapor Analyzer Model 431		1	$6,600
Water Quality Monitoring			
Heron H.O1L Oil and Water Inetrface Meter	1		$1,850
Solinst Model 121 Oil and Water Interface Meter		1	$1,920
Solinst Model 101 Water Level Meter	2	2	$780
Horiba U-22 Water Quality Monitoring System with built-in datalogger for 2,880 data points	1		$6,750
YSI Model 600 QS Water Quality System with built-in datalogger for 150 data sets		1	$6,250
Global Wter Flow Probe/Digital Water Velocity Meter	1		$1,000
Masterflex 0757100 Peristaltic Environmental Sampling Pump	1		$1,650
Total Estimated Budget (US $)	**$139,245**	**$99,599**	**$238,844**

11.0 POLLUTION PREVENTION-BASED EMERGENCY RESPONSE SYSTEM

The concept of integrating pollution prevention into an emergency response system is to take a proactive approach to protect human health and the environment by eliminating, reducing, or reusing waste materials. A typical example is the source reduction pollution prevention program that utilizes innovative solutions (e.g., chemical substitutes, waste conversion, process modifications) to minimize the waste production or reduce the hazardous level of the chemical used and waste generated in the process. This may be accomplished by upgrading equipment hardware to reduce potentials for chemical leaks/releases (e.g., upgrade chemical or waste handling pumps from single seal to double seals, upgrade chemical storage tanks and handling pipeline from single-wall to double-wall containment, install vapor and leak detection system) and developing a waste minimization plan that focuses on waste management alternatives and recycling activities.

Waste management alternatives evaluate chemical used or waste generated by the facility in terms of their characteristics, application and storage practices, compatibility with one another, hazard levels, costs, and purposes in the processing. The information can be used to determine whether the chemicals can be eliminated or substituted. Examples are substitution of a chlorinated solvent for equipment cleaning with a non-chlorinated solvent, or substitution of a gases chlorine for cooling water biocide treatment with the less reactive sodium hypochlorite. Waste management alternative also includes an evaluation of current hazardous chemicals/waste handling and storage practices. Examples are written procedures and policies, training for employees, dedicated hazardous chemical/waste storage area with proper spill containment, paper tracking system (MSDS, waste manifests), and use of qualified chemical or waste transporters. If practical or it can be safely implemented, the facility may also consider waste neutralization (e.g., acid and base) and other on-site treatment processes to eliminate or reduce chemical hazards within the facility.

Another form of waste reduction is to recycle waste that initially ends up to be disposed of or destroyed at off-site facilities. This activity typically requires regional cooperation with other manufacturers and is market-driven or process-specific.

Technologies and equipment have been developed to contain chemicals/hazardous materials once a release occurs to minimize impacts to the public health and environment. Diking, trenching, and use of absorbents are traditional and proven effective methods in the past, but new physical and chemical techniques have also been developed and available in the market to provide emergency responders and others with additional or better tools to reduce the health and environmental hazards of a chemical/hazardous material incident, these including but may not be limited to:

- Rapid, fast-action absorbent/solidification agents for general purpose spill containments or formulated for specific chemicals,
- Pressurized foam applicators that are similar to portable fire extinguishers but allow the operators to use the equipment at a remote location,
- Neutralizing agents that formulated to neutralize the hazard effects (acidic, basic, vapor) of chemicals and produce less or non-toxic waste, and
- Rechargeable system that allow agents to be applied continuously in more serious incidents.

APPENDIX A

COPIES OF SELECTED PRC'S NATIONAL REGULATIONS AND POLICIES

Duplicate

中华人民共和国环境保护法

（１９８９年１２月日第七届全国人民代表大会常务委员会第十一次会议通过
１９８９年１２月２６日中华人民共和国主席令第二十二号公布
1989年１２月２６日起施行）

第一章　总　　则

第一条 为保护和改善生活环境与生态环境，防治污染和其他公害，保障人体健康，促进社会主义现代化建设的发展，制定本法。

第二条 本法所称环境，是指影响人类生存和发展的各种天然的和经过人工改造的自然因素的总体，包括大气、水、海洋、土地、矿藏、森林、草原、野生生物、自然遗迹、人文遗迹、自然保护区、风景名胜区、城市和乡村等。

第三条 本法适用于中华人民共和国领域和中华人民共和国管辖的其他海域。

第四条 国家制定的环境保护规划必须纳入国民经济和社会发展计划，国家采取有利于环境保护的经济、技术政策和措施，使环境保护工作同经济建设和社会发展相协调。

第五条 国家鼓励环境保护科学教育事业的发展，加强环境保护科学技术的研究和开发，提高环境保护科学技术水平，普及环境保护的科学知识。

第六条 一切单位和个人都有保护环境的义务，并有权对污染和破坏环境的单位和个人进行检举和控告。

第七条 国务院环境保护行政主管部门，对全国环境保护工作实施统一监督管理。

县级以上地方人民政府环境保护行政主管部门，对本辖区的环境保护工作实施统一监督管理。

国家海洋行政主管部门、港务监督、渔政渔港监督、军队环境保护部门和各级公安、交通、铁道、民航管理部门，依照有关法律的规定对环境污染防治实施监督管理。

县级以上人民政府的土地、矿产、林业、农业、水利行政主管部门，依照有关法律的规定对资源的保护实施监督管理。

第八条 对保护和改善环境有显著成绩的单位和个人，由人民政府给予奖励。

第二章　环境监督管理

第九条 国务院环境保护行政主管部门制定国家环境质量标准。

省、自治区、直辖市人民政府对国家环境质量标准中未作规定的项目，可以制

定地方环境质量标准，并报国务院环境保护行政主管部门备案。

第十条 国务院环境保护行政主管部门根据国家环境质量标准和国家经济、技术条件，制定国家污染物排放标准。

省、自治区、直辖市人民政府对国家污染物排放标准中未作规定的项目，可以制定地方污染物排放标准；对国家污染物排放标准中已作规定的项目可以制定严于国家污染物排放标准的地方污染物排放标准。地方污染物排放标准须报国务院环境保护行政主管部门备案。

凡是向已有地方污染物排放标准的区域排放污染物的，应当执行地方污染物排放标准。

第十一条 国务院环境保护行政主管部门建立监测制度，制定监测规范，会同有关部门组织监测网络，加强对环境监测的管理。

国务院和省、自治区、直辖市人民政府的环境保护行政主管部门，应当定期发布环境状况公报。

第十二条 县级以上人民政府环境保护行政主管部门，应当会同有关部门对管辖范围内的环境状况进行调查和评价，拟订环境保护规划，经计划部门综合平衡后，报同级人民政府批准实施。

第十三条 建设污染环境的项目，必须遵守国家有关建设项目环境保护管理的规定。

建设项目的环境影响报告书，必须对建设项目产生的污染和对环境的影响作出评价，规定防治措施，经项目主管部门预审并依照规定的程序报环境保护行政主管部门批准。环境影响报告书经批准后，计划部门方可批准建设项目设计任务书。

第十四条 县级以上人民政府环境保护行政主管部门或者其他依照法律规定行使环境监督管理权的部门，有权对管辖范围内的排污单位进行现场检查。被检查的单位应当如实反映情况，提供必要的资料。检查机关应当为被检查的单位保守技术秘密和业务秘密。

第十五条 跨行政区的环境污染和环境破坏的防治工作，由有关地方人民政府协商解决，或者由上级人民政府协调解决，作出决定。

第三章 保护和改善环境

第十六条 地方各级人民政府，应当对本辖区的环境质量负责，采取措施改善环境质量。

第十七条 各级人民政府对具有代表性的各种类型的自然生态系统区域，珍稀、濒危的野生动植物自然分布区域，重要的水源涵养区域，具有重大科学文化价值的地质构造、著名溶洞和化石分布区、冰川、火山、温泉等自然遗迹；以及人文、古树名木，应当采取措施加以保护，严禁破坏。

第十八条 在国务院、国务院有关主管部门和省、自治区、直辖市人民政府划定的风景名胜区、自然保护区和其他需要特别保护的区域内，不得建设污染环境的工业生产设施；建设其他设施，其污染物排放不得超过规定的排放标准。已经建成的设施，其污染物排放超规定的排放标准的，限期治理。

第十九条 开发利用自然资源，必须采取措施保护生态环境。

第二十条 各级人民政府应当加强对农业环境的保护，防治土壤污染、土地砂化、盐渍化、贫瘠化、沼泽化、地面沉降和防治植被破坏、水土流失、水源枯竭、

种源灭绝以及其他生态失调现象的发生和发展，推广植物病虫害的综合防治，合理使用化肥、农药及植物生长激素。

第二十一条 国务院和沿海地方各级人民政府应当加强对海洋环境的保护，向海洋排放污染物、倾倒废弃物，进行海岸工程建设和海洋石油勘探开发，必须依照法律的规定，防止对海洋环境的污染损害。

第二十二条 制定城市规划，应当确定保护和改善环境的目标和任务。

第二十三条 城乡建设应当结合当地自然环境的特点，保护植被、水域和自然景观，加强城市园林、绿地和风景名胜区的建设。

第四章 防治环境污染和其他公害

第二十四条 产生环境污染和其他公害的单位，必须把环境保护工作纳入计划，建立环境保护责任制度；采取有效措施，防治在生产建设或者其他活动中产生的废气、废水、废渣、粉尘、恶臭气体、放射性物质以及噪声、振动、电磁波辐射等对环境的污染和危害，

第二十五条 新建工业企业和现有工业企业的技术改造，应当采用资源利用率高、污染物排放量少的设备和工艺，采用经济合理的废弃物综合利用技术和污染物处理技术。

第二十六条 建设项目中防治污染的设施，必须与主体工程同时设计、同时施工、同时投产使用。防治污染的设施必须经原审批环境影响报告书的环境保护行政主管部门验收合格后，该建设项目方可投入生产或者使用。

防治污染的设施不得擅自拆除或者闲置，确有必要拆除或者闲置的，必须征得所在地的环境保护行政主管部门同意。

第二十七条 排放污染物的企业事业单位，必须依照国务院环境保护行政主管部门的规定申报登记。

第二十八条 排放污染物超过国家或者地方规定的污染物排放标准的企业事业单位，依照国家规定缴纳超标准排污费，并负责治理。水污染防治法另有规定的，依照水污染防治法的规定执行。

征收的超标准排污费必须用于污染的防治，不得挪作他用，具体使用办法由国务院规定。

第二十九条 对造成环境严重污染的企业事业单位，限期治理。

中央或者省、自治区、直辖市人民政府直接管辖的企业事业单位的限期治理，由省、自治区、直辖市人民政府决定。市、县或者市、县以下人民政府管辖的企业事业单位的限期治理，由市、县人民政府决定。被限期治理的企业事业单位必须如期完成治理任务。

第三十条 禁止引进不符合我国环境保护规定要求的技术和设备。

第三十一条 因发生事故或者其他突然性事件，造成或者可能造成污染事故的单位，必须立即采取措施处理，及时通报可能受到污染危害的单位和居民，并向当地环境保护行政主管部门和有关部门报告，接受调查处理。可能发生重大污染事故的企业事业单位，应当采取措施，加强防范。

第三十二条 县级以上地方人民政府环境保护行政主管部门，在环境受到严重污染威胁居民财产安全时，必须立即向当地人民政府报告，由人民政府采取有效措施，解除或者减轻危害。

第三十三条 生产、储存、运输、销售、使用有毒化学物品和含有放射性物质

的物品，必须遵守国家有关规定，防止污染环境。

第三十四条 任何单位不得将产生严重污染的生产设备转移给没有污染防治能力的单位使用。

第五章 法律责任

第三十五条 违反本法规定，有下列行为之一的，环境保护行政主管部门或者其他依照法律规定行使环境监督管理权的部门可以根据不同情节，给予警告或者处以罚款：

（一）拒绝环境保护行政主管部门或者其他依照法律规定行使环境监督管理权的部门现场检查或者在被检查时弄虚作假的；

（二）拒报或者谎报国务院环境保护行政主管部门规定的有关污染物排放申报事项的；

（三）不按国家规定缴纳超标准排污费的；

（四）引进不符合我国环境保护规定要求的技术和设备的；

（五）将产生严重污染的生产设备转移给没有污染防治能力的单位使用的。

第三十六条 建设项目的防治污染设施没有建成或者没有达到国家规定的要求，投入生产或者使用的，由批准该建设项目的环境影响报告书的环境保护行政主管部门责令停止生产或者使用，可以并处罚款。

第三十七条 未经环境保护行政主管部门同意，擅自拆除或者闲置防治污染的设施，污染物排放超过规定的排放标准的，由环境保护行政主管部门责令重新安装使用，并处罚款。

第三十八条 对违反本法规定，造成环境污染事故的企业事业单位，由环境保护行政主管部门或者其他依照法律规定行使环境监督管理权的部门根据所造成的危害后果处以罚款；情节较重的，对有关责任人员由其所在单位或者政府主管机关给予行政处分。

第三十九条 对经限期治理逾期未完成治理任务的企业事业单位，除依照国家规定加收超标准排污费外，可以根据所造成的危害后果处以罚款，或者责令停业、关闭。

前款规定的罚款由环境保护行政主管部门决定。责令停业、关闭，由作出限期治理决定的人民政府决定；责令中央直接管辖的企业事业单位停业、关闭，须报国务院批准。

第四十条 当事人对行政处罚决定不服的，可以在接到处罚通知之日起十五日内，向作出处罚决定的机关的上一级机关申请复议；对复议决定不服的，可以在接到复议决定之日起十五日内，向人民法院起诉，当事人也可以在接到处罚通知之日起十五日内，直接向人民法院起诉。当事人逾期不申请复议、也不向人民法院起诉，又不履行处罚决定的，由作出处罚决定的机关申请人民法院强制执行。

第四十一条 造成环境污染危害的，有责任排除危害，并对直接受到损害的单位或者个人赔偿损失。

赔偿责任和赔偿金额的纠纷，可以根据当事人的请求，由环境保护行政主管部门或者其他依照法律规定行使环境监督管理权的部门处理；当事人对处理决定不服的，可以向人民法院起诉。当事人也可以直接向人民法院起诉。

完全由于不可抗拒的自然灾害，并经及时采取合理措施，仍然不能避免造成环境污染损害的，免予承担责任。

第四十二条 因环境污染损害赔偿提起诉讼的时效时间为三年，从当事人知道或者应当知道受到污染损害时起计算。

第四十三条 违反本法规定，造成重大环境污染事故，导致公私财产重大损失或者人身伤亡的严重后果的，对直接责任人员依法追究刑事责任。

第四十四条 违反本法规定，造成土地、森林、草原、水、矿产、渔业、野生动植物等资源的破坏的，依照有关法律的规定承担法律责任。

第四十五条 环境保护监督管理人员滥用职权、玩忽职守、徇私舞弊的，由其所在单位或者上级主管机关给予行政处分；构成犯罪的，依法追究刑事责任。

第六章　附　则

第四十六条 中华人民共和国缔造或者参加的与环境保护有关的国际条约，同中华人民共和国的法律有不同规定的，适用国际条约的规定，但中华人民共和国声明保留的条款除外。

第四十七条 本法自公布之日起施行。《中华人民共和国环境保护法（试行）》同时废止。

中华人民共和国
固体废物污染环境防治法

1995年10月30日第八届
全国人民代表大会常务委员会
第十六次会议通过

第一章 总 则

第一条 为了防治固体废物污染环境，保障人体健康，促进社会主义现代化建设的发展，制定本办法。

第二条 本法适用于中华人民共和国境内固体废物污染环境的防治。

固体废物污染海洋环境的防治和放射性固体废物污染环境的防治不适用本法。

第三条 国家对固体废物污染环境的防治，实行减少固体废物的产生、充分合理利用固体废物和无害化处置固体废物的原则。

第四条 国家鼓励、支持开展清洁生产，减少固体废物的产生量。

国家鼓励，支持综合利用资源，对固体废物实行充分回收和合理利用，并采取有利于固体废物综合利用活动的经济、技术政策和措施。

第五条 国家鼓励、支持有利于保护环境的集中处置固体废物的措施。

第六条 县级以上人民政府应当将固体废物污染环境防治工作纳入环境保护规划，并采取有利于固体废物污染环境防治的经济、技术政策和措施。

第七条 国家鼓励、支持固体废物污染环境防治的科学研究、技术开发、推广先进的防治技术和普及固体废物污染环境防治的科学知识。

第八条 各级人民政府对在固体废物污染环境防治工作以及相关的综合利用活动中作出显著成绩的单位和个人给于奖励。

第九条 任何单位和个人都有保护环境的义务，并有权对造成固体废物污染环境的单位和个人进行检举和控告。

第十条 国务院环境保护行政主管部门对全国固体废物污染环境的防治工作实施统一监督管理。国务院有关部门在各自的职责范围内负责固体废物污染环境防治的监督管理工作。

县级以上地方人民政府环境保护行政主管部门对本行政区域内固体废物污染环境的防治工作实施统一监督管理。县级以上地方人民政府有关部门在各自的职责范围内负责固体废物污染环境防治的监督管理工作。

国务院建设行政主管部门和县级以上地方人民政府环境卫生行政主管部门负责城市生活垃圾清扫、收集、储存、运输和处置的监督管理工作。

第二章　固体废物污染环境防治的监督管理

第十一条 国务院环境保护行政主管部门建立固体废物污染环境监测制度，制订统一的监测规范，并会同有关部门组织监测网络。

第十二条 建设产生工业固体废物的项目以及建设储存、处置固体废物的项目，必须遵守国家有关建设项目环境保护管理的规定。建设项目的环境影响报告书，必须对建设项目产生的固体废物对环境的污染和影响作出评价，规定防治环境污染的措施，并按照国家规定的程序报环境保护行政主管部门批准。环境影响报告书经批准后，审批建设项目的主管部门方可批准该建设项目的可行性研究报告或者设计任务书。

第十三条 建设项目的环境影响报告书确定需要配套建设的固体废物污染环境防治设施，必须与主体工程同时设计、同时施工、同时投产使用。固体废物污染环境防治设施必须经原审批环境影响报告书的环境保护行政主管部门验收合格后，该建设项目方可投入生产或者使用。对固体废物污染环境防治设施的验收应当与主体工程的验收同时进行。

第十四条 县级以上地方人民政府环境保护行政主管部门和其他固体废物污染环境防治工作的监督管理部门，有权依据各自的职责对管辖范围内与固体废物污染环境防治有关的单位进行现场检查。被检查的单位应当如实反映情况，提供必要的资料。检查机关应当为被检查的单位保守技术秘密和业务秘密。检查人员进行现场检查，应当出示证件。

第三章 固体废物污染环境的防治

第一节　一般规定

第十五条 产生固体废物的单位和个人，应当采取措施，防止或者减少固体废物对环境的污染。

第十六条 收集、储存、运输、利用、处置固体废物的单位和个人，必须采取防扬散、防流失、防渗漏或者其他防止污染环境的措施。

不得在运输过程中沿途丢弃、遗撒固体废物。

第十七条 产品应当采用易回收利用、易处置或者在环境中易消纳的包装物。产品生产者、销售者、使用者应当按照国家有关规定对可以回收利用的产品包装物和容器等回收利用。

第十八条 国家鼓励科研、生产单位研究、生产易回收利用、易处置或者在环境中易消纳的农用薄膜。

使用农用薄膜的单位和个人，应当采取回收利用等措施，防止或者减少农用薄膜对环境的污染。

第十九条 对收集、储存、运输、处置固体废物的设施、设备和场所，应当加强管理和维护，保证其正常运行和使用。

第二十条 禁止擅自关闭、闲置或者拆除工业固体废物污染环境防治设施、场所；确有必要关闭、闲置或者拆除的，必须经所在地县级以上地方人民政府环境保护行政主管部门核准，并采取措施，防止污染环境。

第二十一条 对造成固体废物严重污染环境的企业事业单位，限期治理。被限期治理的企业事业单位必须按期完成治理任务。限期治理由县级以上人民政府按照

国务院规定的权限决定。

第二十二条 在国务院和国务院有关主管部门及省、自治区、直辖市人民政府划定的自然保护区、风景名胜区、生活饮用水源地和其他需要特别保护的区域内，禁止建设工业固体废物集中储存、处置设施、场所和生活垃圾填埋场。

第二十三条 转移固体废物出省、自治区、直辖市行政区域储存、处置的应当向固体废物移出地的省级人民政府环境保护行政主管部门报告，并经固体废物接受地的省级人民政府环境保护行政主管部门许可。

第二十四条 禁止中国境外的固体废物进境倾倒、堆放、处置。

第二十五条 国家禁止进口不能用作原料的固体废物；限制进口可以用作原料的固体废物。国务院环境保护行政主管部门会同国务院对外经济贸易主管部门制订、调整并公布可以用作原料进口的固体废物的目录，未列入该目录的固体废物禁止进口。

确有必要进口列入前款规定目录中的固体废物用作原料的，必须经国务院环境保护行政主管部门会同国务院对外经济贸易主管部门审查许可，方可进口。

具体办法，由国务院规定。

第二节　工业固体质物污染环境的防治

第二十六条 国务院环境保护行政主管部门应当会同国务院经济综合主管部门和其他有关部门对工业固体废物对环境的污染作出界定，制订防治工业固体废物污染环境的技术政策，组织推广先进的防治工业固体废物污染环境的生产工艺和设备。

第二十七条 国务院经济综合主管部门应当会同国务院有关部门组织研究、开发和推广减少工业固体废物产生量的生产工艺和设备，公布限期淘汰产生严重污染环境的工业固体废物的落后生产工艺、落后设备的名录。

生产者、销售者、进口者或者使用者必须在国务院经济综合主管部门会同国务院有关部门规定的期限内分别停止生产、销售、进口或者使用列入前款规定的名录中的设备。生产工艺的采用者必须在国务院经济综合主管部门会同国务院有关部门规定的期限内停止采用列入前款规定的名录中的工艺。

依照前两款规定被淘汰的设备，不得转让给他人使用。

第二十八条 县级以上人民政府有关部门应当制订工业固体废物污染环境防治工作规划，推广能够减少工业固体废物产生量的先进生产工艺和设备，推动工业固体废物污染环境防治工作。

第二十九条 产生工业固体废物的单位应当建立、健全污染环境防治责任制度，采取防治工业固体废物污染环境的措施。

第三十条 企业事业单位应当合理选择和利用原材料、能源和其他资源，采用先进的生产工艺和设备，减少工业固体废物产生量。

第三十一条 国家实行工业固体废物申报登记制度。

产生工业固体废物的单位必须按照国务院环境保护行政主管部门的规定，向所在地县级以上人民政府环境保护行政主管部门提供工业固体废物的产生量、流向、储存、处置等有关资料。

第三十二条 企业事业单位对其产生的不能利用或者暂时不利用的工业固体废物，必须按照国务院环境保护行政主管部门的规定建设储存或者处置的设施、场所。

第三十三条 露天储存冶炼渣、化工渣、燃煤灰渣、废矿石、尾矿和其他工业固体废物的，应当设置专用的储存设施、场所。

第三十四条 建设工业固体废物储存、处置的设施、场所，必须符合国务院环境保护行政主管部门规定的环境保护标准。

本法施行前产生工业固体废物的单位，没有依据本法第三十二条规定建设工业固体废物储存或者处置的设施、场所，或者工业固体废物储存、处置的设施、场所不符合环境保护标准的，必须限期建成或者改造；在限期内，对新产生的污染环境的工业固体废物，应当缴纳排污费或者采取其他措施。采取缴纳排污费措施的单位在限期内提前建成工业固体废物储存或者处置的设施、场所或者经改造使其符合环境保护标准的，自建成或者改造完成之日起，不再缴纳排污费；在限期内未建成或者经改造仍不符合环境保护标准的，继续缴纳排污费，直至建成或者经改造符合环境保护标准为止。具体办法由国务院规定。排污费用于环境污染的防治，不得挪作他用。

第三节　城市生活垃圾污染环境的防治

第三十五条 任何单位和个人应当遵守城市人民政府环境卫生行政主管部门的规定，在指定的地点倾到、堆放城市生活垃圾，不得随意扔撒或者堆放。

第三十六条 储存、运输、处置城市生活垃圾，应当遵守国家有关环境保护和城市环境卫生的规定，防止污染环境。

第三十七条 城市生活垃圾应当及时清运，并积极开展合理利用和无害化处置。

城市生活垃圾应当逐步做到分类收集、储存、运输和处置。

第三十八条 城市人民政府应当有计划地改进燃料结构，发展城市煤气，天然气、液化气和其他清洁能源。

城市人民政府有关部门应当组织净菜进城，减少城市生活垃圾。

城市人民政府有关部门应当统筹规化，合理安排收购网点，促进废弃物的回收利用工作。

第三十九条 城市人民政府应当配套建设城市生活垃圾清扫、收集、储存、运输、处置设施。

第四十条 建设城市生活垃圾处置设施、场所，必须符合国务院环境保护行政主管部门和国务院建设行政主管部门规定的环境保护和城市环境卫生标准。

禁止擅自关闭、闲置或者拆除城市生活垃圾处置设施、场所；确有必要关闭、闲置或者拆除的，必须经所在地县级以上地方人民政府环境卫生行政主管部门和环境保护行政主管部门核准，并采取措施，防止污染环境。

第四十一条 施工单位应当及时清运、处置建筑施工过程中产生的垃圾、并采取措施，防止污染环境。

第四章 危险废物污染环境防治的特别规定

第四十二条 危险废物污染环境的防治，适用本章规定；本章未作规定的，适用本法其他有关规定。

第四十三条 国务院环境保护行政主管部门应当会同国务院有关部门制订国家危险废物名录，规定统一的危险废物鉴别标准、鉴别方法和识别标志。

第四十四条 对危险废物的容器和包装物以及收集、储存、运输、处置危险废物的设施、场所，必须设置危险废物识别标志。

第四十五条 产生危险废物的单位，必须按照国家有关规定申报登记。

第四十六条 产生危险废物的单位，必须按照国家有关规定处置；不处置的，由所在地县级以上地方人民政府环境保护行政主管部门责令限期改正；逾期不处置或者处置不符合国家有关规定的，由所在地县级以上地方人民政府环境保护行政主管部门指定单位按照国家有关规定代为处置，处置费用由产生危险废物的单位承担。

第四十七条 城市人民政府应当组织建设对危险废物进行集中处置的设施。

第四十八条 以填埋方式处置危险废物不符合国务院环境保护行政主管部门的规定的，应当缴纳危险废物排污费。危险废物排污费征收的具体办法由国务院规定。

危险废物排污费用于危险废物污染环境的防治，不得挪作他用。

第四十九条 从事收集、储存、处置危险废物经营活动的单位，必须向县级以上人民政府环境保护行政主管部门申请领取经营许可证，具体管理办法由国务院规定。

禁止无经营许可证或者不按照经营许可证规定从事危险废物收集、储存、处置的经营活动。

禁止将危险废物提供或者委托给无经营许可证的单位从事收集、储存、处置的经营活动。

第五十条 收集、储存危险废物必须按照危险废物特性分类进行。禁止混合收集、储存、运输、处置性质不相容而未经安全性处置的危险废物。

禁止将危险废物混人非危险废物中储存。

第五十一条 转移危险废物的必须按照国家有关规定填写危险废物转移联单，并向危险废物移出地和接受地的县级以上地方人民政府环境保护行政主管部门报告。

第五十二条 运输危险废物必须采取防止污染环境的措施，并遵守国家有关危险货物运输管理的规定。

禁止将危险废物与旅客在同一运输工具上载运。

第五十三条 收集、储存、运输、处置危险废物的场所、设施、设备和容器、包装物及其它物品转作它用时，必须经过消除污染的处理，方可使用。

第五十四条 直接从事收集、储存、运输、利用、处置危险废物的人员，应当接受专业培训，经考核合格，方可从事该项工作。

第五十五条 产生、收集、储存、运输、利用、处置危险废物的单位，应当制定在发生意外事故时采取的应急措施和防范措施，并向所在地县级以上地方人民政府环境保护行政主管部门报告；环境保护行政主管部门应当进行检查。

第五十六条 因发生事故或者其它突发性事件，造成危险废物严重污染环境的单位，必须立即采取措施消除或者减轻对环境的污染危害，及时通报可能受到污染危害的单位和居民，并向地县级以上人民政府环境保护行政主管部门和有关部门报告，接受调查处理。

第五十七条 在发生危险废物严重污染环境、威胁居民生命财产安全时，县级以上地方人民政府环境保护主管部门必须立即向本级人民政府报告，由人民政府采取有效措施，解除或减轻危害。

第五十八条 禁止经中华人民共和国国境转移危险废物。

第五章　法律责任

第五十九条 违反本法规规定，有下列行为之一的，由县级以上人民政府环境保护行政主管部门责令限期改正，并处罚款：

（一）不按照国家规定申报登记工业固体废物或者危险废物，或在申报登记时弄虚作假的；

（二）拒绝环境保护行政主管部门现场检查，或者在被检查时弄虚作假的；

（三）不按照国家规定缴纳排污费的；

（四）将列入限期淘汰名录淘汰的设备转让给他人使用的；

（五）擅自关闭、闲置或者拆除固体废物污染环境防治设施、场所的；

（六）在自然保护区、风景名胜区、生活饮用水源地和其它特别保护的区域内，建设工业固体废物集中储存、处置设施，场所或者生活垃圾填埋场的；

（七）擅自转移固体废物出省、自治区、直辖市行政区域储存、处置的；

有前款第（一）项、第（二）项行为的，处一万元以下罚款；有前款第（三）项行为的处应缴纳排污费金额百分之五十以下的罚款；有前款第（四）项、第（五）项、第（六）项、第（七）项行为之一的，处五万元以下的罚款。

第六十条 违反本法规规定，生产、销售、进口或者使用淘汰的设备，或者采用淘汰的生产工艺的，由县级以上人民政府经济综合主管部门责令改正；情节严重的，由县级以上人民政府经济综合主管部门提出意见，报请同级人民政府按照国务院规定的权限责令停业、关闭。

第六十一条 建设项目中需要配套建设的固体废物污染环境防治措施未建成或者未经验收合格即投人生产或者使用的，由审批该项目的环境影响报告书的环境保护行政主管部门责令停止生产或者使用，可以并处以十万元以下的罚款。

第六十二条 对经限期治理逾期未完成治理任务的企业事业单位，可以根据所造成的危害后果处以十万元以下罚款、或者责令停业、关闭。

前款规定的罚款由环境保护行政主管部门决定。责令停业、关闭，由县级以上人民政府按照国务院规定的权限决定。

第六十三条 储存、运输、处置城市生活垃圾违反本法规规定的，按照国务院关于环境保护和城市环境卫生的有关规定予以处罚。

第六十四条 违反本法有关危险废物污染环境防治的规定，有下列行为之一的，由县级以上人民政府环境保护行政主管部门责令停止违法行为、限期改正，并处五万元以下罚款：

（一）　不设置危险废物识别标志的；

（二）　将危险废物提供或者委托给无经营许可证的单位收集、储存、处置的；

（三）　转移危险废物，不按照国家规定填写危险废物转移联单的或者未向移出地和接受地的县级以上人民政府环境保护行政主管部门报告的；

（四）　将危险废物混人非危险废物中储存的；

（五）　未经安全性处置，混和收集、储存、运输、处置具有不相容性质的危险废物的；

（六）　将危险废物和旅客在同一运输工具上载运的；

（七）　危险废物产生者不处置其产生的危险废物或者不承担依法应当承担的处置费用的；

（八） 未经消除污染的处理将收集、储存、运输、处置危险废物的场所、设施、设备和容器、包装物及其它物品转作他用的。

第六十五条 无经营许可证或者不按照经营许可证规定从事收集、储存、处置危险废物经营活动的，由县级以上人民政府环境保护行政主管部门责令停止违法行为，没收违法所得，可以并处违法所得一倍以下的罚款。

不按照经营许可证规定从事前款活动的，还可以由发证机关吊销经营许可证。

第六十六条 违反本法规规定，将中国境外的固体废物进境倾倒、堆放、处置，或者未经国务院有关主管部门许可擅自进口固体废物作原料的，由海关责令退运该固体废物，可以并处十万元以上一百万元以下罚款。逃避海关监管，构成走私罪的，依法追究刑事责任。

以原料利用为名，进口不能用作原料的固体废物的依照前款规定处罚。

第六十七条 违反本法规定，经中华人民共和国过境转移危险废物的由海关责令退运该危险废物，可以并处五万元以上五十万元以下罚款。

第六十八条 对已经非法入境的固体废物，由省级以上人民政府环境保护行政主管部门依法向海关提出处理意见，海关应当依照本法第六十六条的规定作出处罚决定；已经造成环境污染的由省级以上人民政府环境保护行政主管部门责令进口者消除污染。

第六十九条 违反本法规定，造成固体废物污染环境事故的，由县级以上人民政府环境保护行政主管部门处以十万元以下的罚款；造成重大损失的按照直接损失的百分之三十计算罚款，但是最高不超过五十万元；对负有直接责任的主管人员和其它直接责任人员，由其所在单位或者政府主管机关给予行政处分。

第七十条 罚款一律上交国库，任何单位和个人不得截留。

第七十一条 受到固体废物污染的单位和个人，有权要求依法赔偿损失。

赔偿责任和赔偿金额的纠纷，可以根据当事人的请求，由环境保护行政主管部门或者其它固体废物污染环境防治工作的监督部门调解处理；调解不成的，当事人可以向人民法院提起诉讼。当事人也可以直接向人民法院提起诉讼。

第七十二条 违反本法规定，收集、储存、处置危险废物，造成重大环境污染事故，导致公私财产重大损失或者人身伤亡的严重后果的比照刑法第一百一十五条年或第一百八十七条的规定追究刑事责任。

单位犯本条罪的，处以罚金，并对直接负责的主管人员和其它直接责任人员依照前款规定追究刑事责任。

第七十三条 固体废物污染环境防治监督管理人员滥用职权、玩忽职守、徇私舞弊、构成犯罪的，依法追究刑事责任；尚不构成犯罪的，依法给予行政处分。

第六章　附 则

第七十四条 本法中下列用语含义：

（一）固体废物，是指在生产建设、日常生活和其它活动中产生的污染环境的固态、半固态废物。

（二）工业固体废物，是指在工业、交通等生产活动中产生的固体废物。

（三）城市生活垃圾是指在城市日常生活中或者为城市日常生活提供服务的活动中产生的固体废物以及法律、行政法规规定的视为城市生活垃圾的固体废物。

（四）危险废物，是指列入国家危险废物名录的或者根据国家规定的危险废物

鉴别标准和鉴别方法认定的具有危险特性的废物。

（五）处置，是指将固体废物焚烧和其它改变固体废物的物理、化学、生物特性的方法，达到减少已产生的固体废物数量、缩小固体废物体积、减少或者消除其危险成分的活动，或者将固体废物最终置于符合环境保护规定要求的场所或者设施并不在回取的活动。

第七十五条 液态废物和置于容器中的气态废物的污染防治，适用本法；但是，排入水体的废水和排入大气的废气的污染防治适用有关法律，不适用本法。

第七十六条 中华人民共和国缔结或者参加的与固体废物污染环境防治有关的国际条约与本法有不同现定的，适用国际条约规定；但是，中华人民共和国声明保留的条款除外。

第七十六条 本法自１９９６年４月１日起施行。

附：刑法有关条款

第一百一十五条 违反爆炸性、易燃性、放射性、毒害性、腐蚀性物品的管理规定，在生产、储存、运输、使用中发生重大事故，造成严重后果的，处三年以下有期徒刑或者拘役；后果特别严重的，处三年以上七年以下有期徒刑。

第一百八十七条 国家工作人员由于玩忽职守，致使公共财产、国家和人们利益遭受重大损失的处五年以下有期徒刑或者拘役。

中华人民共和国固体废物污染环境防治法

（1995年10月30日第八届全国人民代表大会
常务委员会第十六次会议通过，同日公布）

第一章 总 则

第一条 为了防治固体废物污染环境，保障人体健康，促进社会主义现代化建设的发展，制定本法。

第二条 本法适用于中华人民共和国境内固体废物污染环境的防治。

固体废物污染海洋环境的防治和放射性固体废物污染环境的防治不适用本法。

第三条 国家对固体废物污染环境的防治，实行减少固体废物的产生、充分合理利用固体废物和无害化处置固体废物的原则。

第四条 国家鼓励、支持开展清洁生产，减少固体废物的产生量。

国家鼓励、支持综合利用资源，对固体废物实行充分回收和合理利用，并采取有利于固体废物综合利用活动的经济、技术政策和措施。

第五条 国家鼓励、支持有利于保护环境的集中处置固体废物的措施。

第六条 县级以上人民政府应当将固体废物污染环境防治工作纳入环境保护规划，并采取有利于固体废物污染环境防治的经济、技术政策和措施。

第七条 国家鼓励、支持固体废物污染环境防治的科学研究、技术开发、推广先进的防治技术和普及固体废物污染环境防治的科学知识。

第八条 各级人民政府对在固体废物污染环境防治工作以及相关的综合利用活动中作出显著成绩的单位和个人给予奖励。

第九条 任何单位和个人都有保护环境的义务，并有权对造成固体废物污染环境的单位和个人进行检举和控告。

第十条 国务院环境保护行政主管部门对全国固体废物污染环境的防治工作实施统一监督管理。国务院有关部门在各自的职责范围内负责固体废物污染环境防治的监督管理工作。

县级以上地方人民政府环境保护行政主管部门对本行政区域内固体废物污染环境的防治工作实施统一监督管理。县级以上地方人民政府有关部门在各自的职责范围内负责固体废物污染环境防治的监督管理工作。

国务院建设行政主管部门和县级以上地方人民政府环境卫生行政主管部门负责城市生活垃圾清扫、收集、贮存、运输和处置的监督管理工作。

第二章　固体废物污染环境防治的监督管理

第十一条　国务院环境保护行政主管部门建立固体废物污染环境监测制度，制定统一的监测规范，并会同有关部门组织监测网络。

第十二条　建设产生工业固体废物的项目以及建设贮存、处置固体废物的项目，必须遵守国家有关建设项目环境保护管理的规定。

建设项目的环境影响报告书，必须对建设项目产生的固体废物对环境的污染和影响作出评价，规定防治环境污染的措施，并按照国家规定的程序报环境保护行政主管部门批准。环境影响报告书经批准后，审批建设项目的主管部门方可批准该建设项目的可行性研究报告或者设计任务书。

第十三条　建设项目的环境影响报告书确定需要配套建设的固体废物污染环境防治设施，必须与主体工程同时设计、同时施工、同时投产使用。固体废物污染环境防治设施必须经原审批环境影响报告书的环境保护行政主管部门验收合格后，该建设项目方可投入生产或者使用。对固体废物污染环境防治设施的验收应当与对主体工程的验收同时进行。

第十四条　县级以上人民政府环境保护行政主管部门和其他固体废物污染环境防治工作的监督管理部门，有权依据各自的职责对管辖范围内与固体废物污染环境防治有关的单位进行现场检查。被检查的单位应当如实反映情况，提供必要的资料。检查机关应当为被检查的单位保守技术秘密和业务秘密。

检查人员进行现场检查，应当出示证件。

第三章　固体废物污染环境的防治

第一节　一般规定

第十五条　产生固体废物的单位和个人，应当采取措施，防止或者减少固体废物对环境的污染。

第十六条　收集、贮存、运输、利用、处置固体废物的单位和个人，必须采取防扬散、防流失、防渗漏或者其他防止污染环境的措施。

不得在运输过程中沿途丢弃、遗撒固体废物。

第十七条　产品应当采用易回收利用、易处置或者在环境中易消纳的包装物。

产品生产者、销售者、使用者应当按照国家有关规定对可以回收利用的产品包装物和容器等回收利用。

第十八条　国家鼓励科研、生产单位，研究、生产易回收利用、易处置或者在环境中易消纳的农用薄膜。

使用农用薄膜的单位和个人，应当采取回收利用等措施，防止或者减少农用薄膜对环境的污染。

第十九条 对收集、贮存、运输、处置固体废物的设施、设备和场所，应当加强管理和维护，保证其正常运行和使用。

第二十条 禁止擅自关闭、闲置或者拆除工业固体废物污染环境防治设施、场所；确有必要关闭、闲置或者拆除的，必须经所在地县级以上地方人民政府环境保护行政主管部门核准，并采取措施，防止污染环境。

第二十一条 对造成固体废物严重污染环境的企业事业单位，限期治理。被限期治理的企业事业单位必须按期完成治理任务。限期治理由县级以上人民政府按照国务院规定的权限决定。

第二十二条 在国务院和国务院有关主管部门及省、自治区、直辖市人民政府划定的自然保护区、风景名胜区、生活饮用水源地和其他需要特别保护的区域内，禁止建设工业固体废物集中贮存、处置设施、场所和生活垃圾填埋场。

第二十三条 转移固体废物出省、自治区、直辖市行政区域贮存、处置的，应当向固体废物移出地的省级人民政府环境保护行政主管部门报告，并经固体废物接受地的省级人民政府环境保护行政主管部门许可。

第二十四条 禁止中国境外的固体废物进境倾倒、堆放、处置。

第二十五条 国家禁止进口不能用作原料的固体废物；限制进口可以用作原料的固体废物。

国务院环境保护行政主管部门会同国务院对外经济贸易主管部门制定、调整并公布可以用作原料进口的固体废物的目录，未列入该目录的固体废物禁止进口。

确有必要进口列入前款规定目录中的固体废物用作原料的，必须经国务院环境保护行政主管部门会同国务院对外经济贸易主管部门审查许可，方可进口。

具体办法，由国务院规定。

第二节 工业固体废物污染环境的防治

第二十六条 国务院环境保护行政主管部门应当会同国务院经济综合主管部门和其他有关部门对工业固体废物对环境的污染作出界定，制定防治工业固体废物污染环境的技术政策，组织推广先进的防治工业固体废物污染环境的生产工艺和设备。

第二十七条 国务院经济综合主管部门应当会同国务院有关部门组织研究、开发和推广减少工业固体废物产生量的生产工艺和设备，公布限期淘汰产生严重污染环境的工业固体废物的落后生产工艺、落后设备和名录。

生产者、销售量、进口者或者使用者必须在国务院经济综合主管部门会同国务院有关部门规定的期限内分别停止生产、销售、进口或者使用列入前款规定的名录中的设备。生产工艺的采用者必须在国务院经济综合主管部门会同国务院有关部门规定的期限内停止采用列入前款规定的名录中的工艺。

依照前两款规定被淘汰的设备，不得转让给他人使用。

第二十八条 县级以上人民政府有关部门应当制定工业固体废物污染环境防治工作规划，推广能够减少工业固体废物产生量的先进生产工艺和设备，推动工业固体废物污染环境防治工作。

第二十九条 产生工业固体废物的单位应当建立、健全污染环境防治责任制度，采

取防治工业固体废物污染环境的措施。

第三十条 企业事业单位应当合理选择和利用原材料、能源和其他资源，采用先进的生产工艺和设备，减少工业固体废物产生量。

第三十一条 国家实行工业固体废物申报登记制度。

产生工业固体废物的单位必须按照国务院环境保护行政主管部门的规定，向所在地县级以上地方人民政府环境保护行政主管部门提供工业固体废物的产生量、流向、贮存、处置等有关资料。

第三十二条 企业事业单位对其产生的不能利用或者暂时不利用的工业固体废物，必须按照国务院环境保护行政主管部门的规定建设贮存或者处置的设施、场所。

第三十三条 露天贮存冶炼渣、化工渣、燃煤灰渣、废矿石、尾矿和其他工业固体废物的，应当设置专用的贮存设施、场所。

第三十四条 建设工业固体废物贮存、处置的设施、场所，必须符合国务院环境保护行政主管部门规定的环境保护标准。

本法施行前产生工业固体废物的单位，没有依照本法第三十二条规定建设工业固体废物贮存或者处置的设施、场所，或者工业固体废物贮存、处置的设施、场所不符合环境保护标准的，必须限期建成或者改造；在限期内，对新产生的污染环境的工业固体废物，应当缴纳排污费或者采取其他措施。采取缴纳排污费措施的单位在限期内提前建成工业固体废物贮存或者处置的设施、场所或者经改造使其符合环境保护标准的，自建成或者改造完成之日起，不再缴纳排污费；在限期内未建成或者经改造仍不符合环境保护标准的，继续缴纳排污费，直至建成或者经改造符合环境保护标准为止。具体办法由国务院规定。排污费用于环境污染的防治，不得挪作他用。

第三节 城市生活垃圾污染环境的防治

第三十五条 任何单位和个人应当遵守城市人民政府环境卫生行政主管部门的规定，在指定的地点倾倒、堆放城市生活垃圾，不得随意扔撒或者堆放。

第三十六条 贮存、运输、处置城市生活垃圾，应当遵守国家有关环境保护和城市环境卫生的规定，防止污染环境。

第三十七条 城市生活垃圾应当及时清运，并积极开展合理利用和无害化处置。

城市生活垃圾应当逐步做到分类收集、贮存、运输和处置。

第三十八条 城市人民政府应当有计划地改进燃料结构，发展城市煤气、天然气、液化气和其他清洁能源。

城市人民政府有关部门应当组织净菜进城，减少城市生活垃圾。

城市人民政府有关部门应当统筹规划，合理安排收购网点，促进废弃物的回收利用工作。

第三十九条 城市人民政府应当配套建设城市生活垃圾清扫、收集、贮存、运输、处置设施。

第四十条 建设城市生活垃圾处置设施、场所，必须符合国务院环境保护行政主管部门和国务院建设行政主管部门规定的环境保护和城市环境卫生标准。

禁止擅自关闭、闲置或者拆除城市生活垃圾处置设施、场所；确有必要关闭、闲置或

者拆除的，必须经所在地县级以上地方人民政府环境卫生行政主管部门和环境保护行政主管部门核准，并采取措施，防止污染环境。

第四十一条 施工单位应当及时清运、处置建筑施工过程中产生的垃圾，并采取措施，防止污染环境。

第四章 危险废物污染环境防治的特别规定

第四十二条 危险废物污染环境的防治，适用本章规定；本章未作规定的，适用本法其他有关规定。

第四十三条 国务院环境保护行政主管部门应当会同国务院有关部门制定国家危险废物名录，规定统一的危险废物鉴别标准、鉴别方法和识别标志。

第四十四条 对危险废物的容器和包装物以及收集、贮存、运输、处置危险废物的设施、场所，必须设置危险废物识别标志。

第四十五条 产生危险废物的单位，必须按照国家有关规定申报登记。

第四十六条 产生危险废物的单位，必须按照国家有关规定处置；不处置的，由所在地县级以上地方人民政府环境保护行政主管部门责令限期改正；逾期不处置或者处置不符合国家有关规定的，由所在地县级以上地方人民政府环境保护行政主管部门指定单位按照国家有关规定代为处置，处置费用由产生危险废物的单位承担。

第四十七条 城市人民政府应当组织建设对危险废物进行集中处置的设施。

第四十八条 以填埋方式处置危险废物不符合国务院环境保护行政主管部门的规定的，应当缴纳危险废物排污费。危险废物排污费征收的具体办法由国务院规定。

危险废物排污费用于危险废物污染环境的防治，不得挪作他用。

第四十九条 从事收集、贮存、处置危险废物经营活动的单位，必须向县级以上人民政府环境保护行政主管部门申请领取经营许可证，具体管理办法由国务院规定。

禁止无经营许可许或者不按照经营许可证规定从事危险废物收集、贮存、处置的经营活动。

禁止将危险废物提供或者委托给无经营许可证的单位从事收集、贮存、处置的经营活动。

第五十条 收集、贮存危险废物，必须按照危险废物特性分类进行。禁止混合收集、贮存、运输、处置性质不相容而未经安全性处置的危险废物。

禁止将危险废物混入非危险废物中贮存。

第五十一条 转移危险废物的，必须按照国家有关规定填写危险废物转移联单，并向危险废物移出地和接受地的县级以上地方人民政府环境保护行政主管部门报告。

第五十二条 运输危险废物，必须采取防止污染环境的措施，并遵守国家有关危险货物运输管理的规定。

禁止将危险废物与旅客在同一运输工具上载运。

第五十三条 收集、贮存、运输、处置危险废物的场所、设施、设备和容器、包装物及其他物品转作他用时，必须经过消除污染的处理，方可使用。

第五十四条 直接从事收集、贮存、运输、利用、处置危险废物的人员，应当接受专业

培训，经考核合格，方可从事该项工作。

第五十五条 产生、收集、贮存、运输、利用、处置危险废物的单位，应当制定在发生意外事故时采取的应急措施和防范措施，并向所在地县级以上地方人民政府环境保护行政主管部门报告；环境保护行政主管部门应当进行检查。

第五十六条 因发生事故或者其他突发性事件，造成危险废物严重污染环境的单位，必须立即采取措施消除或者减轻对环境的污染危害。及时通报可能受到污染危害的单位和居民，并向所在地县级以上地方人民政府环境保护行政主管部门和有关部门报告，接受调查处理。

第五十七条 在发生危险废物严重污染环境、威胁居民生命财产安全时，县级以上地方人民政府环境保护行政主管部门必须立即向本级人民政府报告，由人民政府采取有效措施，解除或者减轻危害。

第五十八条 禁止经中华人民共和国过境转移危险废物。

第五章 法律责任

第五十九条 违反本法规定，有下列行为之一的，由县级以上人民政府环境保护行政主管部门责令限期改正，并处罚款：

(一)不按照国家规定申报登记工业固体废物或者危险废物，或者在申报登记时弄虚作假的；

(二)拒绝环境保护行政主管部门现场检查，或者在被检查时弄虚作假的；

(三)不按照国家规定缴纳排污费的；

(四)将列入限期淘汰名录淘汰的设备转让给他人使用的；

(五)擅自关闭、闲置或者拆除固体废物污染环境防治设施、场所的；

(六)在自然保护区、风景名胜区、生活饮用水源地和其他需要特别保护的区域内，建设工业固体废物集中贮存、处置设施、场所或者生活垃圾填埋场的；

(七)擅自转移固体废物出省、自治区、直辖市行政区域贮存、处置的。

有前款第(一)项、第(二)项行为的，处一万元以下的罚款；有前款第(三)项行为的，处应缴纳排污费金额百分之五十以下的罚款；有前款第(四)项、第(五)项、第(六)项、第(七)项行为之一的，处五万元以下的罚款。

第六十条 违反本法规定，生产、销售、进口或者使用淘汰的设备，或者采用淘汰的生产工艺的，由县级以上人民政府经济综合主管部门责令改正；情节严重的，由县级以上人民政府经济综合主管部门提出意见，报请同级人民政府按照国务院规定的权限责令停业、关闭。

第六十一条 建设项目中需要配套建设的固体废物污染环境防治设施未建成或者未经验收合格即投入生产或者使用的，由审批该建设项目的环境影响报告书的环境保护行政主管部门责令停止生产或者使用，可以并处十万元以下的罚款。

第六十二条 对经限期治理逾期未完成治理任务的企业事业单位，可以根据所造成的危害后果处十万元以下的罚款，或者责令停业、关闭。

前款规定的罚款由环境保护行政主管部门决定。责令停业、关闭，由县级以上人民

政府按照国务院规定的权限决定。

第六十三条 贮存、运输、处置城市生活垃圾违反本法规定的，按照国务院关于环境保护和城市环境卫生的有关规定予以处罚。

第六十四条 违反本法有关危险废物污染环境防治的规定，有下列行为之一的，由县级以上人民政府环境保护行政主管部门责令停止违法行为、限期改正，并处五万元以下的罚款：

（一）不设置危险废物识别标志的；

（二）将危险废物提供或者委托给无经营许可证的单位收集、贮存、处置的；

（三）转移危险废物；不按照国家规定填写危险废物转移联单或者未向移出地和接受地的县级以上地方人民政府环境保护行政主管部门报告的；

（四）将危险废物混入非危险废物中贮存的；

（五）未经安全性处置，混合收集、贮存、运输、处置具有不相容性质的危险废物的；

（六）将危险废物和旅客在同一运输工具上载运的；

（七）危险废物产生者不处置其产生的危险废物或者不承担依法应当承担的处置费用的；

（八）未经消除污染的处理将收集、贮存、运输、处置危险废物的场所、设施、设备和容器、包装物及其他物品转作他用的。

第六十五条 无经营许可证或者不按照经营许可证规定从事收集、贮存、处置危险废物经营活动的，由县级以上地方人民政府环境保护行政主管部门责令停止违法行为，没收违法所得，可以并处违法所得一倍以下的罚款。

不按照经营许可证规定从事前款活动的，还可以由发证机关吊销经营许可证。

第六十六条 违反本法规定，将中国境外的固体废物进境倾倒、堆放、处置，或者未经国务院有关主管部门许可擅自进口固体废物用作原料的，由海关责令退运该固体废物，可以并处十万元以上一百万元以下的罚款，逃避海关监管，构成走私罪的，依法追究刑事责任。

以原料利用为名，进口不能用作原料的固体废物的，依照前款规定处罚。

第六十七条 违反本法规定，经中华人民共和国过境转移危险废物的，由海关责令退动该危险废物，可以并处五万元以上五十万元以下的罚款。

第六十八条 对已经非法入境的固体废物，由省级以上人民政府环境保护行政主管部门依法向海关提出处理意见，海关应当依照本法第六十六条的规定作出处罚决定；已经造成环境污染的，由省级以上人民政府环境保护行政主管部门责令进口者消除污染。

第六十九条 违反本法规定，造成固体废物污染环境事故的，由县级以上人民政府环境保护行政主管部门处十万元以下的罚款；造成重大损失的，按照直接损失的百分之三十计算罚款，但是最高不超过五十万元；对负有直接责任的主管人员和其他直接责任人员，由其所在单位或者政府主管机关给予行政处分。

第七十条 罚款一律上交国库，任何单位和个人不得截留。

第七十一条 受到固体废物污染损害的单位和个人，有权要求依法赔偿损失。

赔偿责任和赔偿金额的纠纷，可以根据当事人的请求，由环境保护行政主管部门或者其他固体废物污染环境防治工作的监督管理部门调解处理；调解不成的，当事人可以

向人民法院提起诉讼。当事人也可以直接向人民法院提起诉讼。

第七十二条 违反本法规定，收集、贮存、处置危险废物，造成重大环境污染事故，导致公私财产重大损失或者人身伤亡的严重后果的，比照刑法第一百一十五条或者第一百八十七条的规定追究刑事责任。

单位犯本条罪的，处以罚金，并对直接负责的主管人员和其他直接责任人员依照前款规定追究刑事责任。

第七十三条 固体废物污染环境防治监督管理人员滥用职权、玩忽职守、徇私舞弊，构成犯罪的，依法追究刑事责任；尚不构成犯罪的，依法给予行政处分。

第六章 附 则

第七十四条 本法中下列用语的含义：

（一）固体废物，是指在生产建设、日常生活和其他活动中产生的污染环境的固态、半固态废弃物质。

（二）工业固体废物，是指在工业、交通等生产活动中产生的固体废物。

（三）城市生活垃圾，是指在城市日常生活中或者为城市日常生活提供服务的活动中产生的固体废物以及法律、行政法规规定视为城市生活垃圾的固体废物。

（四）危险废物，是指列入国家危险废物名录或者根据国家规定的危险废物鉴别标准和鉴别方法认定的具有危险特性的废物。

（五）处置，是指将固体废物焚烧和用其他改变固体废物的物理、化学、生物特性的方法，达到减少已产生的固体废物数量、缩小固体废物体积、减少或者消除其危险成份的活动，或者将固体废物最终置于符合环境保护规定要求的场所或者设施并不再回取的活动。

第七十五条 液态废物和置于容器中的气态废物的污染防治，适用本法；但是，排入水体的废水和排入大气的废气的污染防治适用有关法律，不适用本法。

第七十六条 中华人民共和国缔结或者参加的与固体废物污染环境防治有关的国际条约与本法有不同规定的，适用国际条约的规定；但是，中华人民共和国声明保留的条款除外。

第七十七条 本法自 1996 年 4 月 1 日起施行。

附：刑法有关条款

第一百一十五条 违反爆炸性、易燃性、放射性、毒害性、腐蚀性物品的管理规定，在生产、储存、运输、使用中发生重大事故，造成严重后果的，处三年以下有期徒刑或者拘役；后果特别严重的，处三年以上七年以下有期徒刑。

第一百八十七条 国家工作人员由于玩忽职守，致使公共财产、国家和人民利益遭受重大损失的，处五年以下有期徒刑或者拘役。

化学危险物品安全管理条例

（1987年2月17日国务院发布）

第一章 总 则

第一条 为了加强对化学危险物品的安全管理，保证安全生产，保障人民生命财产的安全，保护环境，特制定本条例。

第二条 凡在中华人民共和国境内生产、储存、经营、运输和使用化学危险物品的单位和个人，必须遵守本条例。

第三条 本条例所指化学危险物品，系指中华人民共和国国家标准GB××××－86《危险货物分类与品名编号》规定的分类标准中的爆炸品、压缩气体和液化气体、易燃液体、易燃固体、自燃物品和遇湿易燃物品、氧化剂和有机过氧化物、毒害品和腐蚀品七大类。

放射性物品、民用爆炸物品、兵器工业的火药、炸药、弹药、火工产品和核能物资以及国家法律、行政法规有专门规定的，按国家有关规定执行。

第四条 生产、储存、经营、运输和使用化学危险物品的单位，必须建立健全化学危险物品安全管理制度。

第五条 化学危险物品的生产企业、仓库和专用车站、码头必须设在安全地点。

第六条 国务院和地方各级人民政府的有关部门，按照职责范围，负责本条例的贯彻实施和监督检查。

第二章 化学危险物品的生产和使用

第七条 国家对化学危险物品的生产，统一规划，严格管理。

国家对新建、扩建、改建生产剧毒化学危险物品企业实行严格控制。

禁止乡、镇、街道企业生产剧毒化学危险物品。

第八条 新建、扩建、改建生产化学危险物品的企业，必须经所在地省辖市以上（含省辖市）人民政府审查同意，并按照国家有关规定履行审批手续。

第九条 地方新建、扩建、改建生产剧毒化学危险物品的企业，必须经所在省、自治区、直辖市人民政府审批，并报化学工业部备案。

第十条 新建、扩建、改建生产化学危险物品的企业，必须向审批单位提交下列文件：

（一）设计任务书（包括工艺、厂区布置、周围建筑情况、厂区周围一千米范围内的居民情况等）；

(二)原料、中间产品和最终产品的理化性能;"

(三)对储存、运输、包装的技术要求;

(四)工业卫生、安全和环境保护影响评价;

(五)处理灾害性事故的应急措施。

审批单位必须会同当地化工、公安、卫生、环保、劳动部门进行审议。

项目建成后,有关单位应当组织参加审议的单位进行竣工验收,验收合格方能投产。

第十一条 新建、扩建、改建生产化学危险物品的企业,必须持有省级化学研究(检验)部门测定的产品燃点、自燃点、闪点、爆炸极限、毒性等技术资料,向省、自治区、直辖市化工行政管理部门申请领取生产许可证,并依照有关规定到工商行政管理部门登记注册。

第十二条 生产和使用化学危险物品的企业,应当根据化学危险物品的种类、性能、设置相应的通风、防火、防爆、防毒、监测、报警、降温、防潮、避雷、防静电、隔离操作等安全设施。

生产企业应当根据需要,建立消防和急救组织。

第十三条 生产化学危险物品的企业,必须严格执行有关工业产品质量责任的法规,保证产品质量符合国家规定的标准。

第十四条 企业生产化学危险物品所使用的压力容器,必须符合国家有关压力容器的规定,并应经常进行维护和监测。

第十五条 化学危险物品的包装和标志必须符合国家规定。

包装监督检验机构应当加强对包装质量和包装材质的监督检查和定期测试。

第十六条 生产、使用化学危险物品的单位和个人,必须遵守各项安全生产制度和操作规程,严格用火管理制度。

第十七条 生产、使用化学危险物品时,必须有安全防护措施和用具。

第十八条 盛装化学危险物品的容器,在使用前后,必须进行检查,消除隐患,防止火灾、爆炸、中毒等事故发生。

第十九条 生产化学危险物品的装置,应当密闭,并设有必要的防爆、泄压设施。

生产有毒物品应当设有监测、报警、自动联锁、中和、消除等安全及工业卫生设施。

第二十条 生产、使用化学危险物品的企业必须按照环境保护法的规定,妥善处理废水、废气、废渣。

第二十一条 销毁、处理有燃烧、爆炸、中毒和其他危险的废弃化学危险物品,应当采取安全措施,并征得所在地公安和环境保护等部门同意。

第三章 化学危险物品的储存

第二十二条 化学危险物品必须储存在专用仓库、专用场地或专用储存室(柜)内,并设专人管理。

化学危险物品的生产车间、经销商店,可根据需要设立周转性的化学危险物品仓库,其储存限量由当地主管部门与公安部门规定。

交通运输部门的车站、码头,应当修建专用仓库储存化学危险物品。修建专用仓库

确有困难又必须在一般仓库短期储存化学危险物品的，应当保持一定的安全距离、隔离存放。

第二十三条 化学危险物品专用仓库、应当符合有关安全、防火规定，并根据物品的种类、性质，设置相应的通风、防爆、泄压、防火、防雷、报警、灭火、防晒、调温、消除静电、防护围堤等安全设施。

第二十四条 储存化学危险物品，应当符合下列要求：

(一)化学危险物品应当分类分项存放，堆垛之间的主要通道应当有安全距离，不得超量储存；

(二)遇火、遇潮容易燃烧、爆炸或产生有毒气体的化学危险物品，不得在露天、潮湿、漏雨和低洼容易积水的地点存放；

(三)受阳光照射容易燃烧、爆炸或产生有毒气体的化学危险物品和桶装、罐装等易燃液体、气体应当在阴凉通风地点存放；

(四)化学性质或防护、灭火方法相互抵触的化学危险物品，不得在同一仓库或同一储存室内存放。

第二十五条 化学危险物品入库前，必须进行检查登记，入库后应当定期检查。

第二十六条 储存化学危险物品的仓库内严禁吸烟和使用明火。对进入仓库区内的机动车辆必须采取防火措施。

第二十七条 储存化学危险物品的仓库，应当根据消防条例，配备消防力量和灭火设施以及通讯、报警装置。

第四章 化学危险物品的经营

第二十八条 国家对化学危险物品实行经营许可证制度。

禁止无证经营化学危险物品。

第二十九条 经营化学危险物品的企业必须具备下列条件：

(一)有符合安全要求的经营设施；

(二)有熟悉专业的技术人员；

(三)有相应的管理制度。

第三十条 新建、扩建、改建经营化学危险物品的企业，必须向所在地的县级以上(含县级)商业局提出申请；当地商业局会同有关部门审查同意后，由省、自治区、直辖市商业厅(局)核发经营许可证。

省、自治区、直辖市商业厅(局)应当每隔2至3年会同有关部门对经营许可证复查一次。

第三十一条 化学危险物品的流通，应当遵守下列规定：

(一)计划分配的化学危险物品，按计划供应；

(二)计划外正常供需渠道的化学危险物品，按合同供应；

(三)使用单位临时需要的化学危险物品，需凭该单位县级以上(含县级)主管部门出具的证明(注明品种、数量、用途)采购；

(四)日常生活需要的且购量不超过500克或500毫升(有特殊限量的除外)的零星

化学危险物品，可直接向经营企业购买。

第五章　化学危险物品的运输装卸

第三十二条　运输化学危险物品，必须按照国家有关危险货物运输管理规定办理。对不符合规定的，发货人不得托运，运输部门不得承运。

第三十三条　运输装卸化学危险物品，应当遵守下列规定。

（一）轻拿轻放，防止撞击、拖拉和倾倒；

（二）碰撞、互相接触容易引起燃烧、爆炸或造成其他危险的化学危险物品，以及化学性质或防护、灭火方法互相抵触的化学危险物品，不得违反配装限制和混合装运；

（三）遇热、遇潮容易引起燃烧、爆炸或产生有毒气体的化学危险物品，在装运时应当采取隔热、防潮措施。

第三十四条　装运化学危险物品时不得客货混装。

载客的火车、船舶、飞机机舱不得装运化学危险物品。

禁止乘客随身携带、夹带化学危险物品乘坐上述交通工具。

第三十五条　禁止无关人员搭乘装运化学危险物品的车厢、船舱和飞机机舱。

第三十六条　装运化学危险物品的车辆（火车除外）通过市区时，应当遵守所在地公安机关规定的行车时间和路线，中途不得随意停车。

第三十七条　对质量检验或科学研究急需的小量易燃、易爆化学危险物品的样品或试剂，在确保安全的条件下，可按有关规定办理快件托运。

第六章　罚　　则

第三十八条　对违反本条例规定的单位视情节轻重，由当地人民政府或有关主管部门责令限期改进或停产、停业整顿；整顿后仍达不到规定要求的，应当吊销其生产许可证或经营许可证。

第三十九条　对违反本条例规定的有关人员，由有关主管部门视情节轻重给予行政处罚，构成犯罪的由司法机关依法追究刑事责任。

第七章　附　　则

第四十条　本条例由国家经济委员会负责解释。

第四十一条　国务院有关部门和各省、自治区、直辖市人民政府可依据本条例规定，制定实施细则。

第四十二条　本条例自发布之日起施行。1961年1月28日，国务院批转国家经委、化学工业部、铁道部、商业部、公安部试行的《关于中、小型化工企业安全生产管理规定》、《化学危险物品储存管理暂行办法》、《化学危险物品凭证经营、采购暂行办法》、《铁路危险物品运输规则》、《化学危险物品防火管理规则》、《关于违反爆炸、易燃物品管理规则处罚暂行办法》同时废止。

农药管理条例

（中华人民共和国国务院令第216号1997年5月8日发布，同日施行）

第一章 总 则

第一条 为了加强对农药生产、经营和使用的监督管理，保证农药质量，保护农业、林业生产和生态环境，维护人畜安全，制定本条例。

第二条 本条例所称农药，是指用于预防、消灭或者控制危害农业、林业的病、虫、草和其他有害生物以及有目的地调节植物、昆虫生长的化学合成或者来源于生物、其他天然物质的一种物质或者几种物质的混合物及其制剂。

前款农药包括用于不同目的、场所的下列各类：

（一）预防、消灭或者控制危害农业、林业的病、虫（包括昆虫、蜱、螨）、草和鼠、软体动物等有害生物的；

（二）预防、消灭或者控制仓储病、虫、鼠和其他有害生物的；

（三）调节植物、昆虫生长的；

（四）用于农业、林业产品防腐或者保鲜的；

（五）预防、消灭或者控制蚊、蝇、蜚蠊、鼠和其他有害生物的；

（六）预防、消灭或者控制危害河流堤坝、铁路、机场、建筑物和其他场所的有害生物的。

第三条 在中华人民共和国境内生产、经营和使用农药的，应当遵守本条例。

第四条 国家鼓励和支持研制、生产和使用安全、高效、经济的农药。

第五条 国务院农业行政主管部门负责全国的农药登记和农药监督管理工作。省、自治区、直辖市人民政府农业行政主管部门协助国务院农业行政主管部门做好本行政区域内的农药登记，并负责本行政区域内的农药监督管理工作。县级人民政府和设区的市、自治州人民政府的农业行政主管部门负责本行政区域内的农药监督管理工作。

国务院化学工业行政管理部门负责全国农药生产的统筹规划、协调指导、监督管理工作。省、自治区、直辖市人民政府化学工业行政管理部门负责本行政区域内农药生产的监督管理工作。

县级以上各级人民政府其他有关部门在各自的职责范围内负责有关的农药监督管理工作。

第二章 农药登记

第六条 国家实行农药登记制度。

生产(包括原药生产、制剂加工和分装,下同)农药和进口农药,必须进行登记。

第七条 国内首次生产的农药和首次进口的农药的登记,按照下列三个阶段进行

(一)田间试验阶段:申请登记的农药,由其研制者提出田间试验申请,经批准,方进行田间试验;田间试验阶段的农药不得销售。

(二)临时登记阶段:田间试验后,需要进行田间试验示范、试销的农药以及在特殊况下需要使用的农药,由其生产者申请临时登记,经国务院农业行政主管部门发给农临时登记证后,方可在规定的范围内进行田间试验示范、试销。

(三)正式登记阶段:经田间试验示范、试销可以作为正式商品流通的农药,由其生者申请正式登记,经国务院农业行政主管部门发给农药登记证后,方可生产、销售。

农药登记证和农药临时登记证应当规定登记有效期限;登记有效期限届满,需要续生产或者继续向中国出售农药产品的,应当在登记有效期限届满前申请续展登记。

经正式登记和临时登记的农药,在登记有效期限内改变剂型、含量或者使用范围、用方法的,应当申请变更登记。

第八条 依照本条例第七条的规定申请农药登记时,其研制者、生产者或者向中出售农药的外国企业应当向国务院农业行政主管部门或者经由省、自治区、直辖市人政府农业行政主管部门向国务院农业行政主管部门提供农药样品,并按照国务院农业政主管部门规定的农药登记要求,提供农药的产品化学、毒理学、药效、残留、环境影响标签等方面的资料。

国务院农业行政主管部门所属的农药检定机构负责全国的农药具体登记工作。省自治区、直辖市人民政府农业行政主管部门所属的农药检定机构协助做好本行政区域的农药具体登记工作。

第九条 国务院农业、林业、化学工业、卫生、环境保护、粮食部门和全国供销合作社等部门推荐的农药管理专家和农药技术专家,组成农药登记评审委员会。

农药正式登记的申请资料分别经国务院农业、化学工业、卫生、环境保护部门和全供销合作总社审查并签署意见后,由农药登记评审委员会对农药的产品化学、毒理学、效、残留、环境影响等作出评价。根据农药登记评审委员会的评价,符合条件的,由国院农业行政主管部门发给农药登记证。

第十条 生产其他厂家已经登记的相同农药产品的,其生产者应当申请办理农药记,提供农药样品和本条例第八条规定的资料,由国务院农业行政主管部门发给农药记证。

第三章 农药生产

第十一条 农药生产应当符合国家农药工业的产业政策。

第十二条 开办农药生产企业(包括联营、设立分厂和非农药生产企业设立农药产车间),应当具备下列条件,并经企业所在地的省、自治区、直辖市化学工业行政管理门审核同意后,报国务院化学工业行政管理部门批准;但是,法律、行政法规对企业设的条件和审核或者批准机关另有规定的,从其规定:

(一)有与其生产的农药相适应的技术人员和技术工人;

(三)有与其经营的农药相适应的规章制度;

(四)有与其经营的农药相适应的质量管理制度和管理手段。

第十九条 农药经营单位购进农药,应当将农药产品与产品标签或者说有书、产品质量合格证核对无误,并进行质量检验。

禁止收购、销售无农药登记证或者农药临时登记证、无农药生产许可证或者农药生产批准文件、无产品质量标准和产品质量合格证和检验不合格的农药。

第二十条 农药经营单位应当按照国家有关规定做好农药储备工作。

贮存农药应当建立和执行仓储保管制度,确保农药产品的质量和安全。

第二十一条 农药经营单位销售农药,必须保证质量,农药产品与产品标签或者说明书、产品质量合格证应当核对无误。

农药经营单位应当向使用农药的单位和个人正确说明农药的用途、使用方法、用量、中毒急救措施和注意事项。

第二十二条 超过产品质量保证期限的农药产品,经省级以上人民政府农业行政主管部门所属的农药检定机构检验,符合标准的,可以在规定期限内销售;但是,必须注明"过期农药"字样,并附具使用方法和用量。

第五章 农药使用

第二十三条 县级以上各级人民政府农业行政主管部门应当根据"预防为主,综合防治"的植保方针,组织推广安全、高效农药,开展培训活动,提高农民施药技术水平,并做好病虫害预测预报工作。

第二十四条 县级以上地方各级人民政府农业行政主管部门应当加强对安全、合理使用农药的指导,根据本地区农业病、虫、草、鼠害发生情况,制定农药轮换使用规划,有计划轮换使用农药,减缓病、虫、草、鼠的抗药性,提高防治效果。

第二十五条 使用农药应当遵守农药防毒规程,正确配药、施药、做好废弃物处理和安全防护工作,防止农药污染环境和农药中毒事故。

第二十六条 使用农药应当遵守国家有关农药安全、合理使用的规定,按照规定的用药量、用药次数、用药方法和安全间隔期施药,防止污染农副产品。

剧毒、高毒农药不得用于防治卫生害虫,不得用于蔬菜、瓜果、茶叶和中草药材。

第二十七条 使用农药应当注意保护环境、有益生物和珍稀物种。

严禁用农药毒鱼、虾、鸟、兽等。

第二十八条 林业、粮食、卫生行政部门应当加强对林业、储粮、卫生用农药的安全、合理使用的指导。

第六章 其他规定

第二十九条 任何单位和个人不得生产未取得农药生产许可证或者农药生产批准文件的农药。

任何单位和个人不得生产、经营、进口或者使用未取得农药登记证或者农药临时登

记证的农药。

进口农药应当遵守国家有关规定，货主或者其代理人应当向海关出示其取得的中国农药登记证或者农药临时登记证。

第三十条 禁止生产、经营和使用假家农药。

下列农药为假农药：

(一)以非农药冒充农药或者以此种农药冒充他种农药的；

(二)所含有效成份的种类、名称与产品标签或者说明书上注明的农药有效成份的种类、名称不符的。

第三十一条 禁止生产、经营和使用劣质农药。

下列农药为劣质农药：

(一)不符合农药产品质量标准的；

(二)失去使用效能的；

(三)混有导致药害等有害成分的。

第三十二条 禁止经营产品包装上未附标签或者标签残缺不清的农药。

第三十三条 未经登记的农药，禁止刊登、播放、设置、张贴广告。

农药广告内容必须与农药登记的内容一致，并依照广告法和国家有关农药广告管理的规定接受审查。

第三十四条 经登记的农药，在登记有效期内发现对农业、林业、人畜安全、生态环境有严重危害的，经农药登记评审委员会审议，由国务院农业行政主管部门宣布限制使用或者撤销登记。

第三十五条 任何单位和个人不得生产、经营和使用国家明令禁止生产或者撤销登记的农药。

第三十六条 县经以上各级人民政府有关部门应当做好农副产品中农药残留量的检测工作。

第三十七条 禁止销售农药残留量超过标准的农副产品。

第三十八条 处理假农药、劣质农药、过期报废农药、禁用农药、废弃农药包装和其他含农药的废弃物，必须严格遵守环境保护法律、法规的有关规定，防止污染环境。

第七章 罚 则

第三十九条 有下列行为之一的，由农业行政主管部门按照以下规定给予处罚：

(一)未取得农药登记证或者农药临时登记证，擅自生产、经营农药的，或者生产、经营已撤销登记的农药的，责令停止生产、经营，没收违法所得，并处违法所得1倍以上10倍以下的罚款；没有违法所得的，并处10万元以下的罚款；

(二)农药登记证或者农药临时登记证有效期限届满未办理续展登记，擅自继续生产该农药的，责令限期补办续展手续，没收违法所得，可以并处违法所得5倍以下的罚款；没有违法所得的，可以并处5万元以下的罚款；逾期不补办的，由原发证机关责令停止生产、经营，吊销农药登记证或者农药临时登记证；

(三)生产、经营产品包装上未附标签、标签残缺不清或者擅自修改标签内容的农药

产品的，给予警告，没收违法所得，可以并处违法所得3倍以下的罚款；没有违法所得的，可以并处3万元以下的罚款；

（四）不按照国有有关农药安全使用的规定使用农药的，根据所造成的危害后果，给予警告，可以并处3万元以下的罚款；

有前款第（四）项所列行为，构成犯罪的，依法追究刑事责任。

第四十条 有下列行为之一的，由省级以上人民政府化学工业行政管理部门按照以下规定给予处罚：

（一）未经批准、擅自开办农药生产企业的，或者未取得农药生产许可证或者农药生产批准文件，擅自生产农药的，责令停止生产，没收违法所得，并处违法所得1倍以上10倍以下的罚款；没有违法所得的，并处10万元以下的罚款；

（二）未按照农药生产许可证或者农药生产批准文件的规定，擅自生产农药的，责令停止生产，没收违法所得，并处违法所得1倍以上5倍以下的罚款；没有违法所得的，并处5万元以下的罚款；情节严重的，由原发证机关吊销农药生产许可证或者农药生产批准文件。

第四十一条 假冒、伪造或者转让农药登记证或者农药临时登记证、农药登记证号或者农药临时登记证号、农药生产许可证或者农药生产批准文件、农药生产许可证号或者农药生产批准文件号的，由农业行政主管部门收缴或者吊销农药登记证或者农药临时登记证，由化学工业行政管理部门收缴或者吊销农药生产许可证或者农药生产批准文件，由农业行政主管部门或者化学工业行政管理部门没收违法所得，可以并处违法所得10倍以下的罚款；没有违法所得的，可以并处10万元以下的罚款；构成犯罪的，依法追究刑事责任。

第四十二条 生产、经营假农药、劣质农药的，由农业行政主管部门或者法律、行政法规规定的其他有关部门没收假农药、劣质农药和违法所得，并处违法所得1倍以上10倍以下的罚款；没有违法所得的，并处10万元以下的罚款；情节严重的，由农业行政主管部门吊销农药登记证或者农药临时登记证，由化学工业行政管理部门吊销农药生产许可证或者农药生产批准文件；构成犯罪的，依法追究刑事责任。

第四十三条 违反工商行政管理法律、法规，生产、经营农药的，或者违反农药广告管理规定的，由工商行政管理机关依照有关法律、法规的规定给予处罚。

第四十四条 违反本条例规定，造成农药中毒、环境污染、药害等事故或者其他经济损失的，应当依法赔偿。

第四十五条 违反本条例规定，在生产、储存、运输、使用农药过程中发生重大事故，造成严重后果，构成犯罪的，对直接负责的主管人员和其他直接责任人员，依法追究刑事责任；尚不构成犯罪的，依法给予行政处分。

第四十六条 农药管理工作人员滥用职权、玩忽职守、徇私舞弊、索贿受贿，构成犯罪的，依法追究刑事责任；尚不构成犯罪的，依法给予行政处分。

第八章 附 则

第四十七条 中华人民共和国缔结或者参加的与农药有关的国际条约与本条例有

不同规定的，适用国际条约的规定；但是，中华人民共和国声明保留的条款除外。

第四十八条 本条例自1997年5月8日起施行。

中华人民共和国公安部令

第 18 号

《易燃易爆化学物品消防安全监督管理办法》已经1994年1月25日公安部部务会议通过，现予发布，自1994年5月1日起施行。

公安部部长　陶驷驹

一九九四年三月二十四日

易燃易爆化学物品消防安全监督管理办法

第一章　总　　则

第一条　为加强易燃易爆化学物品的消防安全监督管理，保障国家和人民生命财产安全，根据《中华人民共和国消防条例》《化学危险物品安全管理条例》的规定，制定本办法。

第二条　本办法适用于中华人民共和国境内生产、使用、储存、经营、运输和销毁易燃易爆化学物品的单位和个人。

第三条　本办法所称易燃易爆化学物品，系指国家标准GB12268－90《危险货物品名表》中以燃烧爆炸为主要特性的压缩气体和液化气体；易燃液体；易燃固体、自燃物品和遇湿易燃物品；氧化剂和有机过氧化物；毒害品、腐蚀品中部分易燃易爆化学物品。

第四条　新建、扩建、改建的生产、储存易燃易爆化学物品的工厂、仓库和装运易燃易爆化学物品的专用车站、码头，必须设在城镇以外的独立安全地带。对已建成的严重影响城市消防安全的工厂、仓库，应纳入城市改造规划，并分别采取限期搬迁、改变使用性质、限制生产或储存化学物品种类和数量等措施，消除不安全因素。

第五条　生产、储存、经营和运输易燃易爆化学物品的单位和个人，必须填报《易燃易爆化学物品消防安全审核申报表》或《易燃易爆化学物品准运证审核申报表》，经公安消防监督机构审核合格后，分别填发《易燃易爆化学物品消防安全审核意见书》《易燃易爆化学物品安全许可证》或《易燃易爆化学物品准运证》。

无《易燃易爆化学物品消防安全审核意见书》《易燃易爆化学物品消防安全许可证》《易燃易爆化学物品准运证》的单位和个人不得生产、储存、经营、运输易燃易爆化学物品。

第六条　民用建筑、民用地下建筑不得用于生产、储存易燃易爆化学物品。

第二章　生产、使用监督管理

第七条　生产、使用易燃易爆化学物品的单位和个人，必须具备下列条件：

（一）生产、使用易燃易爆化学物品的建筑和场所必须符合建筑设计防火规范和有关专业防火规范；

（二）生产、使用易燃易爆化学物品的场所必须按照有关规范安装防雷保护设施；

（三）生产、使用易燃易爆化学物品场所的电气设备，必须符合国家电气防爆标准；

（四）生产设备与装置必须按国家有关规定设置消防安全设施，定期保养、校验；

（五）易产生静电的生产设备与装置，必须按规定设置导除静电设施，并定期进行检查；

（六）从事生产易燃易爆化学物品的人员必须经主管部门进行消防安全培训，经考试取得合格证，方准上岗。

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第八条　易燃易爆化学物品出厂时，必须有产品安全说明书。说明书中必须有经法定检验机构测定的该物品的闪点、燃点、自然点、爆炸极限等数据和防火、灭火、安全储运的注意事项。

第九条　易燃易爆化学物品的灌装容器、包装及其标志，必须符合国家标准或行业标准。

第十条　大量销毁易燃易爆化学物品时，应当征得所在地公安消防监督机构的同意。

第三章　储存、经营监督管理

第十一条　易燃易爆化学物品的储存应当遵守《仓库防火安全管理规则》，同时还应当符合下列条件：

（一）专利仓库、货场或其他专用储存设施，必须由经过消防安全培训合格的专人管理；

（二）应根据 GB12268－90《危险货物品名表》分类、分项储存。化学性质相抵触或灭火方法不同的易燃易爆化学物品，不得在同一库房内储存；

（三）不得超量储存。

第十二条　易燃易爆化学物品的储存单位，必须建立入库验收、发货检查、出入库登记制度。凡包装、标志不符合国家标准或破损、残缺、渗漏、变形及物品变质、分解的，严禁出入库。

第十三条　易燃易爆化学物品仓库管理人员在发货时，必须检查提货单位的《易燃易爆化学物品准运证》，无《易燃易爆化学物品准运证》的不得发货。

第十四条　经营易燃易爆化学物品的单位和个人，必须具备下列条件：

（一）有符合防火防爆要求的储存、经营设施；

（二）有经过消防培训合格的经营人员；

（三）有消防安全管理制度。

第四章　运输监督管理

第十五条　运输易燃易爆化学物品的车辆必须办理《易燃易爆化学物品准运证》，无《易燃易爆化学物品准运证》的车辆不得从事易燃易爆化学物品的运输业务。

第十六条　办理《易燃易爆化学物品准运证》必须具备下列条件：

（一）有主管部门或单位的证明、车辆年检证、驾驶员证、押运员证；

（二）有符合消防安全要求的运输工具和配备相应的消防器材；

（三）有经过消防安全培训合格的驾驶员、押运员。

第十七条　《易燃易爆化学物品准运证》分长期和临时两种，全国通用。长期《易燃易爆化学物品准运证》期限为一年，急需运输的可办一次性临时《易燃易爆化学物品准运证》。

第十八条　《易燃易爆化学物品准运证》由承运单位或个人所在县（含县）以上公安消防监督机构批准填发。

第十九条　运输易燃易爆化学物品，应当遵守下列规定：

（一）运输单位和个人必须对装运物品严格检查，对包装不牢、破损，品名标签、标志不明显的易燃易爆化学物品和不符合安全要求的罐体、没有瓶帽的气体钢瓶不得装运；

（二）轻拿轻放，防止碰撞、拖拉和倾倒；

（三）运输易燃易爆化学物品的车辆、船舶，须彻底清扫冲洗干净后，才能继续装运其他危险物品；

（四）化学性质、安全防护、灭火方法互相抵触的易燃易爆化学物品，不得混合装运；

（五）遇热容易引起燃烧、爆炸或产生有毒气体的化学物品，按夏季限运物品安排在夜间运输，必要时应采取隔热降温措施不宜在阴雨天运输。若必须运输时，除具有良好的装卸条件外，还应有防潮遮雨措施。

（六）遇潮容易引起燃烧、爆炸或产生有毒气体的化学物品；

第二十条　无关人员不得搭乘装有易燃易爆化学物品的运输工具。

第二十一条　运输易燃易爆化学物品的车辆标志，必须符合国家标准 GB13392－92《道路运输危险货物车辆标志》。

第二十二条　运输压缩、液气体化和易燃液体的槽、罐车的颜色，必须符合国家色标要求，并安装静电接地装置和阻火设备。

第五章　罚则

第二十三条　违反本办法规定的，按照《中华人民共和国治安管理处罚条例》和有关消防法规予以处罚。构成犯罪的，依法追究刑事责任。

第六章　附则

第二十四条　与本办法相配套的《化学危险物品消防安全监督管理品名表》《易燃易爆化学物品消防安全许可证》《易燃易爆化学物品准运证》由公安部统一制定、印制。

第二十五条　本办法自 1994 年 5 月 1 日起施行。

国家环境保护局
海关总署 文件
对外贸易经济合作部

环管[1994]140号

关于发布《化学品首次进口及有毒化学品进出口环境管理规定》的通知

国务院各部委、局(办)、总公司,全军环办,各省、自治区、直辖市环境保护局,经贸厅(委)局,海关广东分署,直属各海关:

为了保护人体健康和生态环境,加强化学品进出口环境管理和执行联合国《关于化学品国际贸易资料交流的伦敦准则》,现发布《化学品首次进口及有毒化学品进出口环境管理规定》。自一九九四年五月一日起施行。

附件:1、《化学品首次进口及有毒化学品进出口环境管理规定》

2、《中国禁止或严格限制的有毒化学品名录》(第一批)

3、有毒化学品进(出)口环境管理放行通知单

化学品首次进口及有毒化学品进出口环境管理规定

第一章 总 则

第一条 为了保护人体健康和生态环境,加强化学品首次进口和有毒化学进出口的环境管理,执行《关于化学品国际贸易资料交流的伦敦准则》(1989年修正本)(以下简称《伦敦准则》),制定本规定。

第二条 在中华人民共和国管辖领域内从事化学品进出口活动必须遵守本规定。

第三条 本规定适用于化学品的首次进口和列入《中国禁止或严格限制的有毒化学品名录》(以下简称《名录》)的化学品进出口的环境管理。

食品添加剂、医药、兽药、化妆品和放射性物质不适用本规定。

第四条 本规定中下列用语的含义是:

(一)"化学品"是指人工制造的或者是从自然界取得的化学物质,包括化学物质本

身、化学混合物或者化学配制物中的一部分，以及作为工业化学品和农药使用的物质。

（二）“禁止的化学品”是指因损害健康和环境而被完全禁止使用的化学品。

（三）“严格限制的化学品”是指因损害健康和环境而被禁止使用，但经授权在一些特殊情况下仍可使用的化学品。

（四）“有毒化学品”是指进入环境后通过环境蓄积、生物累积、生物转化或化学反应等方式损害健康和环境，或者通过接触对人体具有严重危害和具有潜在危险的化学品。

（五）“化学品首次进口”是指外商或其代理人向中国出口其未曾在中国登记过的化学品，即使同种化学品已有其他外商或其代理人在中国进行了登记，仍被视为化学品首次进口。

（六）“事先知情同意”是指为保护人类健康和环境目的而被禁止或严格限制的化学品的国际运输，必须在进口国指定的国家主管部门同意的情况下进行。

（七）“出口”和“进口”是指通过中华人民共和国海关办理化学品进出境手续的活动，但不包括过境运输。

第二章　监督管理

第五条　国家环境保护局对化学品首次进口和有毒化学品进出口实施统一的环境监督管理，负责全面执行《伦敦准则》的事先知情同意程序，发布中国禁止或严格限制的有毒化学品名录，实施化学品首次进口和列入《名录》内的有毒化学品进出口的环境管理登记和审批，签发《化学品集进（出）口环境管理登记证》和《有毒化学品进（出）口环境管理放行通知单》，发布首次进口化学品登记公告。

第六条　中华人民共和国海关对列入《名录》的有毒化学品的进出口凭国家环境保护局签发的《有毒化学品进（出）口环境管理放行通知单》（见附件）验放。

对外贸易经济合作部根据其职责协同国家环境保护局对化学品首次进口和有毒化学品进出口环境管理登记申请资料有关内容进行审查和对外公布《中国禁止或严格限制的有毒化学品名录》。

第七条　国家环境保护局设立国家有毒化学品评审委员会，负责对申请进出口环境管理登记的化学品的综合评审工作，对实施本规定所涉及的技术事务向国家环境保护局提供咨询意见。

国家有毒化学品评审委员会由环境、卫生、农业、化工、外贸、商检、海关及其它有关方面的管理人员和技术专家组成，每届任期三年。

第八条　地方各级环境保护行政主管部门依据本规定对本辖区的化学品首次进口及有毒化学品进出口进行环境监督管理。

第三章　登记管理

第九条　外商或其代理人向中国出口所经营的未曾在中国登记（除农药以外）的任何化学品，必须向国家环境保护局提出化学品首次进口环境管理登记申请，并按规定填写《化学品首次进口环境管理登记申请表》，免费提供试验样品（一般不少于二百五十

表、化学品进出口环境管理登记证和临时登记证、有毒化学品进出口环境管理放行通知单，由国家环境保护局统一监制。

第四章　防止污染口岸环境

第十九条　进出口化学品的分类、包装、标签和运输，按照国际或国内有关危险货物运输规则的规定执行。

第二十条　在装卸、贮存和运输化学品过程中，必须采取有效的预防和应急措施，防止污染环境。

第二十一条　因包装损坏或者不符合要求而造成或者可能造成口岸污染的，口岸主管部门应立即采取措施，防止和消除污染，并及时通知当地环境保护行政主管部门，进行调查处理。防止和消除其污染的费用由有关责任人承担。

第五章　罚　　则

第二十二条　违反本规定，未进行化学品进出口环境管理登记而进出口化学品的，由海关根据海关行政处罚实施细则有关规定处以罚款，并责令当事人补办登记手续；对经补办登记申请但未获准登记的，责令退回货物。

第二十三条　进出口化学品造成中国口岸污染的，由当地环境保护行政主管部门予以处罚。

第二十四条　违反国家外贸管制规定而进出口化学品的，由外贸行政主管部门依照有关规定予以处罚。

第六章　附　　则

第二十五条　因实验需要，首次进口且年进口量不足50公斤的化学品免于登记（《中国禁止或严格限制的有毒化学品名录》中的化学品除外）。

第二十六条　化学品进出口环境管理登记收费办法另行制定。

第二十七条　本规定由国家环境保护局负责解释。

第二十八条　本规定自1994年5月1日起施行。

化学品首次进口及有毒化学品进出口环境管理登记实施细则

第一章 总 则

第一条 为实施《化学品首次进口及有毒化学品进出口环境管理规定》，制定本实施细则。

第二条 本实施细则适用于化学品首次进口及有毒化学品进出口的环境管理登记，即外商或其代理人（以下简称"外商"）向中国出口未列入《中国禁止或严格限制的有毒化学品名录》中的化学品的环境管理登记、外商向中国出口列入《中国禁止或严格限制的有毒化学品名录》中的化学品（以下简称"有毒化学品"，详见附表1）的环境管理登记、国内出口商向中国境外出口有毒化学品的环境管理登记、以及国内进口商中国境外进口有毒化学品的环境管理登记。

第三条 国家环境保护局化学品登记中心负责受理化学品进（出）口环境管理登记的申请。

第四条 本实施细则使用的"化学品"、"有毒化学品 "、"化学品首次进口"、"进口"和"出口"等术语，详见《化学品首次进口及有毒化学品进出口环境管理规定》中第四条规定的定义。

第二章 化学品进出口环境管理登记类型

第五条 外商向中国出口有毒化学品，第份合同的每种有毒化学品均须办理有毒化学品进口环境管理登记，当合同的执行期超过二年时，由评审委员会决定登记的有效期。

第六条 国内进口商从国外进口有毒化学品，凭合同所涉外商办理的有毒化学品进口环境管理登记证，每批到港货物的每种有毒化学品均须办理《有毒化学品进（出）口环境管理放行通知单》。

第七条 国内出口商向国外出口有毒化学品，每批出口货物的每种有毒化学品均须办理《有毒化学品进（出）口环境管理放行通知单》。

第八条 外商向中国出口列入《化学品首次进口环境管理第一类化学品》（详见附表2）中的化学品，每种化学品均须办理化学品首次进口环境管理登记，该登记的有效期为五年。

第九条 外商向中国出口列入《化学品首次进口环境管理第二类化学品》（详见附表3）中的化学品，每种化学品均须办理化学品首次进口环境管理登记，该登记的有效期为五年。

第十条 外商向中国出口多品种规格的油墨、油漆、聚合物、染料、颜料等产品经评审委员会确认是系列产品的化学品时，以每个产品系列作为一种产品办理化学品首次进口环境管理登记，该登记的有效期为五年。

第十一条 外商向中国出口添加剂、分散剂、助剂、专项化学品等产品，经评审委员确认是精细化工品时，每种化学品均须办理化学品首次进口环境管理登记，该登记的有效期为五年。

第十二条 外商向中国出口本实施细则第五条至第十一条规定的登记以外的化学品，每种化学品均须办理化学品首次进口环境管理登记，该登记的有效期为五年。

第十三条 外商向中国出口塑料制成品、橡胶制成品等产品，免于环境管理登记。

第三章 化学品进出口环境管理登记的资料要求

第十四条 《附件1 有毒化学品进出口环境管理登记申请表》(以下简称"附件1")和《附件2 化学品首次进口环境管理登记申请表》(以下简称"附件2")的项目是化学品进(出)口环境管理登记的全部资料要求。

第十五条 申请办理有毒化学品进(出)口环境管理登记，必须填写"附件1"中所列各项。

第十六条 化学品首次进口环境管理登记须填写"附件2"。

第十七条 "附件2"中的第Ⅰ、Ⅱ、Ⅴ、Ⅵ、Ⅹ和Ⅺ项为申请的基本资料要求，任何化学品首次进口环境管理登记申请均须填写此六项。

第十八条 "附件2"中的第Ⅲ、Ⅳ和Ⅻ项应尽可能填写。

第十九条 "附件2"中的Ⅶ、Ⅷ和Ⅸ项须按照《附件4 化学品首次进口环境管理登记申请表填表说明》的要求填写，但当申请人能提供化学品的安全数据单(Materia Safety Data Sheet)时，可免于填写此三项。

第二十条 除申请人按照上述要求提供资料外，当登记主管机关根据评审委员会的评审结果，认为已提供的资料尚不能说明申请登记的化学品对环境的影响时，有权要求申请人补充资料，但所要求的资料将不超过"附件2"所列的内容。

第二十一条 在没有得到登记主管机关的特别要求时，申请人不必提供样品，但登记主管机关在必要时有权要求申请人提供样品。

第四章 化学品进出口环境管理登记的收费

第二十二条 外商办理本实施细则第五条规定的环境管理登记，费用为10000美元或按付款当日的等值人民币。

第二十三条 国内进(出)口商办理本实施细则第六条或第七条规定的环境管理登记，费用均为2000元人民币。

第二十四条 外商办理本实施细则第八条规定的环境管理登记，费用为2000美元或按付款当日的等值人民币。

第二十五条 外商办理本实施细则第九条规定的环境管理登记，费用为1500美元

或按付款当日的等值人民币。

第二十六条 外商办理本实施细则第十条规定的环境管理登记，费用为2000美元或按付款当日的等值人民币。

第二十七条 外商办理本实施细则第十一条规定的环境管理登记，费用为200美元或按付款当日的等值人民币。

第二十八条 外商办理本实施细则第十二条规定的环境管理登记，费用为1000美元或按付款当日的等值人民币。

第五章 附 则

第二十九条 本实施细则由国家环境保护局化学品登记中心负责解释。

第三十条 本实施细则自一九九五年二月十六日起实行。

国家环境保护总局文件

环发[1999]83号

关于修订《中国禁止或严格限制的有毒化学品目录(第一批)》的通知

各省、自治区、直辖市及计划单列市环境保护局：

原国家环境保护局与海关总署、外经贸部《关于发布〈化学品首次进口及有毒化学品进出口环境管理规定〉的通知》(环管[1994]140号)下发执行以来，对保护我国的生态环境和人民身体健康起到了积极的作用。根据几年来的执行情况，我局与海关总署共同对有毒化学品目录进行了细化，提出了每类化学品中所需要控制的具体化学品名称和海关编码。现将调整后的《中国禁止或严格限制的有毒化学品目录(第一批)》(以下简称《目录》，见附件)印发你们，并就有关问题通知如下：

一、外商及其代理人向中国出口和国内从国外进口《目录》中的有毒化学品之前，必须办理《化学品进(出)口环境管理登记证》。每次进口/出口《目录》中所列有毒化学品时，进、出口者必须持国家环保总局签发的《有毒化学品进(出)口环境管理放行通知单》。

二、外商及其代理人向中国出口所经营的未曾在中国登记(除农药以外)的任何化学品，必须向国家环保总局提出化学品首次进口环境管理登记申请，取得《化学品进(出)口环境管理登记证》后，方能进口所登记的化学品。

各地环境保护局应督促辖区内使用进口化学品做原料的企业进行化学品进(出)口环境管理登记，协助海关做好化学品进出口的验放工作，减少化学品对环境的污染。

附：中国禁止或严格限制的有毒化学品目录(第一批)

附件：

中国禁止或严格限制的有毒化学品目录(第一批)

(1998年12月25日修订)

序号	化学品名 中文 英文	需控制化学品名称 中文别名(俗名、商品名、化学名) 英文	CAS	分子式 (结构式)	H.S. Code 化学品 制剂 Preparation	H.S. Code 化学品纯物质 Pure Substance
1	青石棉 Crocidolite	Asbestos crocidolite; Amorphous crocidolite asbestos; Asbestos; Blue asbestos; Brown asbestos; Crocidolite; Crocidolite asbestos; Fibrous crocidolite asbestos	12001－28－4	$ONa_2Fe_2O_3Fe$ $O_8SiO_2H_2O$		2524.0090 25240010
2	多氯联苯 PCBs	1,1－联苯氯代衍生物;多氯代联苯;氯代联苯 1,1－Biphenyl, chloro derivs; 1,1－Biphenyl, chloro derivatives; 1,1－Biphenyl, chloro derivs. Biphenyl, chlorinated Chlorinated biphenyl Chlorinated diphenyl Diphenyl, chlorinated PCB Polychlorinated biphenyl Polychlorinated biphenyls(PCBs) See also specific PCBs	1336－36－3			2903.6990

序号	化学品名 中文 英文	需控制化学品名称 中文别名(俗名、商品名、化学名) 英文	CAS	分子式 (结构式)	H.S.Code 化学品 制剂 Preparation	H.S.Code 化学品纯物质 Pure Substance
3	多溴联苯 PBBs	六溴联苯 1,1'-Biphenyl,2,2'4,4'5,5'-hexabromo- 2,4,5,2',4',5'-Hexabromobiphenyl	59080-40-9	$C_{12}H_4Br_6$		2903.6990
		八溴联苯 biphenyl, octabromo-; Octabromobiphenyl; ar, ar, ar, ar, ar', ar', ar', ar'-Octabromo 1,1'-biphenyl; Octabromodiphenyl	27858-07-7	$C_{12}H_4Br_8$		2903.6990
		十溴联苯; 2,2',3,3'4,4'5,5'6,6'-十溴代-1,1'-联苯; 1,1'-Biphenyl,2,2'3,3'4,4',5,5'6,6'-decabromo-	13654-09-6	$C_{12}Br_{10}$		2903.6990
4	三(2,3-二溴丙基)磷酸酯 Tris(2,3-dibromopropyl) phosphate	磷酸三(2,3-二溴丙基)酯;2,3-二溴-1-丙醇磷酸酯(3:1) 1-propanol,2,3-dibromo-,phosphate(3:1);2,3-Dibromo-1-propanol phosphate;(2,3-Dibromopropyl)phosphate; Phosphoric acid, tris(2,3-dibromopropyl)ester; Tris-BP; Tris(dibromopropyl)phosphate; Tris(2,3-dibromopropyl) phosphoric acid ester	126-72-7	$C_9H_{15}Br_6O_4P$		2919.0000

序号	化学品名 中文 英文	需控制化学品名称 中文别名(俗名、商品名、化学名) 英文	CAS	分子式 (结构式)	H. S. Code 化学品 制剂 Preparation	H. S. Code 化学品纯物质 Pure Substance
5	三吖丙啶基氧化磷 Tri－aziridinyl－phosphinoxide	phosphine oxide, tris(1－aziridinyl)－; Aziridine, 1, 1′, 1″－Phosphinylidynetris－; 1, 1′, 1″－Phosphinylidynetrisaziridine; Phosphoramide, N, N′, N″－triethylene－; Phosphoric acid triethylene imide; Phosphoric triamide, N, N′N″－tri－1, 2－ethanediyl－; Phosphoric triamide, N, N′, N″－triethylene－; TAPO; TEF; TEPA; Triaziridinophosphine oxide; Triaziridinylphosphine oxide; Tri(aziridinyl)phosphine oxide; Tri－1－aziridinylphosphine oxide; Tri(1－aziridinyl)phosphine oxide; N, N′, N″－Tri－1, 2－ethanediylphosphoric triamide; Triethylenephosphoramide; N, N′, N″－Triethylenephosphoramide; Triethylenephosphoric triamide; N, N′, N″－Triethylenephosphoric triamide; Triethylenephosphorotriamide; Tris(1－aziridine)phosphine oxide; Tris(aziridinyl)phosphine oxide; Tris(1－aziridiny)phosphine oxide; Tris(1－－aziridinyl)phosphine oxide, solution; Tris(N－ethylene)phosphorortriamidate	545－55－1	$C_6H_{12}N_3OP$		2933.9000
6	丙烯腈 Acrylonitrile	2－丙烯腈;乙烯基氰 2－propenenitrile; cyanoethylene; Acritet; Acrylon; Acrylonitrile; Acrylonitrile, inhibited; Acrylonitrile monomer; Carbacryl; Cyanoethylene; Fumigrain; Miller′s fumigrain; Propenenitrile; 2－Propenenitrile; VCN; Ventox; Vinyl cyanide; Vinylcyanide	107－13－1	C_3H_3N		2926.1000

序号	化学品名 中文 英文	需控制化学品名称 中文别名(俗名、商品名、化学名) 英文	CAS	分子式 (结构式)	H.S.Code 化学品制剂 Preparation	H.S.Code 化学品纯物质 Pure Substance
7	汞和汞化合物 Mercury and Mercury compounds	水银 Mercury Mercury element Quecksilber Quicksilver	7439－97－6	Hg		2805.4000
		氯乙基汞 Mercury, chlorowthyl－; Chloroethylmercury; EMC; Ethylmercuric chloride; Ethylmercury chloride;	107－27－7	C_2H_5ClHg		23910000
		乙酸苯汞 phenyl mercuric acetate; 醋酸苯基汞; 醋酸苯汞; 赛力散 mercury, (acetato－o) phenyl－; (Acetato) phenylmercury; Acetic acid, phenylmercury deriv; (Acetoxymercuri) benzene; Acetoxyphenylmercury; Benzene, (acetoxymercuri)－; Benzene, (acetoxymercurio)－; Hexasan(fungicide); Mercuriphenyl acetate; Mercury(II) acetate, phenyl－; Mercury, acetoxyphenyl－; Mergamma; Panomatic; Phenomercuric acetate; Phenylmercuriacetate; Phenylmercuric acetate; Phenylmercuric acetate; Phenylmercury acetate; Phenylmercury(II) acetate; PMA; PMA; PMAC; PMAS	62－38－4	$C_8H_8HgO_2$		29310000

序号	化学品名 中文 英文	需控制化学品名称 中文别名(俗名、商品名、化学名) 英文	CAS	分子式 (结构式)	H.S.Code 化学品 制剂 Preparation	H.S.Code 化学品纯物质 Pure Substance
8	艾氏剂 Aldrin	1,4,5,8-Dimethanonaphthalene,1,2,3,4,10,10-hexachloro-1,4,4a,5,8,8a-hexahydro-,endo,exo-;Aldrin;Aldrite;Aldrosol;Altox;Hexachlorohexahydro-endo-exo-dimethanonaphthalene;1,2,3,4,10,10-Hexachloro-1,4,4a,5,8,8a-hexahydrol,4,5,8-dimethanonaphthalene;1,2,3,4,10,10-Hexachloro-1,4,4a,5,8,8a-hexahydro-exo-1,4-endo-5,8-dimethanonaphthalene;1,2,3,4,10,10-Hexachloro-1,4,4a,5,8,8a-hexahydro-1,4-endo-exo-5,8-dimethanonaphthalene;HHDN;	309-00-2	$C_{12}H_8Cl_6$		2903.5900
9	狄氏剂 Dieldrin	1,4,5,8-Dimethanonaphthalene,1,2,3,4,10,10-hexachloro-1,4,4a,5,8,8a-hexahydro-,endo,exo-;Dieldrex;Dieldrin;HEOD;Hexachloroepoxyoctahydro-endo,exodimethanonaphthalene;3,4,5,6,9,9-Hexachloro-1a,2,2a,3,6,6a,7,7a-octahydro-2,7:3,6-dimethanonaphth(2,3-b)oxirene;	60-27-1	$C_{12}H_8Cl_6O$		2910.9000
10	异狄氏剂 Endrin	1,4,5,8-Dimethanonaphthalene,1,2,3,4,10,10-hexachloro-6,7-epoxy-1,4,4a,5,6,7,8,8a-octahydro-,endo,endo-;Endrex;Endrin;Hexachloroepoxyoctahydro-endo,endo-dimethanonaphthalene;3,4,5,6,9,9-Hexachloro-1a,2,2a,3,6,6a,7,7a-octahydro-2,7:3,6-dimethanonaphth(2,3-b)oxirene;Hexadrin;	72-20-8	$C_{12}H_8Cl_6O$		2910.9000

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11	滴滴涕 DDT	二氯二苯二氯乙烷;2,2-双(对氯苯基)-1,1,1-三氯乙烷;1,1,1-三氯-2,2-双对氯苯基)乙烷;Ethane,1,1,1-trichloro-2,2-bis(p-chlorophenyl)-;2,2-bis(p-chlorophenyl)-1,1,1-trichloroethane;benzene,1,1-(2,2,2-trichloroethylidene)bis(4-chloro-;Ethane,1,1,1-trichloro-2,2-bis(p-chlorophenyl)-;Benzene,1,1'-(2,2,2-trichloroethylidene)bis(4-chloro-;alpha,alpha-Bis(p-chlorophenyl)-heta,beta,beta-trichlorethane;1,1-Bis-(p-chlorophenyl)-2,2,2-trichloroethane;2,2-Bis(p-chlorophenyl)-1,1,1-trichloroethane;Chlorophenothan;Chlorophenothane;Chlorophenotoxum;Clofenotane;DDT; p,p'-DDT;Dichlorodiphenyltrichloroethane; Dichlorodiphenyltrichloroethane; p,p'-Dichlorodiphenyltrichloroethane; Dichlorodiphenyltrichloroethane;Parachlorocidum; PEB1;Pentachlorin;Pentech; Trichlorobis(4-chlorophenyl)ethane; 1,1,1-Trichloro-2,2-bis(p-chlorophenyl)ethane; 1,1,1-Trichloro-2,2-di(4-chlorophenyl)-ethane	50-29-3	$C_{14}H_9Cl_5$		2903.6200
12	六六六·混合异构体 HCH·Mixedisomers	Cyclohexane,1,2,3,4,5,6-hexachloro-;Benzene hexachloride;BHC;HCH;Hexachlorocyclohexane;1,2,3,4,5,6-Hexachlorocyclohexane;	608-73-1	$C_6H_6Cl_6$		2903.5100

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13	七氯 Heptachlor	4,7 - Methanoindene, 1, 4, 5, 6, 7, 8, 8 - heptachloro - 3a, 4, 7, 7a - tetrahydro - ; 3 - Chlorochlordene; Dicyclopentadiene, 3, 4, 5, 6, 7, 8, 8a - heptachloro - ; Heptachlor; Heptachlorane; 3, 4, 5, 6, 7, 8, 8 - Heptachlorodicyclopentadiene; 3, 4, 5, 6, 7, 8, 8a - Heptachlorodicyclopentadiene; 1, 4, 5, 6, 7, 8, 8 - Heptachloro - 3a, 4, 7, 7a - tetrahydro - 4, 7 - endomethanoindene; 1, 4, 5, 6, 7, 8, 8a - Heptachloro - 3a, 4, 7, 7a - tetrahydro - 4, 7 - methanoindane; 1, 4, 5, 6, 7, 8, 8 - Heptachloro - a, 4, 7, 7a - tetrahydro - 4, 7 - methanoindene; 1(3a), 4, 5, 6, 7, 8, 8 - Heptachloro - a(1), 4, 7, 7a - tetrahydro - 4, 7 - methanoindene; 1, 4, 5, 6, 7, 8, 8 - Heptachloro - 3a, 4, 7, 7a - tetrahydro - 4, 7 - methanol - 1H - indene; 1, 4, 5, 6, 7, 8, 8 - Heptachloro - 3a, 4, 7, 7, 7a - tetrahydro - 4, 7 - methylene indene; 1, 4, 5, 6, 7, 10, 10 - Heptachloro - 4, 7, 8, 9 - tetrahydro - 4, 7 - methyleneindene; 1, 4, 5, 6, 7, 10, 10 - Heptachloro - 4, 7, 8, 9 - tetrahydro - 4, 7 - endomethyleneindene;	76 - 44 - 8	$C_{10}H_5Cl_7$		2903.5900
14	六氯苯 Hex- achlorobenzene	六氯代苯; 过氯苯; 全氯代苯; benzene, hexachloro; perchlorobenzene; Hexachlorobenzene; Pentachlorophenyl chloride; Perchlorobenzene; Phenyl perchloryl	118 - 74 - 1	C_6Cl_6		2903.6200
15	三环锡·普特丹 Cyhexatin	Cyhexatin; Plictran; Plyctran; TCTH; Tin, tricyclohexylhydroxy - ; Tricyclohexylhydroxystannane; Tricyclohexylhydroxytin; Tricyclohexylstannanol; Tricyclohexylstannium hydroxide; Tricyclohexyltin hydroxide	13121 - 70 - 5	$C_{18}H_{34}OSn$		2931.0000

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11	滴滴涕 DDT	二氯二苯二氯乙烷;2,2-双(对氯苯基)-1,1,1-三氯乙烷;1,1,1-三氯-2,2-双对氯苯基)乙烷;Ethane, 1,1,1-trichloro-2,2-bis(p-chlorophenyl)-;2,2-bis(p-chlorophenyl)-1,1,1-trichloroethane;henzene,1,1-(2,2,2-trichloroethylidene)bis(4-chloro-;Ethane, 1,1,1-trichloro-2,2-bis(p-chlorophenyl)-;Benzene,1,1'-(2,2,2-trichloroethylidene)bis(4-chloro-;alpha,alpha-Bis(p-chlorophenyl)-beta,beta,beta-trichlorethane;1,1-Bis-(p-chlorophenyl)-2,2,2-trichloroethane;2,2-Bis(p-chlorophenyl)-1,1,1-trichloroethane;Chlorophenothan;Chlorophenothane;Chlorophenotoxum;Clofenotane;DDT; p,p'-DDT;Dichlorodiphenyltrichloroethane; Dichlorodiphenyltrichloroethane; p,p'-Dichlorodiphenyltrichloroethane; Dichlorodiphenyltrichloroethane;Parachlorocidum; PEB1;Pentachlorin;Pentech; Trichlorobis(4-chlorophenyl)ethane; 1,1,1-Trichloro-2,2-bis(p-chlorophenyl)ethane; 1,1,1-Trichloro-2,2-di(4-chlorophenyl)-ethane	50-29-3	$C_{14}H_9Cl_5$		2903.6200
12	六六六·混合异构体 HCH·Mixedisomers	Cyclohexane,1,2,3,4,5,6-hexachloro-;Benzene hexachloride;BHC;HCH;Hexachlorocyclohexane;1,2,3,4,5,6-Hexachlorocyclohexane;	608-73-1	$C_6H_6Cl_6$		2903.5100

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13	七氯 Heptachlor	4,7 – Methanoindene, 1, 4, 5, 6, 7, 8, 8 – heptachloro – 3a, 4, 7, 7a – tetrahydro – ; 3 – Chlorochlordene; Dicyclopentadiene, 3, 4, 5, 6, 7, 8, 8a – heptachloro – ; Heptachlor; Heptachlorane; 3, 4, 5, 6, 7, 8, 8 – Heptachlorodicyclopentadiene; 3, 4, 5, 6, 7, 8, 8a – Heptachlorodicyclopentadiene; 1, 4, 5, 6, 7, 8, 8 – Heptachloro – 3a, 4, 7, 7a – tetrahydro – 4, 7 – endomethanoindene; 1, 4, 5, 6, 7, 8, 8a – Heptachloro – 3a, 4, 7, 7a – tetrahydro – 4, 7 – methanoindane; 1, 4, 5, 6, 7, 8, 8 – Heptachloro – a, 4, 7, 7a – tetrahydro – 4, 7 – methanoindene; 1(3a), 4, 5, 6, 7, 8, 8 – Heptachloro – a(1), 4, 7, 7a – tetrahydro – 4, 7 – methanoindene; 1, 4, 5, 6, 7, 8, 8 – Heptachloro – 3a, 4, 7, 7a – tetrahydro – 4, 7 – methanol – IH – indene; 1, 4, 5, 6, 7, 8, 8 – Heptachloro – 3a, 4, 7, 7, 7a – tetrahydro – 4, 7 – methylene indene; 1, 4, 5, 6, 7, 10, 10 – Heptachloro – 4, 7, 8, 9 – tetrahydro – 4, 7 – methyleneindene; 1, 4, 5, 6, 7, 10, 10 – Heptachloro – 4, 7, 8, 9 – tetrahydro – 4, 7 – endomethyleneindene;	76 – 44 – 8	$C_{10}H_5Cl_7$		2903.5900
14	六氯苯 Hex- achlorobenzene	六氯代苯;过氯苯;全氯代苯;benzene, hexachloro; perchlorobenzene; Hexachlorobenzene; Pentachlorophenyl chloride; Perchlorobenzene; Phenyl perchloryl	118 – 74 – 1	C_6Cl_6		2903.6200
15	三环锡·普特丹 Cyhexatin	Cyhexatin; Plictran; Plyctran; TCTH; Tin, tricyclohexylhydroxy – ; Tricyclohexylhydroxystannane; Tricyclohexylhydroxytin; Tricyclohexylstannanol; Tricyclohexylstannium hydroxide; Tricyclohexyltin hydroxide	13121 – 70 – 5	$C_{18}H_{34}OSn$		2931.0000

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16	1,2－二溴乙烷 EDB	二溴乙烷; ethane, 1,2－dibromo－; ethlene bromide; 1,2－Dibromoethane; alpha, beta－Dibromoethane; sym－Dibromoethane; 1,2－Dibromoethane; Ethylene bromide; Ethylene dibromide; 1,2－Ethylene dibromide; Fumo－gas; Glycol bromide; Glycol dibromide;	106－93－4	$C_2H_4Br_2$		2903.3090
17	氟乙酰胺·敌蚜胺 Fluoroacetamide	Acetamide, 2－fluoro－; Fluoroacetamide; 2－Fluoroacetamide; Fluoroacetic acid amide; Flutritex 1; Fussol; Megatox; Monofluoroacetamide; Navron;	640－19－7	C_2H_4FNO		2924.1000
18	2,4,5－涕 2,4,5－T	2,4,5－三氯苯氧乙酸 Acetic acid, (2,4,5－trichlorophenoxy)－; Amine 2,4,5－Tfor rice; Arbokan; BCF－Bushkiller; Brushtox; Dacamine; Debroussaillant concentre; Debroussaillant super concentre; Decamine 4T; Ded－weed brush killer; Ded－weed LV－6 brush kil and T－5 brush kil; Dinoxol; Envert－T; Esterside T－2 and T－245; Farmco fence rider, Fence rider, Line rider, Phortox; 2,4,5－T; Tippon; 2,4,5－Trichlorophenoxyacetic acid; Visko thap low volatile ester	93－76－5	$C_8H_5Cl_3O_3$		2918.9000
19	二溴氯烷 DBCP	1,2－二溴－3－氯丙烷 Propane, 1,2－dibromo－3－chloro－; BBC 12; 1－Chloro－2,3－dibromopropane; 3－Chloro－1,2－dibromopropane; DBCP; Dibromochloropropane; Dibromochloropropane; 1,2－Dibromo－3－chloropropane; Oxy DBCP; Propane, 1－chloro－2,3－dibromo－	96－12－8	$C_3H_5Br_2Cl$		2903.4990

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201	内吸磷 Demeton	Demeton－O;O,O－Diethyl O－(2－ eththioethyl)phosphorothioate;Diethyl 2－eththioethyl thionophosphate;O,O－Diethy O－2－(ethylthio)ethyl phosphorothioate;O,O－Diethyl－2－ethylthio ethyl phosphorothioate;Diethyl 2－9ethylthio)ethyl phosphorothionate;Mercaptofos;Di－septon; Ethanethiol,2－(ethylthio)－;S－ester with O,O－diethyl phosphorodithioate;Ethanol,2－(ethylthio)－,O－ester with O,O－diethyl phosphorothioate;Thiolmecaptophos	298－03－3	$C_8H_{19}O_3PS_2$		2930.9090

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21	氰化合物 Cyanide	氢氰酸 Carbon nitride ion (CN(sup.1－));Cyanide(1－);Cyanide, dry(UN1588);Cyanide anion;Cyanide(CN(cup.1－));Cyanide ion;Cyanide(1－)ion;Cyanide solutions;Ilydrocyanic acid, ion(1－);Isocyanide	57－12－5	HCN		2841.1910
		氰化锌 Zinc cyanide;Zinc dicyanide	557－21－1	C_2N_2Zn		2837.1990
		氰化银钾 二氰合银酸(1－)钾 Argentate(1－);bis(cyano－c－)－, potassium; potassium cyanoargenate;potassium silver cyanide;Silver potassium cyanide	506－61－6	C_2AgN_2K		2843.2900
		氰化钠;山奈(固);山奈奶(液) Cyanide of sodium;Cyanobrik;Cyanogran;Cymag;Hydrocyanic acid, sodium salt;Sodium cyanide	143－33－9	C－N－Na		2837.1110
		氰化钾,山奶钾 Cyanide of potassium; Hydrocyanic acid, potassum salt;Potassium cyanide	151－50－8	C－K－N		2837.1910

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		氰化亚铜 Copper cyanide; Cuprous cyanide; Copper(I) cyanide; Cupricin; Copper monocyanide	544－92－3	C－Cu－N		2837.1990
		氰化银 Silver cyanide; Silver(I) cyanide	506－64－9	C－Ag－N		2843.2900
		氰化金 Gold cyanide; Gold monocyanide; Gole (I+) cyanide; Aurous cyanide	506－65－0	C－Au－N		2843.3000
		氰化(亚)金钾; 氰化金酸钾 Aurate(1－), bis(cyano－kC)－, potassium; Aurate(1－), bis(cyano－C); potassium; potassium dicyanoaurate; Potassium cyanoaurate(1); Aurale(1－); dicyano－, potassium; Gold potassium cyanide; Monopotassium dicyanoaurate; Potassium aurocyanide; Potassium aurocyanide; Potassium dicyanoaurate(1－); Potassium dicyanoaurate(I); Potassium gold cyanide	13967－50－5	$C_2AuN_2.K$		2843.3000

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22	氯丹 Chlordane	八氯化甲桥茚 Aspon－chlordane; Chlordan; Chlordane; Chlorindan; Chlor KIL; Chlorodane; Chlortox; Clordano; Cortilan－neu; Dichlorochlordene; Dowchlor; 4, 7－Methano－1H indene, 1, 2, 4, 5, 6, 7, 8, 8－octachloro－2, 3, 3a, 7, 7a－hexahydro－; Ocatachlor; Octachlorodihydrodicyclopentadiene; 1, 2, 4, 5, 6, 7, 8, 8－Octahydro－2, 3, 3a, 4, 7, 7, 7a－hexahydro－4, 7－methanoindan; 1, 2, 4, 5, 6, 7, 8, 8－Octachlor－2, 3, 3a, 4, 7, 7a－hexahydro4, 7－methanoindane; 1, 2, 4, 5, 6, 7, 8, 8－Octachloro－2, 3, 3a, 4, 7, 7a－hexahydro－4, 7－methanoindene; 1, 2, 4, 5, 6, 7, 8, 8－Octachloro－2, 3, 3a, 4, 7, 7a－hexahydro－4, 7－methano－1 H－indene; 1, 2, 4, 5, 6, 7, 8, 8－Octachloro 3a, 4, 7, 7a－hexahydro－4, 7－methylene indane; Octachloro－4, 7－methanohydroindane; Octachloro－4, 7－methanotetrahydroindane; 1, 2, 4, 5, 6, 7, 8, 8－Octachloro－4, 7－methano－3a, 4, 7, 7a－tetrahydroidane; 1, 2, 4, 5, 6, 7, 8, 8－Octachloro－3a, 4, 7, 7a－tetrahydro－4, 7－methanoindan; 1, 2, 4, 5, 6, 7, 8, 8－Octachloro－3a, 4, 7, 7a－tetrahydro－4, 7－methanoindane; 1, 2, 4, 5, 6, 7, 10, 10－Octachloro－4, 7, 8, 9－tetrahydro－4, 7－methyleneindane; Octa－klor, Oktaterr; Ortho－klor	57－74－9	$C_{10}H_6Cl_8$		2903.5900

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23	杀虫脒 Chlordimeform	Acaron; Bermat; CDM; Chlordimeform; Chlorfenamidine; N' - (4 - Chloro - 2 - methylphenyl) - N, N - dimethylmethanimidamide; Chlorophenamidin; Chlorophenamidine; N' - (4 - Chloro - o - toly) - N, N - dimethylformamidine; Nsup 2) - (4 - Chloro - O - tolyl) - N(sup 1), N(sup 1) - dimethylformamidine; Chlorphenamidine; N, N - Dimethyl - N' - (2 - methyl - 4 - chlorophenyl)formamidine; Methanimidamide, N' - (4 - chloro - 2 - methylphenyl) - N, N - dimethyl - , N' - (2 - Methyl - 4 - chlorophenyl) - N, N - dimethylformamidine	6164 - 98 - 3	$C_{10}H_{13}ClN_2$		2921.4300
24	氯化苦 Chloropicrin	三氯硝基甲烷 Acquinite; Chloroform, nitro; Chlor - O - pic; Chloropicrin; Nitrochloroform; Nitrotrichloromethane; Pic - Clor; Picfume; Picride; PS; Trichloronitromethane; 76 - 06 - 2	$CC_{13}NO_2$		2904.9030	

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25	砷和砷化合物 Arsenic and Arsenic compounds	砷 Arsenic; Arsenicals; Arsenic Black; Colloidal arsenic; Grey arsrnic; Metallic arsenic;	7440－38－2	As		2804.8000
		砷烷 Arsenic hydrid; Arsenic hydride; Arsenic trihydride; Arseniuretted hydrogen; Arsenous hydride; Arsine; Hydrogen arsenide	7784－42－1	AsH_3		2850.0000
		氧化亚砷; 三氧化二砷;亚砷酐;砒霜;白砒 Arsenic; Arsenicals; Arsenic Black; Colloidal arsenic; Grey arsenic; Metallic arsenic	1327－53－3	As_2O_3		2811.2900
26	五氯酚 Pentachlorophenol	五氯苯酚 Acutox; Chem－Penta; Chem－Tol; Chlon; Chlorophen; amtimicrobial; Durotox; Fungifen; Glazd penta; Grundier arbezol; 1－Hydroxypentachlorobenzene; Lauxtol; Lauxtol A; Liroprem; Penchlorol; Penta; Pentachlorofenol; Pentachlorophenate; Pentachlorophenol; 2, 3, 4, 5, 6－Pentachlorophenol; Pentachlorohenol; Pentachlorophenol, technical; Pentacon; Penta－kil; Penta ready; Permacide; Permagard; Permasan; Permatox penta; Permite; Prevenol;	87－86－5	C_6HCl_5O		2908.1090

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27	地乐酚 Dinoseb	Aatox; Basanite; Blaartox; Butaphen; Butaphene; 2 - sec - Butyl - 4, 6 - dinitrophenol; Caldon; Chemox P. E.; DBNF; Desicoil; Dibutox; Dibutox 2, 4 - Dinitro - 6 - sec - butylhenol; 4, 6 - Dinitro - o - sec - buitylphenol; 4, 6 - Dinitro - 2 - sec - butylphenol; 4, 6 - Dinitro - 2 - (1 - methyl - n - propy)phenol; Gebutox; Hel - Fire; Hivertox; Kiloseb; Laob; Lased; 2 - (1 - Methylpropyl) - 4, 6 - dinitrophenol	88 - 85 - 7	$C_{10}H_{12}N_2O_5$		2908.9090

注:"别名"栏中的各项英文名称仅供参考

联合国环境规划署
联合国粮食及农业组织
关于在国际贸易中对某些危险化学品和农药采用事先知情同意程序的公约的全权代表会议
1998年9月10－11日，鹿特丹

经政府间谈判委员会第五届会议商定的关于在国际贸易中对某些危险化学品和农药采用事先知情同意程序的公约案文

秘书处的说明

1.政府间谈判委员会在其于1998年3月9－14日在布鲁塞尔举行的第五届会议上商定采用下述办法完成经议定的公约案文的最后定稿：

"秘书处汇报说，它将在主席的指导下对案文进行审查，以便进行文字调整和润色，诸如纠正排印方面的差错、调整编号和相互参照之处等，以确保所引用文件的准确性，或设法纠正案文中可能存在的任何其它差错。秘书处还指出，它将对所有语文文本进行核查，以便编制具有同等效力的作准文本。秘书处希望各位代表能够在1998年4月1日之前为此项提供投入。"(UNEP/FAO/PIC/INC.5/3，第95段)。

2.附于本说明之后的案文即是根据上述任务规定编制的；现将此份案文提交给全权代表会议通过。

关于在国际贸易中对某些危险化学品和农药采用事先知情同意程序的鹿特丹公约

本公约缔约方

意识到国际贸易中的某些危险化学品和农药对人类健康和环境具有有害影响。

忆及《关于环境与发展的里约热内卢宣言》和《21世纪议程》关于"有毒化学品的无害环境管理，包括防止在国际上非法贩运有毒和危险产品"的第19章的有关规定。

铭记联合国环境规划署(环境署)和联合国粮食及农业组织(粮农组织)在实施环境署《经修正的关于化学品国际贸易资料交流的伦敦准则》(以下简称"经修正的伦敦准则")和粮农组织的《农药的销售与使用国际行为守则》(以下简称"国际行为守则")中规定的自愿性事先知情同意程序方面所开展的工作。

考虑到发展中国家和经济转型国家的具体情况和特殊需要，特别是有必要加强管理

化学品的国家能力和力量，包括技术转让，提供财务和技术援助以及推动缔约方之间的合作。

注意到一些国家对有关过境转移资料的特殊需求。

认识到应在所有国家推动采用良好的化学品管理做法，特别是顾及《国际行为守则》和环境署的《国际化学品贸易道德守则》中制定的自愿标准。

希望根据《经修正的伦敦准则》和《国际行为守则》中的原则，确保从其境内输出的危险化学品以能充分保护人类健康和环境的方式加以包装和张贴标签。

确认到贸易和环境政策应相辅相成，以实现可持续发展。

强调不得将本公约的任何规定理解为缔约方根据适用于化学品国际贸易或环境保护的任何现行国际协定所享有的权利和所承担的义务有任何改变。

认为以上陈述无意在本公约与其它国际协定之间建立一个等级体系。

决心保护包括消费者和工人健康在内的人类健康和环境免受国际贸易中某些危险化学品和农药的潜在有害影响。

兹协议如下：

第1条　目标

本公约的目标是通过便利就国际贸易中的某些危险化学品的特性进行资料交流，为此类化学品的进出口规定一套国家决策程序并将这些决定通知缔约方，以促进缔约方在此类化学品的国际贸易中分担责任和开展合作，保护人类健康和环境免受此类化学品可能造成的危害，并推动以无害环境的方式加以使用。

第2条　定义

为本公约的目的：

(a)“化学品”是指一种物质，无论是该物质本身还是其混合物或制剂的一部分，无论是人工制造的还是取自大自然的，但不包括任何生物体。它由以下类别组成：农药（包括极为危险的农药制剂）和工业用化学品。

(b)“禁用化学品”是指为保护人类健康或环境而采取最后管制行动禁止其在一种或多种类别中的所有用途的化学品。它包括首次使用即未能获得批准或者已由工业界从国内市场上撤回或在国内审批过程中撤销对其作进一步审议、且有明确证据表明采取此种行动是为了保护人类健康或环境的化学品。

(c)“严格限用化学品”是指为保护人类健康或环境而采取最后管制行动禁止其在一种或多种类别中的几乎所有用途，但其某些特定用途仍获批准的化学品。它包括几乎其所有用途皆未能获得批准或者已由工业界从国内市场上撤回或在国内审批过程中撤销对其作进一步审议、且有明确证据表明采取此种行动是为了保护人类健康或环境的化学品。

(d)“极为危险的农药制剂”是指用作农药用途的，在使用条件下一次或多次暴露后即可在短时期内观察到对健康或环境产生严重影响的化学品。

(e)“最后管制行动”是指一缔约方为禁用或严格限用某一化学品而采取的，且其后

无需该缔约方再采取管制行动的行动。

(f)“进口”和“出口”，就其各自涵义而言，是指化学品从一缔约方转移到另一缔约方，但不包括纯粹的过境运输。

(g)“缔约方”是指已同意受本公约约束，且本公约已对其生效的国家或区域经济一体化组织。

(h)“区域经济一体化组织”是指一个特定区域的主权国家组成的组织，它已获得其成员国转让的处理本公约所规定事项的权限、且已按照其内部程序获得正式授权可以签署、批准、接受、核准或加入本公约。

(i)“化学品审查委员会”是指第18条第6款提及的附属机构。

第3条　公约的范围

1.本公约适用于：

(a)禁用或严格限用的化学品；

(b)极为危险的农药制剂；

2.本公约不适用于：

(a)麻醉药品和精神药物；

(b)放射性材料；

(c)废物；

(d)化学武器；

(e)药品，包括人用和兽用药品；

(f)用作食物添加剂的化学品；

(g)食物；

(h)其数量不可能影响人类健康或环境的化学品，但以下列情况为限：

(i)为了研究或分析而进口；或者

(ii)个人为自己使用而进口，且就个人使用而言数量合理。

第4条　指定的国家主管部门

1.各缔约方应指定一个或数个国家主管部门。国家主管部门应获得授权，在行使本公约所规定的行政职能时代表缔约方行事。

2.各缔约方应力求确保国家主管部门有足够的资源以有效地履行其职责。

3.各缔约方应在不迟于本公约对其生效之日将国家主管部门的名称和地址通知秘书处。各缔约方应在国家主管部门的名称和地址有变动时立即通知秘书处。

4.秘书处应立即向缔约方通报其根据第3款收到的通知。

第5条　禁用或严格限用化学品的程序

1.采取最后管制行动的各缔约方应将此类行动书面通知秘书处。这一通知应尽早发出，且在任何情况下不得迟于最后管制行动生效后九十天，如有附件一所需提供的资料，则应包括这类资料。

2.各缔约方应在本公约对其生效之日将届时已生效的最后管制行动书面通知秘书

处，但已根据《经修正的伦敦准则》或《国际行为守则》提交了最后管制行动通知的各缔约方则无需再提交此种通知。

3.秘书处在收到第1款和第2款所述通知后应尽快，并在任何情况下不得迟于其后六个月核实通知是否包括附件一所需提供的资料。如果通知包括所需资料，秘书处应立即将所收到资料的摘要送交所有缔约方。如果通知未包括所需资料，它应将此情况通知发出通知的缔约方。

4.秘书处应以每六个月向缔约方提交一份根据第1款和第2款收到的资料的概要，包括那些未载有附件一所需提供全部资料的通知的资料。

5.秘书处在至少收到两个事先知情同意区域的每一个区域就一种特定的化学品发来的一份通知，并经其核实符合附件一的规定时，应将通知送交化学品审查委员会。事先知情同意区域的组成方式应在将由缔约方大会第一次会议以协商一致方式通过的一项决定中予以确定。

6.化学品审查委员会应审查通知中所提供的资料，并应根据附件二规定的标准向缔约方大会建议是否应该对该化学品采用事先知情同意程序并因此将其列入附件三。

第6条　极为危险的农药制剂的程序

1.任何发展中国家缔约方或经济转型国家缔约方在其境内遇到由极为危险的农药制剂在使用条件下造成的问题时，可建议秘书处将此极为危险的农药制剂列入附件三。在起草提案时，缔约方可利用任何来源的技术专业知识。提案应包括附件四第1部分所需提供的资料。

2.秘书处应尽快，且在任何情况下不得迟于收到第1款所述提案后六个月核实提案是否包括附件四第1部分所需提供的资料。如提案包括所需资料，秘书处应立即将所收到的资料的摘要送交所有缔约方。如提案未包括所需资料，它应就此通知提出提案的缔约方。

3.秘书处应就按第2款送交的提案收集附件四第2部分所规定的其它资料。

4.在一种特定的极为危险的农药制剂符合上述第2和3款的规定时，秘书处应将提案和有关资料送交化学品审查委员会。

5.化学品审查委员会应审查提案所提供的资料和所收集的其它资料，并应根据附件四第3部分所规定的标准，就是否应该对该极为危险的农药制剂采用事先知情同意程序并因此将其列入附件三向缔约方大会提出建议。

第7条　将化学品列入附件三

1.对于化学品审查委员会已决定建议列入附件三的每一种化学品，化学品审查委员会均应编制一份决定指导文件草案。决定指导文件应该至少以附件一或酌情以附件四所规定的资料为基础，并包括有关在最后管制行动所适用类别之外的一种类别中的化学品用途的资料。

2.第1款中述及的建议应同决定指导文件草案一并呈交缔约方大会。缔约方大会应决定是否应该对有关化学品采用事先知情同意程序，并因此将其列入附件三和核准该决定指导文件草案。

3.如果缔约方大会决定将某一化学品列入附件三并已核准有关的决定指导文件，秘书处应立即将这一资料送交所有缔约方。

第8条　自愿性事先知情同意程序中的化学品

缔约方大会如果确信在其第一次会议召开之前已列入自愿性事先知情同意程序，但不在附件三之列的任何化学品已符合列入附件三的所有要求，则应在其第一次会议上决定将此化学品列入附件三。

第9条　将化学品从附件三删除

1.如果一缔约方向秘书处提交了在决定将某一化学品列入附件三时尚未获得的资料，且该资料表明根据附件二或酌情根据附件四的有关标准可能不再有理由将该化学品列于附件三，秘书处应将该资料送交化学品审查委员会。

2.化学品审查委员会应审查其根据第1款收到的资料。化学品审查委员会应为其根据附件二或酌情根据附件四的有关标准决定建议从附件三中删除的每一种化学品编制一份经修订的决定指导文件草案。

3.第2款提及的建议应提交缔约方大会并附有经修订的决定指导文件。缔约方大会应决定是否应该从附件三中删附除该化学品和核准经修订的决定指导文件草案。

4.在缔约方大会决定从附件三中删除某一化学品和核准了经修订的决定指导文件时，秘书处应立即将这一资料送交所有缔约方。

第10条　附件三所列化学品进口的相关义务

1.各缔约方应采取适当的立法或行政措施，以确保及时就附件三所列化学品的进口作出决定。

2.各缔约方应在第7条第3款述及的决定指导文件发送后尽快，且无论如何不得迟于发送日期后九个月就今后该化学品的进口向秘书处作了回复。如果缔约方修改其所作的回复，则应立即向秘书处提交经修改的回复。

3.秘书处应在第2款中规定的时限期满时立即致函尚未作出回复的缔约方要求其作出回复。如该缔约方不能作出回复，秘书处应酌情协助其在第11条第2款最后一句所规定的时限内作出回复。

4.根据第2款作出的回复应采取以下形式之一：

(a)根据立法或行政措施作出的最后决定：

(i)同意进口；

(ii)不同意进口；或

(iii)同意在特定条件下的进口；或者

(b)临时回复，它可包括：

(i)同意在有特定条件或无特定条件的情况下进口或者不同意在暂定时期内进口的临时决定；

(ii)表示正在积极考虑作出最后决定的说明；

(iii)向秘书处或通知最后管制行动的缔约方提出提供进一步资料的要求；

(iv)向秘书处提出协助评估该化学品的要求。

5.在第4款(a)或(b)项下作出的回复应与附件三中为该化学品列明的类别相关。

6.最后决定应附有据以作出最后决定的任何立法或行政措施的说明。

7.各缔约方应在不迟于本公约对其生效之日向秘书处送交其就附件三所列各种化学品作出的回复。已依照《经修正的伦敦准则》或《国际行为守则》作出此种回复的缔约方则无需另作回复。

8.各缔约方应根据其立法或行政措施向其管辖范围内的有关各方提供本条作出的回复。

9.根据以上第2和第4款以及第11条第2款决定不同意进口某一化学品或只同意在特定条件下进口该化学品的缔约方,如其尚未同时禁止或以同样条件限制下列情形,则应同时禁止或以同样条件限制:

(a)从任何来源进口该化学品;和

(b)在国内生产供国内使用的该化学品。

10.秘书处应每六个月将所收到的回复通报各缔约方。如有可能,此类通报应包括有关据以作出决定的立法或行政措施的资料。此外,秘书处还应向缔约方通报任何未能送交回复的情况。

第11条 附件三所列化学品出口的相关义务

1.各出口缔约方应:

(a)采取适当的立法或行政措施,将秘书处根据第10条第10款送交的回复通知其管辖范围内的有关各方;

(b)采取适当的立法或行政措施,以确保其管辖范围内的出口商在不迟于秘书处根据第10条第10款向缔约方首次通报此类回复之日后六个月遵守每一回复中的决定;

(c)根据要求并酌情建议和协助进口缔约方:

(i)获取进一步资料以协助其根据第10条第4款和下列第2款(c)项采取行动;和

(ii)加强在化学品生命周期内对化学品进行安全管理的能力。

2.各缔约方应确保不从其境内将附件三所列化学品出口到因特殊情况未送交回复或送交了一份未包括临时决定的临时回复的缔约方,除非:

(a)该化学品在进口时已作为化学品在进口缔约方注册登记;或

(b)有证据表明该化学品以前曾在进口缔约方境内使用过或进口过,且没有采取过任何管制行动予以禁用,或

(c)出口商曾通过进口缔约方的指定国家主管部门要求给予明确同意,且已获得了此种同意。进口缔约方应在六十天内对此要求作出回复,并应立即将其决定通知秘书处。

本款所规定的出口缔约方的义务应从秘书处根据第10条第10款将一缔约方未送交回复或送交一份未包括临时决定的临时回复的情况首次通报各缔约方之日起期满六个月时开始适用,并应适用一年。

第12条 出口通知

1.缔约方从其境内出口其已禁用或严格限用的某一化学品时,应向进口缔约方发出出口通知。出口通知应包括附件五所述及的资料。

2.在采取相应的最后管制行动之后,该化学品的出口通知应在其首次出口之前发出。此后,出口通知应在任何日历年内的首次出口之前发出。进口缔约方指定的国家主管部门可放弃在出口前发出通知的要求。

3.在出口缔约方采取了一项导致该化学品的禁用或严格限用状况发生重大变化的最后管制行动后,该出口缔约方应发出经过更新的出口通知。

4.进口缔约方应确认在采取最后管制行动后收到的首次出口通知。出口缔约方如果在发出出口通知30天之内未收到此种确认,则应发出第二次通知。出口缔约方应做出合理努力,以确保进口缔约方收到第二次通知。

5.缔约方应在下列情况下停止履行第1款所规定的义务:

(a)该化学品已列入附件三。

(b)进口缔约方已根据第10条第2款就该化学品向秘书处作了回复;以及

(c)秘书处已根据第10条第10款向缔约方分发了回复。

第13条 出口化学品应附的资料

1.缔约方大会应鼓励世界海关组织酌情为附件三所列各种化学品或各化学品类别指定特定的协调制度海关编码。在为此类化学品指定了编码的情况下,各缔约方应要求该化学品在出口时其装运文件中填有这一编码。

2.在不损害进口缔约方任何要求的情况下,各缔约方应要求附件三所列化学品和在其境内禁用或严格限用的化学品在出口时均符合张贴标签的规定,以确保充分提供有关对人类健康或环境所构成风险和/或危害的资料,同时顾及有关国际标准。

3.在不损害进口缔约方任何要求的情况下,各缔约方可要求在其境内须遵守张贴环境或健康标签规定的化学品在出口时要符合张贴标签的规定,以确保充分提供有关对人类健康或环境所构成风险和/或危害的资料,同时顾及有关国际标准。

4.关于第2款所述用于职业目的化学品,各出口缔约方应要求向每个进口商发送一份采用国际公认格式,并列有现有最新资料的安全数据单。

5.标签和安全数据单上的资料应尽可能用进口缔约方的一种或多种正式语文填写。

第14条 资料交流

1.各缔约方应酌情并根据本公约的目标,促进:

(a)交流有关本公约范围内化学品的科学、技术、经济和法律资料,包括毒理学、生态毒理学和安全性方面的资料。

(b)提供与本公约目标相关的国内管制行动方面的公开资料;并且

(c)酌情直接或通过秘书处向其它缔约方提供关于实质性地限制所涉化学品一种或多种用途的国内管制行动的资料。

2.缔约方在根据本公约交流资料时,应依照共同商定的办法保护机密资料。

3. 为本公约的目的，以下资料不应视为机密资料：

(a)根据第5和第6条分别提交的，附件一和附件四所述及的资料。

(b)第13条第4款述及的安全数据单上的资料。

(c)化学品的失效日期；

(d)关于预防措施的资料，包括危害类别、风险性质和有关安全性建议；以及

(e)毒理学和生态毒理学试验结果摘要。

4. 为本公约的目的，有关化学品的生产日期一般不应视为机密资料。

5. 任何缔约方如果需要有关附件三所列化学品经其领土过境转移方面的资料，则可向秘书处表明此种需要。秘书处应就此通知所有缔约方。

第15条 公约的实施

1. 各缔约方应采取可能必要的措施，建立和加强其国家基础设施和机构，以便有效地实施本公约。这些措施可酌情包括采取或修订国家立法或行政措施，并亦可包括：

(a)建立包括化学品安全资料在内的国家化学品登记机构和数据库；

(b)鼓励工业界采取主动行动，以提高化学品的安全程度；以及

(c)在考虑到第16条的规定的情况下，促进达成自愿协议。

2. 各缔约方应在切实可行的程度上确保公众有适当机会获得下列资料：化学品的处理和意外事故的管理以及比附件三所列化学品对人类健康或环境更安全的替代品。

3. 在次区域、区域和全球各级实施本公约时，各缔约方同意直接或酌情通过具有资格的国际组织开展合作。

4. 本公约中的任何规定均不得解释为限制缔约方采取比本公约所要求的更为严格地保护人类健康和环境的行动的权利，但此种行动须符合本公约的规定和国际法。

第16条 技术援助

缔约方在特别考虑到发展中国家和经济转型国家的需要的同时，应开展合作促进技术援助，以发展管理化学品所必需的基础设施和能力。从而能够实施本公约。拥有更先进的化学品管制规划的缔约方应该向其它缔约方提供技术援助、包括培训，以发展它们在化学品整个生命周期内对其进行管理的基础设施和能力。

第17条 不遵守情事

缔约方大会应尽快制定并通过用于确定不遵守本公约规定的情事和处理被查明处于不遵守状况的缔约方的程序和体制机制。

第18条 缔约方大会

1. 兹设立缔约方大会。

2. 缔约方大会第一次会议应在不迟于本公约生效后一年由环境署执行主任和粮农组织总干事共同召开。其后，缔约方大会的常会应按缔约方大会所确定的间隔时间定期召开。

3. 缔约方大会的非常会议可在缔约方大会认为必要的其它时间举行，或应任何缔约

方的书面请求举行，但这一请求须得到至少三分之一缔约方的支持。

4.缔约方大会应以协商一致方式在其第一次会议上议定并通过缔约方大会和任何附属机构的议事规则和财务规则以及有关秘书处运作的财务规定。

5.缔约方大会应不断审查和评价本公约的执行情况。它应履行公约为其指定的职责，为此目的，应：

(a)根据以下第6款的规定设立它认为执行公约所必需的附属机构；

(b)酌情与具有资格的国际组织以及政府间组织和非政府组织合作；以及

(c)考虑并采取为实现本公约的目标可能所需的任何其它行动。

6.缔约方大会应在其第一次会议方上设立一个附属机构，称为化学品审查委员会，以行使本公约为其指定的职责。在这方面：

(a)化学品审查委员会的成员应由缔约方大会任命。委员会成员应由限定人数的化学品管理方面的政府指定专家组成。委员会的成员应在公平地域分配的基础上任命，包括确保在发达国家与发展中国家缔约方之间达成平衡；

(b)缔约方大会应确定该委员会的职责范围、组织和运作方式；

(c)委员会应尽一切努力以协商一致方式提出建议。如果已尽了一切努力仍未达成协商一致意见，则作为最后手段，应以出席并参加表决的成员的三分之二多数票通过此类建议。

7.联合国、其专门机构和国际原子能机构以及任何非本公约缔约方的国家均可作为观察员出席缔约方大会的会议。任何其它组织或机构，无论是国家或国际性质、政府或非政府性质，只要在本公约所涉事项方面具有资格，并通知书处愿意以观察员身份出席缔约方大会的会议，均可被接纳参加会议，除非至少三分之一出席的缔约方反对。观察员的接纳和参加应遵守缔约方大会通过的议事规则。

第19条 秘书处

1.兹设立秘书处。

2.秘书处的职责应为：

(a)为缔约方大会及其附属机构的会议做出安排，并向它们提供所需的服务；

(b)根据要求，便利协助缔约方，特别是发展中国家缔约方和经济转型国家缔约方实施本公约；

(c)确保与其它有关的国际组织的秘书处进行必要的协调；

(d)在缔约方大会的全面指导下，达成有效履行其职责可能需要的行政和合同安排；以及

(e)履行本公约规定的其它秘书处职责以及缔约方大会可能确定的其它职责。

3.本公约的秘书处职责应由环境署执行主任与粮农组织总干事共同履行，并须遵循他们之间所商定的，并经缔约方大会核可的安排。

4.如果缔约方大会认为秘书处没有履行其预期的职责，它可由出席并参加表决的缔约方四分之三多数票决定将秘书处职责交给一个或多个其它具有资格的国际组织。

第20条 争端的解决

1.缔约方应通过谈判或其选择的其它和平方式解决它们之间就本公约的解释或适用而产生的任何争端。

2.非区域经济一体化组织的缔约方在批准、接受、核准或加入本公约时，或在其后任何时候，可在交给保存人的一份书面文书中声明，关于本公约的解释或适用方面的任何争端，它承认在涉及接受同样义务的任何缔约方时，以下一种或两种争端解决方式具有强制性：

(a)按照将由缔约方大会尽早通过的，载于一附件中的程序进行仲裁；和

(b)将争端提交国际法院。

3.区域经济一体化组织的缔约方可就根据第2(a)款所述程序进行仲裁发表类似声明。

4.根据第2款所作的声明，在依照其有效期失效之前，或在撤销声明的书面通知交存于保存人之后三个月内，应一直有效。

5.除非争端各方另有协议，声明的失效、撤销声明的通知或作出新的声明，丝毫不得影响仲裁法庭或国际法院正在进行的审理。

6.如果争端的双方尚未根据第2款接受相同程序或任何程序，且它们未能在一方通知另一方存在争端后十二个月内解决其争端，则该争端应根据争端任何一方的要求提交调解委员会。调解委员会应提出载有建议的报告。与调解委员会有关的其它程序应列入最迟由缔约方大会第二次会议通过的一项附件中。

第21条 公约的修正

1.任何缔约方均可对本公约提出修正案。

2.本公约的修正案应在缔约方大会的会议上通过。提出的任何修正案案文均应由秘书处至少在拟议通过该修正案的会议之前六个月送交缔约方。秘书处还应将提出的修正案送交本公约签署方，并呈交保存人以供参考。

3.缔约方应尽一切努力以协商一致的方式就对本公约提出的任何修正案达成协议。如为谋求协商一致已尽了一切努力而仍未达成协议，则作为最后手段，应以出席会议并参加表决的缔约方的四分之三多数通过该修正案。

4.该修正案应由保存人送交所有缔约方，供其批准、接受或核准。

5.对修正案的批准、接受或核准应以书面形式通知保存人。依照第3款通过的修正案，应自至少四分之三的缔约方交存批准、接受或核准书之日后的第九十天起对接受该修正的缔约方生效。其后，该修正案应自任何其它缔约方交存批准、接受或核准该修正案的文书之日后的第九十天起对其生效。

第22条 附件的通过和修正

1.本公约的附件应成为本公约的组成部分，除非另有明文规定，凡提及本公约时，亦包括其任何附件在内。

2.附件应限于程序、科学、技术或行政事项。

3.下列程序应适用于本公约增补附件的提出、通过和生效。

(a)增补附件应根据第21条第1、第2和第3款规定的程序提出和通过;

(b)任何缔约方如果不能接受一项增补附件,则应在保存人就通过该增补附件发出通知之日起一年内将此情况书面通知保存人。保存人应在接到任何此类通知后立即通知所有缔约方。缔约方可随时撤销以前对某一增补附件提出的不接受通知,该附件即应根据以下第(c)项的规定对该缔约方生效;

(c)在保存人就通过一项增补附件发出通知之日起一年后,该附件应对未曾依以上第(b)项的规定提交通知的所有缔约方生效。

4.除附件三外,本公约附件的修正案的提出、通过和生效均应遵守公约增补附件的提出、通过和生效所采用的同一程序。

5.下列程序应适用于附件三的修正案的提出、通过和生效。

(a)附件三的修正案应根据第5至第9条以及第21条第2款规定的程序提出和通过;

(b)缔约方大会应以协商一致的方式就通过问题作出决定;

(c)保存人应立即将修正附件三的决定通知缔约方。该修正案应在该决定规定的日期对所有缔约方生效。

6.如果一项增补附件或对一项附件的修正案涉及对本公约的修正,则该增补附件或修正案应在对本公约的修正生效后方能生效。

第23条 表决权

1.除以下第2款之规定外,本公约每一缔约方应有一票表决权。

2.区域经济一体化组织对属于其权限范围内的事项行使表决权时,其票数应与其作为本公约缔约方的成员国数目相同。如果此类组织中的任何成员国行使表决权,则该组织就不应行使表决权,反之亦然。

3.为本公约的目的,"出席并参加表决的缔约方"是指出席会议并投赞成票或反对票的缔约方。

第24条 签署

本公约应从____至____在鹿特丹并从_____至_____在纽约联合国总部开放供所有国家和区域经济一体化组织签署。

第25条 批准、接受、核准或加入

1.本公约须经各国和各区域经济一体化组织批准、接受或核准。本公约应从签署截止日之后开放供各国和各区域经济一体化组织加入。批准、接受、核准和加入书应交存于保存人。

2.任何成为本公约缔约方但其成员国却均未成为缔约方的区域经济一体化组织应受本公约规定的一切义务的约束。如果此类组织的一个或多个成员国为本公约的缔约方,则该组织及其成员国应决定各自在履行本公约义务方面的责任。在此种情况下,该组织及其成员国无权同时行使本公约所规定的权利。

3.区域经济一体化组织应在其批准、接受、核准或加入书中声明其在本公约所规定事项上的权限。任何此类组织还应将其权限范围的任何有关变更通知保存人,再由保存人通知各缔约方。

第26条 生效

1.本公约应自第五十份批准、接受、核准或加入书交存之日后第九十天起生效。

2.对于在第五十份批准、接受、核准或加入书交存之后批准、接受或核准或加入本公约的各国或各区域经济一体化组织,本公约应自该国或该区域经济一体化组织交存其批准、接受、核准或加入书之日后第九十天起生效。

3.为第1和第2款的目的,区域经济一体化组织所交存的任何文书不应视为该组织的成员国所交存文书之外的额外文书。

第27条 保留

不得对本公约作任何保留。

第28条 退出

1.自本公约对一缔约方生效之日起三年后,该缔约方可随时向保存人发出书面通知,退出本公约。

2.任何此种退出应在保存人收到退出通知之日起一年后生效,或在退出通知中可能指明的一个更晚日期生效。

第29条 保存人

联合国秘书长应为本公约保存人。

第30条 作准文本

本公约正本应存于联合国秘书长,其阿拉伯文、中文、英文、法文、俄文和西班牙文文本均为作准文本。

下列签署人,经正式授权,在本公约上签字,以昭信守。

一九九八年____月____日订于鹿特丹。

附件一

根据第5条发出通知所需提供的资料

通知应包括

1.特性、名称和用途

(a)通用名称

(b)如有国际公认的术语集,根据该术语集(例如国际纯化学和应用化学联合会的术

语集等)所命名的化学名称;

(c)贸易名称和制剂名称;

(d)编码号:化学文摘社编号、协调制度海关编码和其它编号;

(e)如果要求对有关化学品进行分类,有关危害分类的资料;

(f)有关化学品的用途;

(g)有关化学品的物理—化学、毒理学和生态毒理学特性。

2.最后管制行动

(a)有关最后管制行动的资料

(i)最后管制行动概要;

(ii)所依据的管制文件;

(iii)最后管制行动生效日期;

(iv)关于最后管制行动是否根据风险或危害评估作出的说明,如果是,关于此类评估资料,包括述及的有关文件的说明;

(v)采取涉及人类健康、包括涉及消费者和工人的健康或环境的最后管制行动的原因;

(vi)有关化学品对人类健康,包括对消费者和工人的健康或环境造成的危害和风险以及最后管制行动预期产生影响的摘要;

(b)已采取最后管制行动的类别,以及对每种类别:

(i)最后管制行动禁止的用途;

(ii)仍允许的用途;

(iii)如有可能,化学品的生产,进口、出口和使用的估计数量;

(c)关于最后管制行动后可能与其它国家和区域之间的相关性的尽可能详细的说明;

(d)可能涉及以下方面的其它有关资料:

(i)对最后管制行动的社会—经济影响的评估;

(ii)如有替代品,有关替代品及其相对风险的资料,例如:

—害物综合治理战略;

—工业习惯做法和工艺,包括更为清洁的技术。

附件二

将禁用或严格限用化学品列入附件三的标准

化学品审查委员会在审查秘书处根据第5条第5款送交的通知时应:

(a)确认为保护人类健康或环境已采取了最后管制行动;

(b)确定已根据风险评估结果采取了最后管制行动。该评估应在根据有关缔约方的现有条件对科学数据进行审查的基础上进行。为此,所提供的文件应表明:

(i)数据是根据公认的科学方法得出的;

(ii)数据的审查和记录是根据公认的科学原则和程序进行的；

(iii)最后管制行动是根据采取此种行动的缔约方的现有条件的风险评估确定的；

(c)通过考虑下列因素审议有关的最后管制行动是否提供了充分的依据，因而值得将有关化学品列入附件三：

(i)有关的最后管制行动是否导致了或预期将导致所用化学品数量或使用次数大幅度下降；

(ii)有关的最后管制行动是否导致了对发出通知缔约方的人民健康或环境的风险的实际减少或预期将使这类风险大幅度减少；

(iii)导致采取最后管制行动的考虑因素是否仅适用于一个有限的地理区域或其它有限的情况

(iv)是否有证据表明仍在进行该化学品的国际贸易；

(d)考虑到有意滥用行为本身并不构成将某一化学品列入附件三的充分理由。

附件三

适用事先知情同意程序的化学品

化学品	化学文摘社的有关编号	类别
2、4、5－涕	93－76－5	农药
艾氏剂	309－00－2	农药
敌菌丹	2425－06－1	农药
氯丹	57－74－9	农药
杀虫脒	6164－98－3	农药
乙酯杀螨醇	510－15－6	农药
滴滴涕	50－29－3	农药
狄氏剂	60－57－1	农药
地乐酚和地乐酚盐	88－85－7	农药
1,2－二溴乙烷(EDB)	106－93－4	农药
敌蚜胺	640－19－7	农药
六六六(混合异构体)	608－73－1	农药
七氯	76－44－8	农药
六氯苯	118－74－1	农药

杀丹	58－89－9	农药
汞化合物，包括无机汞化作品物，烷基汞化合物和烷氧烷基及芳基汞化合物。		
五氯苯酚	87－86－5	农药
久效磷(有效成份含量超过 600g/L 的可溶性液剂)	6923－22－4	极为危险的农药制剂
甲胺磷(有效成分含量超过 600g/L 的可溶性液剂)	10265－92－6	极为危险的农药制剂
磷胺(有效成份含量超过 1000g/L 的可溶性液剂)	13171－21－6(混合物、(E)和(Z)异构体)23783－98－4((Z)－异构体)297－99－4((E)－异构体)	极为危险的农药制剂
甲基对硫磷(有效成份含量为 19.5%、40%、50%、60%的乳油及有效成份含量为 1.5%、2%和 3%的粉剂)	298－00－0	极为危险的农药制剂
对硫磷(除悬浮剂(CS)以外的所有制剂－气溶胶、可粉化的粉剂(DP)、乳油(EC)、颗粒剂(GR)和可湿性粉剂(WP))－均在此列	56－38－2	极为危险的农药制剂
青石棉	12001－28－4	工业用
多溴联苯(PBB)	36355－01－8(六－)27858－07－7(八－)13654－09－6(十－)	工业用
多氯联苯(PCB)	1336－36－3)	工业用
多氯三联苯(PCT)	61788－33－8	工业用
三(2,3－二溴丙磷酸酯)磷酸盐	126－72－7	工业用

附件四

将极为危险的农药制剂列入附件三的标准

第 1 部分：提出提案的缔约方需提供的文件

根据第6条第1款提交的提案应包括载有以下资料的适当文件：

(a)有关危险农药制剂名称；

(b)制剂中有效成分名称；

(c)每种有效成份在制剂中的相对含量；

(d)制剂种类；

(e)如有可能，贸易名称和生产商商名称；

(f)有关制剂在提出提案缔约方境内的常规和公认的使用方式；

(g)有关问题所涉事件的明确说明，包括有害影响和有关制剂的使用方法；

(h)提出提案缔约方对这种事件已经采取或准备采取的任何立法、行政或其它措施。

第2部分，秘书处需收集的资料

秘书处应根据第6条第3款收集与有关制剂相关的资料，包括：

(a)有关制剂的物理－化学、毒理学和生态毒理学特性；

(b)其它国家是否对处理或施用器械有所限制；

(c)其它国家涉及有关制剂的事件的资料；

(d)其它缔约方、国际组织、非政府组织或其它有关来源，无论是国家或国际性来源所提供的资料；

(e)如有可能，风险和/或危害评估报告；

(f)如有可能，有关农药制剂的使用范围的说明，例如登记数或生产量或销售量等；

(g)有关农药的其它制剂，如曾发生事件，与这些制剂有关的事件；

(h)防治害物的替代方法；

(i)化学品审查委员会可能认为有关的其它资料。

第3部分，将极为危险的农药制剂列入附件三的标准

化学品审查委员会在审查秘书处根据第6条第5款提交的提案时应考虑到：

(a)说明按照常规或公认的做法在提出提案的缔约方境内使用有关制剂而导致发生所报告的事件的证据是否可靠；

(b)此类事件与其它具有类似的气候条件和制剂使用方式的国家是否相关；

(c)处理或施用器械方面的限制是否涉及在缺乏基础设施的国家中可能没有得到合理或广泛应用的技术或工艺；

(d)就制剂的使用量而言，所报告的影响是否具有意义；

(e)有意滥用行为本身并不构成将制剂列入附件三的充分理由。

附件五

出口通知所需提供的资料

1.出口通知应包括以下资料：

(a)出口缔约方和进口缔约方的有关指定国家主管部门的名称和地址；

(b)向进口缔约方出口的预定日期；

(c)禁用或严格限用化学品的名称以及根据第5条将向秘书处提供的附件一所规定的资料的摘要。如混合物或制剂中含有一种以上此类化学品,则应就每种化学品提供此类资料。

(d)如已知悉,有关化学品的预期用途类别和在进口缔约方境内该预期用途类别中的预期用途的说明;

(e)为减少有关化学品的暴露及其排放而采取的预防措施的资料;

(f)如为混合物或制剂,有关禁用或严格限用化学品的浓度;

(g)进口商的名称和地址;

(h)出口缔约方有关指定国家主管部门现有的、对进口缔约方指定国家主管部门具有帮助的任何其它资料;

2.除第1款提及的资料外,出口缔约方应提供进口缔约方可能要求提供的附件一所规定的进一步资料。

已签署《鹿特丹公约》的国家名单

截止到1999年2月27日,联合国在国际互联网上官方公布的已签署《鹿特丹公约》的国家共58个,名单如下:

安哥拉(Angola)、阿根廷(Argentina)、亚美尼亚(Armenia)、奥地利(Austria)、巴巴多斯(Barbados)、比利时(Belgium)、贝宁(Benin)、巴西(Brazil)、布基纳法索(Burkina Faso)、喀麦隆(Cameroon)、乍得(Chad)、智利(Chile)、哥伦比亚(Colombia)、刚果(Congo)、科特迪瓦(Cote d' Iovoire)、古巴(Cuba)、塞浦路斯(Cyprus)、刚果民主共和国(Democratic Republic of the Congo)、丹麦(Denmark)、厄瓜多尔(Ecuador)、欧盟(European Community)、芬兰(Finland)、法国(France)、德国(German)、加纳(Ghana)、希腊(Greece)、印度尼西亚(Indonesia)、意大利(Italy)、肯尼亚(Kenya)、科威特(Kuwait)、卢森堡(Luxembourg)、马达加斯加(Madagascar)、马里(Mali)、蒙古(Mongolia)、纳米比亚(Namibia)、荷兰(Netherlands)、新西兰(New Zealand)、挪威(Norway)、巴拿马(Panama)、巴拉圭(Paraguay)、秘鲁(Peru)、菲律宾(Philippines)、葡萄牙(Portugal)、圣卢西亚(Saint Lucia)、塞内加尔(Senegal)、塞舌尔群岛(Seychelles)、斯洛文尼亚(Slovenia)、西班牙(Spain)、瑞典(Sweden)、瑞士(Switzerland)、叙利亚(Syrian Arab Republic)、塔吉克斯坦(Tajikistan)、突尼斯(Tunisia)、土耳其(Turkey)、英国(United Kingdom of Great Britain and Northern Ireland)、坦桑尼亚(United Republic of Tanzania)、美国(United States of America)、乌拉圭(Uruguay)。

《关于在国际贸易中对某些危险化学品和农药采用事先知情同意程序的鹿特丹公约》有关资料情况介绍

一、《鹿特丹公约》背景简介

随着二十世纪六十年代到七十年代化学品国际贸易的增长，导致有毒有害化学品使用风险的增加。一个例子就是农药在发展中国家没有专门的技术或必要的措施来确保它们的安全使用。联合国粮食及农业组织（FAO）于1985年颁布了《农药的销售与使用国际行为守则》（以下简称国际行为守则），联合国环境规划署（UNEP）于1987年颁布了《关于化学品国际贸易资料交流的伦敦准则》（以下简称伦敦准则），使许多国家的技术机构对本国使用的一些有害的化学品进行测试及风险评估，得到很多有关资料。有些国家通过立法对某些极危险的化学品和农药的使用加以控制。

1989年，FAO对《国际行为守则》、UNEP对《伦敦准则》进行了修正（以下简称经修正的伦敦准则），均加入了事先知情同意程序并实施。事先知情同意是指这样的原则：为保护人类健康和环境目的而被禁用或严格限用的化学品，其国际运输不得在未经进口国指定的国家主管当局同意或在违反其决定的情况下进行。为了确保它的实施，又增加了禁用或严格限用的化学品的国际贸易资料交流和出口国在发出货物之前应先发出出口通知的规定。

《国际行为守则》和《经修正的伦敦准则》的颁布，其目的在于通过它们加强各国政府进行化学品国际贸易的资料（科技、经济和法律等）交流，以提高各国化学品的安全使用，促进各国化学品的良好管理。其中涉及到的禁用或严格限用的化学品的国际贸易资料交流，这方面需要出口国与进口国之间，根据它们保护人类健康及全球环境的共同责任，进行合作。进口国有权获得其它国家禁用或严格限用的化学品的有关资料，以便决定是否同意、限制或禁止某一化学品将来进口到本国，并将这一决定通知出口国。出口国将把进口国的决定通知本国出口部门并做出安排，确保本国出口部门货物的国际运输不在违反进口国决定的情况下进行。进口国的决定应适用于所有出口国。

化学品的使用具有高度的风险，而化学品对于可持续发展又必不可少。由于《国际行为守则》和《经修正的伦敦准则》采用的是自愿性事先知情同意程序，不能完全有效地避免全球性的化学品所涉风险的影响。因此，缔结全球性事先知情同意公约具有重大意义。

FAO理事会于1994年11月举行的第一百零七届会议上同意了FAO秘书处就事先知情同意公约草案的准备工作、和其它有关的国际和非政府组织的合作，会议讨论了事先知情同意公约的进程表以及FAO成员国同意FAO与UNEP共同合作制定事先知情同意公约。

UNEP理事会于1995年5月举行的第十八届会议上授权环境署执行主任联合FAO、各国以及其它有关的国际组织组成一个政府间谈判委员会为拟定一项有关在国际贸易中对某些危险化学品和农药采用事先知情同意的具有法律约束力的国际文书。UNEP还召集了一些愿意提供必要的资金和技术援助的政府以资助参加谈判的，特别是

发展中国家和经济转型国家的谈判代表团，确保政府间谈判委员会的作用得以充分发挥。

FAO 理事会于 1996 年 10 月举行第一百一十一届会议，对事先知情同意公约的谈判进展表示满意并希望政府间谈判委员会的谈判工作继续进行。UNEP 理事会于 1997 年 1 月举行第十九届会议，通过了拟订事先知情同意公约的第 19/13A 号决定，以及定于 1997 年内完成谈判工作的第 18/12 号决定。

在 FAO、UNEP、95 个参与国及一些非政府组织的共同努力下，经过两年的谈判工作，于 1998 年 9 月在荷兰鹿特丹召开的第五届政府间谈判委员会全权代表会议上，在《国际行为守则》和《经修正的伦敦准则》基础上，最终将《关于在国际贸易中对某些危险化学品和农药采用事先知情同意程序的公约》定稿，使其成为具有法律约束力的国际公约。简称《鹿特丹公约》。公约于 1998 年 9 月 11 日至 1999 年 9 月 10 日开放供所有国家和区域经济一体化组织签署，签署截止日之后开放供各国和区域经济一体化组织加入。自第五十份加入书交存之日后第九十天起公约生效。到目前为止，已有 63 个国家政府签署了该公约。

我国也参加了历届谈判工作。1998 年 9 月在荷兰鹿特丹召开的第五届政府间谈判委员会全权代表会议上，我国政府代表团代表中国在最后文件上签字，目前，我国政府已同意签署该仅约。

二、《鹿特丹公约》的基本内容

《鹿特丹公约》由三十条正文和五个附件组成。其核心是要求各缔约方对某些极危险的化学品和农药的进出口实行一套决策程序，即事先知情同意(PIC)程序。公约以附件三的形式公布了第二批 27 种极危险的化学品和农药清单(以下简称 PIC 清单)。

《鹿特丹公约》规定，首先，缔约方应指定一个或数个国家主管部门来全权代表本国履行《鹿特丹公约》的职责和义务。国际上，EAO 与 INEP 联合设立一个秘书处来协助各缔约方执行《鹿特丹公约》。

公约规定了列入 PIC 清单化学品的进出口的相关义务，要求在公约生效之日，各缔约方需对列入 PIC 清单的化学品是否同意进口对秘书处进行答复，并提交本国最后管制行动的化学品清单及相关资料。秘书处将把这些答复和资料的摘要送交各缔约方，且每六个月送交一次。缔约方有权修改本国的答复，并应立即通知秘书处。答复的形式是：同意进口；不同意进口；或同意在特定条件下的进口；或者是临时回复。出口缔约方应采取适当的立法或行政措施将其它缔约方的答复通知本国有关各方。并采取适当的立法或行政措施，以确保本国出口商遵守每一回复的决定。避免将 PIC 清单中的化学品输出到不同意进口的另一缔约方境内。不同意 PIC 清单中某一化学品进口的缔约方，应禁止该化学品任何来源的进口，其本国也应禁止生产。

缔约方向另一缔约方出口本国最后管制的化学品时，须事先向进日缔约方发出出口通知，只有收到进口缔约方的同意意见或默许(进口缔约方 90 天内不答复即为默许)时，出口缔约方才能向进口缔约方发出货物。该化学品的出口通知应在其首次出口之前发出。此后，出口通知应在每一日历年内的首次出口之前发出。进口缔约方应确认在采取最后管制行动后收到的首次出口通知。

《鹿特丹公约》的 PIC 清单是开放的，规定了向清单中增加化学品和删除化学品的程序。

秘书处在至少收到两个事先知情同意区域就一种特定的化学品发来的通知、并经其核实符合规定时，将通知送交化学品审查委员会。当发展中国家或经济转型国家缔约方在使用极为危险的农药遇到问题时，可建议秘书处将此农药列入 PIC 清单。秘书处将有关资料送交学品审查委员会。化学品审查委员会经审查并按一定标准向缔约方大会建议是否将该化学品列入 PIC 清单，经缔约方大会批准，该化学品就列入了 PIC 清单。秘书处立即将这一决定和该化学品的决定指导性文件交送所有缔约方。各缔约方将根据这一决定和该化学品的决定指导性文件来回复秘书处，决定是否同意进口该化学品。答复的形式也是：同意进口；不同意进口；或同意在特定条件下的进口；或者是临时回复。进口缔约方可在临时回复中向秘书处或通知最后管制行动的缔约方提出提供进一步资料的要求，也可向秘书处提出协助评估该化学品的要求。

当某一缔约方向秘书处提交了某些资料，该资料表明根据有关标准可能不再有理由将某一化学品列于 PIC 清单，秘书处将该资料送交化学品审查委员会。化学品审查委员会经审查并按一定标准向缔约方大会建议是否将该化学品从 PIC 清单中删除，经缔约方大会批准，该化学品就从 PIC 清单中被删除。秘书处立即将这一决定和经缔约方大会核准的经修订的决定指导性文件交送所有缔约方。

公约还规定了出口化学品应附的资料以及资料交流、技术援助等方面的措施。

公约设立缔约方大会和秘书处。由缔约方大会在其第一次会议上设立一个附属机构—化学品审查委员会，其成员由缔约方大会任命。缔约方大会应确定该委员会的职责范围、组织和运作方式。而委员会则应尽一切努力以协商一致方式提出建议。公约还规定了秘书处的职责。

公约还就不遵守情事、争端的解决、公约的修正、附件的通过和修正、表决权、签署、加入和退出等方面作出了规定。

公约规定自公约签署截止日之后开放供各国和各区域经济一体化组织加入。公约将于第五十份加入书交存之日后第九十天起生效。

三、我国与《鹿特丹公约》有关的情况

1、PIC 清单所列化学品在我国的生产、使用、进出口、企业和用途等情况

现阶段的 PIC 清单有 27 种化学品，其中 22 种是农药或农药制剂，另外 5 种为工业化学品。22 种农药中的 12 种在我国已经没有生产、使用和进出口；有 3 种有生产但无使用，仅用作农药中间体和少量出口；有 2 种有少量生产但限量销售和使用；其余 5 种则是我国目前的看家农药。另外 5 种工业化学品在国内已经停止生产和使用。

1)、生产使用情况

我国是农药生产和使用大国，每年农药使用量约 80 万吨（制剂），居世界第一位，农药生产总量从 1990 年起一直名列世界第二位，仅次于美国，1996－1997 年均产量为 38 万吨（折成 100％有效成份计）。目前，我国农药产品结构仍以杀虫剂为主，杀虫剂的生产量占农药总产量的 75％左右，其中有机磷杀虫剂占杀虫剂总产量的 77％，在年产量万吨

以上的6个杀虫剂品种中，有5个是有机磷杀虫剂。

2)、进出口情况

在列入PIC清单的我国有生产8个农药品种之中，甲胺磷出口量最大，每年3～4万吨，出口额4～5千万美元，林丹年出口额达500～800万美元，DDT年出口额达100～300万美元，其余5个品种的出口额合计不到100万美元。但近年来，我国农药的出口量在逐年减少。

在进口方面，除了久效磷以前曾有过少量进口外，其他品种均无进口。

3)、PIC清单中农药的主要用途

甲胺磷、甲基对硫磷、对硫磷、久效磷均为我国大量生产、使用的有机磷杀虫剂，广谱、高效，广泛用于水稻、棉花等多种作用上防治数以百计的多种害虫。由于这些品种药效高、成本低，深受农民欢迎。滴滴涕目前主要用于杀蚊灭蝇等卫生用途，因残留较高国内已于1983年停止使用。目前国内有天津化工厂，扬州农药厂生产，一是用于生产杀螨剂三氯杀螨醇的原料，二是用于出口非洲、东南亚一带用于防疟灭蚊用。林丹除国内用于防治小麦吸浆虫、竹蝗、飞蝗外，多用于出口。

4)、PIC清单中5种化学品的主要用途

青石棉：工业上使用青石棉是利用其的隔热性能，可作为仪器设备和建筑材料的隔热(保温)材料。

多溴联苯(六溴联苯，八溴联苯和十溴联苯)：多溴联苯具有耐热和不易降解性能，可用作电器设备和电子元器件的隔热材料，也能添加入人工合成材料(如橡胶、塑料)中以改进耐热性能。

多氯联苯：用途如多溴联苯，曾广泛用于变压器中和电器元件中。

多氯三联苯：用途如多氯联苯

三(2,3－二溴丙磷酸酯)磷酸盐：作为添加剂添加到聚酯和合成纤维以改善性能和质感。

具体情况列表如下。

序号	化学品名	生产量	使用	进出口	企业数	用途
1	2、4、5－涕					
2	艾氏剂					
3	敌菌丹					
4	氯丹	160吨	130吨	出口30吨(30万美元)		防治白蚁
5	杀虫脒					
6	乙酯杀螨醇					
7	滴滴涕(DDT)	3000吨		出口100－300万美元/年	天津化工厂、杨州农药厂	作农药中间体

序号	化学品名	生产量	使用	进出口	企业数	用途
8	狄氏剂					
9	地乐酚和地乐酚盐					
10	1,2－二溴乙烷(EDB)					
11	敌蚜胺					
12	六六六(混合异构体)	14，000吨	14，000吨			作农药中间体
13	七氯					
14	六氯苯					
15	林丹	1335吨		出口1307吨(500－800万美元/年)	大沽化工厂、沈阳化工厂	防治小麦吸浆虫、飞蝗、荒滩竹蝗等。
16	汞化合物，包括无机汞化合物，烷基汞化合物和烙氧烷基及芳基汞化合物					
17	五氯苯酚	4000吨			15	生产五氯酚钠、木材防腐和血防灭螺
18	久效磷(有效成份含量超过600g/L的可溶性液剂)	10，000吨			15家(7－8家生产)	常用农药
19	甲胺磷(有效成份含量超过600g/L的可溶性液剂)	6－7万吨		出口3－4万吨(4－5千万美元)	40家	主要农药
20	磷胺(有效成份含量超过1000g/L的可溶性液剂)				3－5家很少生产	
21	甲基对硫磷(有效成份含量为19.5%、40%、50%、60%的乳油及有效成份含量为1.5%，2%和3%的粉剂	13，000吨			15家	防治水稻、棉花、玉米、小麦、苹果等作物的主要害虫。

序号	化学品名	生产量	使用	进出口	企业数	用途
22	对硫磷（除悬浮剂(CS)以外的所有制剂－气溶胶、可粉化的粉剂(DP)、乳油(EC)、颗粒剂(GR)和可湿性粉剂(WP)－均在此列）	4000 吨			7 家	防治水稻、棉花、玉米、小麦、苹果等作物的主要害虫。
23	青石棉					
24	多溴联苯(PBB)					
25	多氯联苯(PCB)					
26	多氯三联苯(PCT)					
27	三(2,3－二溴丙磷酸酯)磷酸盐					

备注：1. 五氯苯酚已开发代用品，用量逐渐减少。

2. 氯丹 98 年开始恢复生产，生产量为 98 年年产量。

3. 生产量为年产量

4. 斜线表示这些化学品在我国已经停止生产和使用。

2、签署和实施《鹿特丹公约》对我国的影响

目前，我国的农药行业的生产能力大于国内的市场需求，近年农药出口量的增加很大程度上平衡了产大于需或淡季生产的问题。但 PIC 清单中甲胺磷、久效磷和(甲基)对硫磷等农药正是我国农药生产的主导品种。公约一旦签署和实施，列入 PIC 清单的农药的出口就必须增加很多繁琐的手续，且进口国主管当局有权拒绝进口，成为非关税贸易壁垒，国外的农药公司也可拒绝销售。当有机磷类农药出口受阻而替代产品生产又未能跟上时，将会影响我国的农药出口。

我国出口的主要农药是高毒性的有机磷农药，属影响生态环境和人体健康的、低技术含量低附加值的产品。《鹿特丹公约》的实施有利于我国对国际上禁用和限用农药的了解、推动农药行业的产品结构调整、促进农药品种的更新换代、保护人体健康和生态环境。就《鹿特丹公约》目前的清单来看，我国农药出口(约 6000 多万美元)占我国总出口额的比例很小，所以对我国总的出口贸易不会产生太大的影响。

PIC 清单中的 5 种工业化学品，在我国已没有生产、使用和进出口，并且早已列入我国的禁止或严格限制有毒化学品名单，因此，《鹿特丹公约》的签署和实施就这 5 种工业化学品来说对我国没有影响。也将促进我国对这些化学品的管理及其废物的处理和处置。

3、我国执行《鹿特丹公约》的意义

《鹿特丹公约》是联合国 FAO 与 UNEP 为了全球人类健康和环境在国际贸易中免受某些极危险的化学品和农药的有害影响，促进各国在此类化学品的国际贸易中进行资料交流、分担责任和开展技术合作。使国际贸易和环境政策相辅相成，以实现可持续发展而制定。

我国政府代表团参加了《鹿特丹公约》的第一至五届政府间谈判委员会会议，在谈判中坚持了我国的立场与观点，并已在《鹿特丹公约》中体现。我国政府代表团代表中国已于 1998 后 9 月在《鹿特丹公约》的最后文件上签字。

我国是经济大国，属经济转型国家，又是农药生产和使用大国。每年农药使用量居世界第一位，农药的安全使用显得尤为重要。我国农药生产总量列世界第三位，农药每年也有较大出口，执行《鹿特丹公约》可以体现我国在化学品的国际贸易中分担责任。

执行《鹿特丹公约》将有利于我国对缔约的世界各国的禁用或严格限用化学品的了解，获得更多这些化学品的有关资料。可以有效控制，掌握某些极危险的化学品和农药进出口的情况，防止其对我国人民健康和环境带来有害影响。可以提高我国化学品的安全使用，推动我国化学品的良好管理。可以增加我国农药生产企业的危机感和紧迫感、加快调整品种结构的步伐、促进农药品种的更新换代、保护我国人民健康和生态环境。可以促进国际合作，得到国际上化学品管理先进国家的技术转让与援助。促进我国对有毒有害化学品的管理及其废物的处理和处置。使我国的经济发展与环境保护相辅相成，实现可持续发展。

四、签署《鹿特丹公约》后将开展的工作

1、国际方面

1)、由我国指定主管部门与执行鹿特丹公约的秘书处开展工作

a、我国政府签约，公约生效后，我方通知秘书处我国主管部门名址。

b、我国向秘书处发出我国最后管制行动的书面通知(清单与资料)。

c、我国就 PIC 清单所列化学品是否同意进口向秘书处作出各个回复。

d、就某种在我国使用的极为危险的农药制剂向秘书处建议列入 PIC 清单的提案。

e、秘书处送交我方就某一将被列入 PIC 清单的化学品的决定指导文件，我国将根据该化学品的决定指导文件决定是否同意进口并作出的回复。

f、我国具体实施公约的部门将把秘书处送交我方的各缔约方主管部门名址、各缔约方最后管制行动的摘要资料、各缔约方针对PIC清单所列化学品是否同意进口作出的各个回复、各缔约方对极为危险的农药制剂的提案、从 PIC 清单中删除某一化学品和核准了的经修定的决定指导文件、我国最后管制行动的清单及资料、我国就 PIC 清单所列化学品是否同意进口向秘书处作出各个回复等资料以数据库的形式加以管理。并根据秘书处的通知及时更新。为我国对这些极危险的化学品和农药的管理，提供依据。

2)、与我国进行有毒化学品贸易的国家开展的工作

a、出口受我国最后管制行动的化学品，我方向进口国发出出口通知(历年首次出口

之前发，每年一次）等待进口国回复或默许。

b、进口受对方最后管制行动的化学品，我方收到对方发出的出口通知后回复对方。

2、国内方面

1）、我国主管部门针对《鹿特丹公约》进行广泛宣传。

2）、我国主管部门就 PIC 清单所列化学品及我国管制的第一批《名录》中的有毒化学品进行调研。

3）、我国主管部门发布我国执行《鹿特丹公约》内容的管理规定。

4）、我国主管部门发布我国执行《鹿特丹公约》的程序。

5）、我国主管部门发布我国严禁或严格限制的化学品清单。

6）、具体实施《鹿特丹公约》

a、我国主管部门审批国内进口商进口 PIC 清单及将被列入 PIC 清单的化学品的申请。

b、我国主管部门审批国内进口商进口受我国最后管制行动的化学品的申请。

c、我国主管部门审批国内进口商进口受对方最后管制行动的化学品的申请。（待出口国发出出口通知后）

d、我国主管部门审批国内出口商出口 PIC 清单及将被列入 PIC 清单的化学品的申请。

e、我国主管部门审批国内出口商出口受我国最后管制行动的化学品的申请。

f、我国主管部门审批国内出口商出口受对方最后管制行动的化学品的申请。

g、我国主管部门向各有关部委、各地方有关部门及时通报我国对 PIC 清单所列化学品作出的各个回复及将被列入 PIC 清单的化学品作出的回复。以便各地方有关部门对这些化学品的安全使用进行监督和管理。

h、向各有关部委、各地方有关部门通报秘书处送交的各缔约方针对 PIC 清单所列化学品作出的各个回复。以便各地方有关部门对进口到我国的这些化学品的安全使用进行监督和管理。

i、在实施《鹿特丹公约》的过程中与各有关部委、各地方有关部门的协调、信息交流、相关研究调查时的合作等。

签署《鹿特丹公约》后我国将开展的工作详见附表 1。

五、有关《鹿特丹公约》问答

1）、什么是事先知情同意（PIC）

是指这样的原则：为保护人类健康和环境目的而被禁用或严格限用的化学品，其国际贸易不得在未经进口国指定的国家主管当局同意或在违反其决定的情况下进行。

2）、什么是事先知情同意（PIC）程序

是指正式获得和散发进口国就是否接受被禁用或严格限用的化学品进口所做决定的程序。即指各缔约方针对公约中所列极危险的化学品和农药的清单，是否同意进口对公约秘书处作出各个回复。秘书处备案后，将回复送交所有缔约方，以便各缔约方做出

安排，避免将清单中的化学品出口不同意进口的国家。本国禁用或严格限用的化学品的清单(即最后管制行动清单)及有关资料也应递交秘书处，秘书处备案后，送交所有缔约方。当本国出口最后管制行动清单中的化学品时，须向进口国发出出口通知，得到进口国同意或默许后，方可出口。

3)、执行事先知情同意(PIC)程序的意义

事先知情同意程序可以帮助缔约国获得更多有关运输到本国的、有潜在危害的化学品的特性的资料。据此可做出决定是否同意这些化学品将来使用和进口到本国。通过事先知情同意程序还可使这一决定很快散发到其它缔约国。

通过 PIC 程序这种方式可以正式地获得及散发进口国是否同意接收某一化学品的决定。PIC 程序的目的在于提高进出口国在国际贸易中共同防止这些极危险的化学品对人类健康和环境产生有害影响的抵御能力。事先知情同意不是禁止或严格限制这些化学品的使用。

4)、《鹿特丹公约》制定的目的

联合国 FAO 与 UNEP 制定《鹿特丹公约》的目的是为了监督和控制世界各国在国际贸易中某些极危险的化学品和农药的使用，加强各缔约方之间就这些极危险的化学品和农药的特性的资料交流，促进各缔约方在此类化学品的国际贸易中分担责任和开展技术合作。推动以无害环境的方式加以安全使用。推动各国采取良好的化学品管理措施，防止在国际贸易中的某些危险的化学品和农药对人类健康和环境产生有害影响。使贸易和环境政策相辅相成，以实现可持续发展。

5)、国际上由谁组织实施《鹿特丹公约》

国际上由联合国环境规划署(UNEP)和联合国粮食及农业组织(FAO)共同组织实施《鹿特丹公约》，联合成立一个公约秘书处，具体实施《鹿特丹公约》。

6)、国内由谁组织执行

国内将由国家环境保护总局和农业部共同组织《鹿特丹公约》的执行，由国家环境保护总局化学品登记中心和农业部农药检定所具体实施。(暂定)

7)、《鹿特丹公约》与我国现行法规的关系

我国现在实施的是1994年5月1日生效的《化学品首次进口及有毒化学品进出口环境管理规定》，其中的有毒化学品进出口环境管理即是执行的事先知情同意程序，我国加入《鹿特丹公约》后，将对我国的禁用或严格限用的化学品清单进行调整，与《鹿特丹公约》并轨管理。

8)、哪类化学品可归入 PIC 程序

因健康或环境等原因被缔约方政府禁用或严格限用的农药、工业用和消费用化学品，可归入 PIC 程序。另外，发展中国家在使用有毒农药的情况下发生危险时，可将此农

药归入PIC程序。

一些特殊的化学品，如麻醉药品、精神药物、放射性材料和食品添加剂等不应归入PIC程序而由其它相关法规管理。为了科研目的使用的小量化学品及为个人使用的极小量化学品不应归入PIC程序。

9)、如何将化学品列入PIC清单

公约秘书处在至少收到两条事先知情同意区域就一种特定的化学品发来的管制通知，并经其核实符合规定时，秘书处将该管制通知送交化学品审查委员会。化学品审查委员会经审查并按一定标准向缔约方大会建议是否将该化学品列入PIC清单，经缔约方大会批准后，该化学品就列入了PIC清单。秘书处立即将这一决定和该化学品的决定指导性文件交送所有缔约方。各缔约方将根据这一决定和该化学品的决定指导性文件来回复秘书处决定是否同意进口该化学品。

10)、什么是最后管制行动

"最后管制行动"是指一缔约方为禁用或严格限用某一化学品而采取的，其后无需该缔约方再采取管制行动的行动。即指一缔约方为禁用或严格限用某一化学品在本国采取的行政性管理措施。

11)、《鹿特丹公约》所指的化学品

"化学品"是指一种物质，无论是该物质本身还是其混合物或制剂的一部分，无论是人工制造的还是取自大自然的，但不包括任何生物体。它由以下类别组成：农药（包括极为危险的农药制剂）和工业用化学品。

12)、什么是禁用化学品

"禁用化学品"是指为保护人类健康和环境而采取最后管制行动禁止其在一种或多种类别中的所有用途的化学品。它包括首次使用即未能获得批准或者已由工业界从国内市场上撤回或在国内审批过程中撤消对其作进一步审议，且有明确证据表明采取此种行动是为了保护人类健康或环境的化学品。

13)、什么是严格限用的化学品

"严格限用的化学品"是指为保护人类健康或环境而采取最后管制行动禁止其在一种或多种类别中的几乎所有用途，但其某些特定用途仍获批准的化学品。它包括几乎其所有用途皆未能获得批准或者已由工业界从国内市场上撤回或在国内审批过程中撤消对其作进一步审议，且有明确证据表明采取此种行动是为了保护人类健康或环境的化学品。

14)、PIC清单与各缔约方的最后管制行动的清单的关系

PIC清单的形成最早是以参照《国际行为守则》和《经修正的伦敦准则》的自愿性事先知情同意程序的各国的最后管制行动的清单得来。当10个或10个以上国家的最后管

制行动的清单中均有某一化学品时，该化学品立即列入PIC清单。所以各缔约方的最后管制行动的清单是PIC清单的基础，而两者又不同。《鹿特丹公约》中规定了PIC清单的加入程序。详见问答9。

15)、什么是决定指导性文化

它是帮助各缔约方作出是否同意进口某一化学品的指南性文件，针对每一个将被列入PIC清单的化学品，化学品审查委员会都编制一份决定指导性文件草案，待该草案在缔约方大会上通过时，由秘书处送交所有缔约方。决定指导性文件的内容包括该化学品的特性(物理、化学、毒理学和生态毒理学等)、名称、用途以及在使用和处置该化学品时，对人类健康和环境造成的潜在危害和风险及现有的防范措施等。以及有哪些国家或区域采取最后管制行动及采取最后管制行动的原因等相关资料。

16)、各缔约方针对PIC清单和将列入PIC清单的化学品是否同意进口向秘书处所作的答复能否修改。

能。各缔约方可以修改向秘书处所作的答复，但须立即向秘书处提交经修改的答复。秘书处将每六个月一次向各缔约方送交收到的各缔约方提交的资料。

17)、出口通知应由谁在何时发出

当一缔约方从其境内出口其已禁用或严格限用的某一化学品时，应向进口缔约方发出出口通知。该化学品的出口通知应在其首次出口之前发出。此后，出口通知应在任何日历年内的首次出口之前发出。

18)、进口国应做什么

进口缔约方应确认在采取最后管制行动后收到的首次出口通知。

19)、PIC清单中的化学品贸易是否在全球禁止

否。列入PIC清单中的化学品在全球仍然可以进行贸易。但此贸易必须在进口国主管当局同意的情况下进行。

20)、是否所有国家都要执行《鹿特丹公约》

否。凡加入了《鹿特丹公约》的国家都要执行，加入公约是以自愿形式。

21)、《鹿特丹公约》何时生效

此公约从签署截止日(1999年9月10日)之后开放供各国和各区域经济一体化组织批准、接受、核准或加入。第五十份批准、接受、核准或加入书交存之日后第九十天起公约生效。

22)、我国签署《鹿特丹公约》且公约生效后将与国际的哪个组织合作来执行《鹿特丹公约》

我国签署《鹿特丹公约》后将与 FAO 和 UNEP 为实施《鹿特丹公约》设立的秘书处合作来执行《鹿特丹公约》。

23)、我国各地方有关部门针对《鹿特丹公约》应做什么

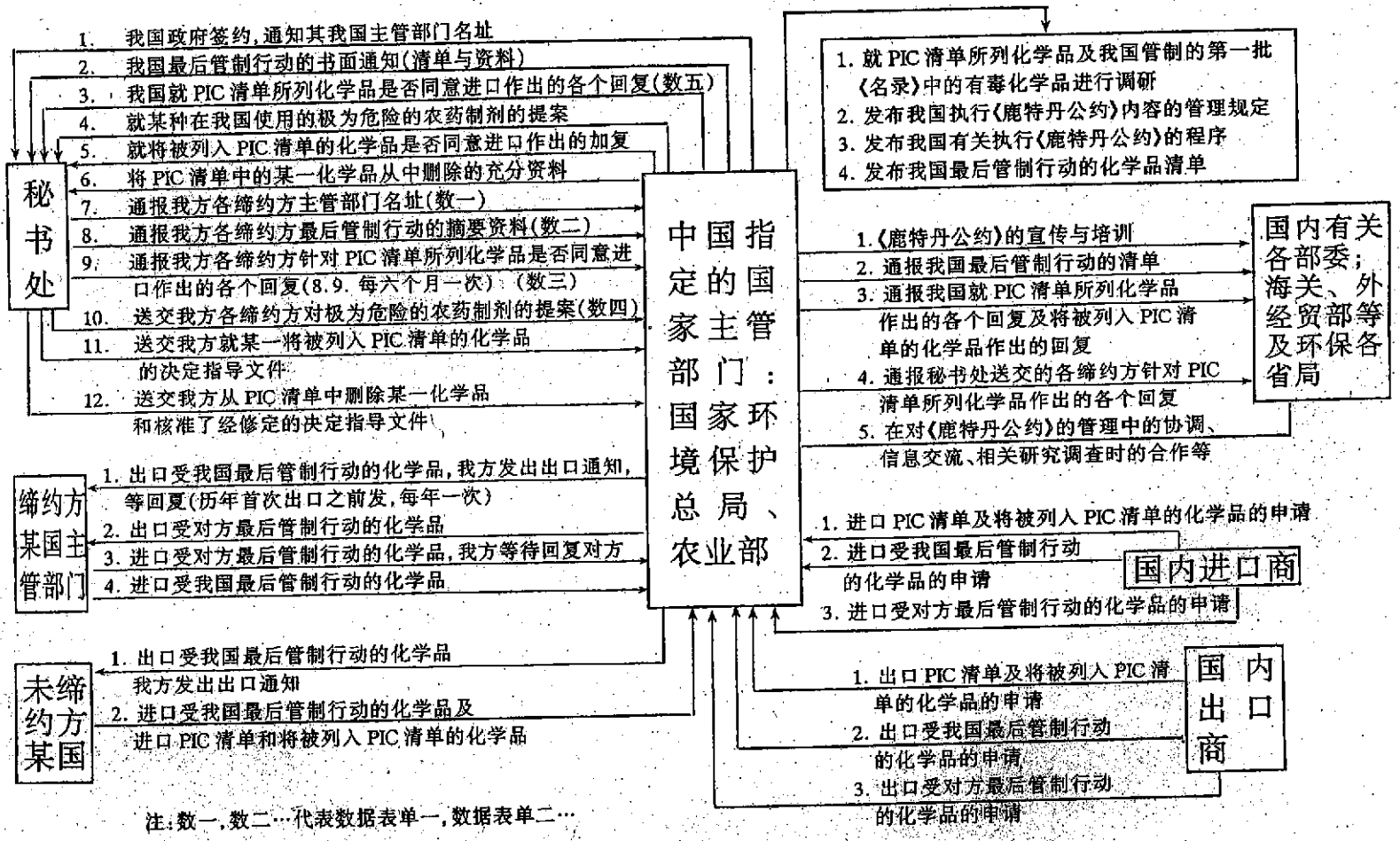
在 PIC 清单中的化学品和其它缔约方最后管制的化学品进口到我国后，对这些化学品的安全使用进行监督和管理。

24)、如何获得更多有关《鹿特丹公约》的信息，与谁联系

如果想获得更多有关《鹿特丹公约》的信息，可以上网查询 http://www.fao.org/waicent/FaoInfo/Agricult/AGP/AGPP/Pesticid/PIC/pichome.htm 或 http://www.chem.unep.ch/pic。

还可以与国家环境保护总局化学品登记中心联系（电话：010－84915286，传真：010－84913897，主页：http://www.crc-nepa.net.cn）。

附表 1　有关我国执行《鹿特丹公约》的框架



注：数一，数二…代表数据表单一，数据表单二…

国家危险废物名录

1998年1月4日颁布

1998年7月1日实施

国家环境保护局

国家经济贸易委员会

对外贸易经济合作部

公　安　部

Ministry of Foreign Trade and Economic Development

Ministry of Public Security

国家危险废物名录

说明

一、为防止危险废物对环境的污染，加强对危险废物的管理，保护环境和保障人民身体健康，根据《中华人民共和国固体废物污染环境防治法》，制定《国家危险废物名录》。

二、国家制定《危险废物鉴别标准》。凡《名录》中所列废物类别高于鉴别标准的属危险废物，列入国家危险废物管理范围；低于鉴别标准的，不列入国家危险废物管理。

三、对需要制定危险废物鉴别标准的废物类别，在其鉴别标准颁布以前，仅作为危险废物登记使用。

四、危险废物的管理按照《中华人民共和国固体废物污染环境防治法》中有关危险废物的管理条款执行。

五、本次公布《国家危险废物名录》为第一批执行《名录》。随着经济和科学技术的发展，《国家危险废物名录》将不定期修订。

六、本《名录》由国家环境保护局负责解释。

国家危险废物名录

编号	废物类别	废物来源	常见危害组分或废物名称
HW01	医院临床废物	从医院、医疗中心和诊所的医疗服务中产生的临床废物 ____手术、包扎残余物 ____生物培养、动物试验残余物 ____化验检查残余物 ____传染性废物 ____废水处理污泥	手术残物、敷料、化验废物，传染性废物，动物试验废物
HW02	医药废物	从医用药品的生产过程中产生的废物，包括兽药产品(不含中药类废物) ____蒸馏及反应残余物 ____高浓度母液及反应基或培养基废物 ____脱色过滤(包括载体)废物 ____用过废弃的吸附剂,催化剂,溶剂 ____生产中产生的报废药品或过期原料	废抗菌药，甾类药，抗组织胺类药，镇痛药，心血管药，神经系统药，杂药，基因类废物
HW03	废药物、药品	过期、报废的无标签的及多种混杂的药、物药品(不包括 HW01，HW02 类中的废药品) ____生产中产生的报废药品(包括药品废原料和中间体反应物) ____使用单位(科研、监测、学校、医疗单位、化验室等)积压或报废的药品(物) ____经营部门过期的报废药品(物)	废化学试剂，废药品，废药物
HW04	农药废物	来自杀虫、杀菌、除草、灭鼠和植物生长调节剂的生产、经销、配置和使用过程中产生的废物 ____蒸馏及反应残余物 ____生产过程母液及(反应罐及容器)清洗液 ____吸附过滤物(包括载体，吸附剂，催化剂) ____废水处理后的污泥 ____生产、配置过程中的过期原料 ____生产、销售、使用过程中的过期和淘汰产品 ____沾有农药及除草剂的包装物及容器	废有机磷杀虫剂、有机氯杀虫剂、有机氮杀虫剂、氨基甲酸酯类杀虫剂、拟除虫菊酯类杀虫剂、杀螨剂、有机磷杀虫剂、有机氯杀虫剂、有机硫杀虫剂、有机锡杀虫剂、有机氮杀虫剂、醌类杀虫剂、无机杀虫剂、有机胂杀虫剂、氨基甲酸酯类除草剂、醚类除草剂、酚类除草剂、酰胺类除草剂、取代脲类除草剂、苯氧羧酸类除草剂、均三氮苯类除草剂、无机除草剂
HW05	木材防腐剂废物	从木材防腐化学品的生产、配制和使用中产生的废物(不包括与HW04类重复的废物) ____生产单位生产中产生的废水处理污泥，工艺反应残余物、吸附过滤物及载体 ____使用单位积压、报废或配置过剩的木材防腐化学品 ____销售经营部门报废的木材防腐化学品	含五氯酚，苯酚，2-氯酚，甲酚、对氯间甲酚、三氯酚、屈萘、四氯酚、杂酚油、萤蒽、苯并 a 芘、2,4 二硝基酚、2,4-二甲酚；苯并(b)萤蒽，苯并(a)蒽，二苯并(a)蒽的废物

编号	废物类别	废物来源	常见危害组分或废物名称
HW06	有机溶剂废物	从有机溶剂生产、配制和使用过程中产生的废物(不包含 HW42 类的废有机溶剂) ____有机溶剂的合成、裂解、分离、脱色、催化、沉淀、蒸馏等过程中产生的反应残余物，吸附过滤物及载体 ____配置和使用过程中产生的含有机溶剂的清洗杂物	废催化剂，清洗剥离物，反应残渣，吸附物及载体废物
HW07	热处理含氰废物	从含有氰化物热处理和退火作业中产生的废物 ____金属含氰热处理 ____含氰热处理回活池冷却 ____含氰热处理炉维修 ____热处理渗碳炉	含氰热处理钡渣，含氰污泥及冷却及冷却液，含氰热处理炉内衬，热处理渗碳氰渣
HW08	废矿物油	不适合于原来用途的废矿物油 ____来自于石油开采和炼制产生的油泥和油脚 ____矿物油类仓储过程中产生的沉积物 ____机械、动力、运输等设备的更换油及清洗油（泥） ____金属轧制、机械加工过程中产生的废油(渣) ____含油废水处理过程中产生的废油和油泥 ____油加工和油再生过程中产生的油渣及过滤介质	机油；原油；液压油；真空泵油；柴油；汽油；重油；煤油；樟脑油；润滑油(脂)
HW09	废乳化液	从机械加工、设备清洗等过程中产生的废乳化液、废油水混合物 ____生产、配置、使用过程中产生的过剩乳化液(膏) ____机械加工、金属切削和冷拔过程产生的废乳化剂 ____清洗油罐、油件过程中产生的油水、烃水混合物 ____来自于(乳化液)水压机定期更换的乳化废液	废皂液、乳化油/水、烃/水混合物、乳化液(膏)、切削液(膏)、切削剂、冷却剂、润滑剂、拔丝剂
HW10	含多氯联苯废物	含有或沾有多氯联苯(PCBs)、多氯三联苯(PCTs)、多溴联苯(PBBs)的废物质和废物品 ____过剩的、废弃的、封存的、待替换的含有 PCBs, PBBS, PCTs 的电力设备(电容器、变压器) ____从含有 PCBs, PBBs,或 PCTs 的电力设备中倾倒出的介质油、绝缘油、冷却油传热油 ____来自含有 PCBs, PBBs 和 PCTs 或被这些物质污染的电力设备的清洗液 ____被 PBCs, PBBs 和 PCTs 污染的土壤及包装物等	含多氯联苯(PCBs)，多溴联苯(PBBs)，多氯三联苯(PCTs)废物

编号	废物类别	废物来源	常见危害组分或废物名称
HW11	精(蒸)馏残渣	从精炼、蒸馏和任何热处理中产生的废焦油状残留物 ____煤气生产过程中产生的焦油渣 ____原油蒸馏过程中产生的焦油残留物 ____原油精制过程中产生的沥青状焦油及酸焦油 ____化学品生产过程中产生的精馏残渣和蒸馏釜底物 ____化学品原料生产的热解过程中产生的焦油状残余物 ____被工业生产过程中产生的焦油或蒸馏残余物污染的土壤 ____盛装过焦油状残余物的包装和容器	沥青渣、焦油渣、废酸焦油、酚渣、蒸馏釜残物、精馏釜残物、甲苯渣、液化石油器残夜（含苯并（α）芘、屈萘、萤蒽、多环芳烃类废物）
HW12	染料、涂料废物	从油墨、染料、颜料、油漆、真漆、罩光漆的生产配置和使用过程中产生的废物 ____生产过程中产生的废弃的颜料、染料、涂料和不合格产品 ____染料、颜料生产硝化、氧化、还原、磺化、重氮化、卤化等化学反应中产生的废母液、残渣、中间体废物 ____油漆、油墨生产、配置和使用过程中产生的含有颜料、油墨的有机溶剂废物 使用酸、碱或有机溶剂清洗容器设备产生的污泥状剥离物 ____含有染料、颜料、油墨、油漆残余物的废弃包装物 废水处理污泥	废酸性染料、碱性染料、媒染染料、偶氮染料、直接染料、冰染染料、还原染料、硫化染料、活性染料、醇酸树脂涂料、丙烯酸树脂涂料、聚氨脂、树脂涂料、聚乙烯树脂涂料、环氧树脂涂料、双组分涂料、油墨、重金属颜料
HW13	有机树脂类废物	从树脂、乳胶、增塑剂、胶水/胶合剂生产、配置和使用过程中产生的废物 ____生产、配置、使用中产生的不合格产品、废副产品 ____在合成、酯化、缩合等反应中产生的废催化剂、高浓度废液 ____精馏、分离、精制过程中产生的釜残液、过滤介质和残渣 ____使用溶剂或酸、碱清洗容器设备剥离下的树脂状，粘稠杂物 ____废水处理污泥	邻苯二甲酸脂类，脂肪酸二元酸脂类，磷酸脂类，环氧化合物类，偏苯三甲酸脂类，聚酯类，氯化石蜡，二元醇和多元醇脂类，磺酸衍生物的废物
HW14	新化学药品废物	从研究和开发或教学活动中产生的尚未鉴定的和(或)新的对人类和(或)环境影响未明的化学废物	新化学品研制中产生的废物

编号	废物类别	废物来源	常见危害组分或废物名称
HW15	爆炸性废物	在生产、销售、使用爆炸物品过程中产生的次品、废品及具有爆炸性质的废物 ____不稳定、在无爆震时容易发生剧烈变化的废物 ____能和水形成爆炸性混合物 ____经过发热、吸湿、自发的化学变化具有着火倾向 ____在有引发源或加热时能爆震或爆炸的废物	含叠氮乙酰，硝酸乙酰脂，叠氮铵，氯酸铵，六硝基钴酸铵，硝酸铵，氮化铵，过碘酸铵，高锰酸铵，苦味酸铵，四过氧铬酸铵，叠氮羰基胍，叠氮钡，氯化重氮苯，苯并三唑，亚硝基胍，硝化淀粉、四硝基戊四醇、三硝基氯苯、聚乙烯硝酸脂，硝酸钾，叠氮化银、氮化银，三硝基苯间二酚银，四氮烯银，无烟火药，叠氮化钠，苦味酸钠，四硝基甲烷，四氮化四硒、四氮化四硫，四氮烯，氮化铊，二氮化三铅，二氮化三汞，三硝基苯，雷汞，雷银，三硝基甲苯，三硝基间苯二酚的废物
HW16	感光材料废物	从摄影化学品、感光材料的产生、配置、使用中产生的废物 ____生产单位生产过程中产生的不合格产品和过期产品 ____生产过程中产生的残渣及废水污泥 ____出版社、报社、印刷厂、电影厂在使用和经营活动中产生的废显(定)影液，胶片及废像纸 ____社会照相部、冲洗部在使用和经营活动中产生的废显(定)　液、胶片及废像纸 ____医疗院所的 X 光和 CT 检查中产生的废显(定)液及胶片	废显影液、定影液、正负胶片、像纸、感光原料及药品
HW17	表面处理废物	从金属和塑料表面处理过程中产生的废物 ____电镀行业的电镀槽渣、槽液及水处理污泥 ____金属和塑料表面酸(碱)洗、除油、除锈、洗涤工艺产生的腐蚀液、洗涤液和污泥 ____金属和塑料表面磷化、出光、化抛过程中产生的残渣(液)及污泥 ____镀层剥除过程中产生的废液及残渣	废电镀溶液、镀槽淤渣、电镀水处理污泥、表面处理酸碱渣、氧化槽渣、磷化渣、亚硝酸盐废渣等
HW18	焚烧处理残渣	从工业废物处置中产生的残余物	焚烧处置残渣及灰尘
HW19	含金属羰基化合物废物	在金属羰基化合物制造以及使用过程中产生的含有羰基化合物成分的废物 ____精细化工产品生产 ____金属有机化合物的合成	金属羰基化合物（五羰基铁，八羰基二钴，羰基镍，三羰基钴，氢氧化四羰基钴）废物
HW20	含铍废物	含铍及其化合物的废物 ____稀有金属冶炼 ____铍化合物产生	含铍，硼氢化铍，溴化铍，氢氧化铍，碘化铍，碳酸铍，硝酸铍，氧化铍，硫酸铍，氟化铍，氯化铍，硫化铍的废物

编号	废物类别	废物来源	常见危害组分或废物名称
HW21	含铬废物	含六价铬化合物的废物 ____化工(铬化合物)生产 ____皮革加工（鞣革）业 ____金属、塑料电镀 ____酸性媒介染料染色 ____颜料生产与使用 ____金属铬冶炼(铁合金)	含铬酸酐，(重)铬酸钾，(重)铬酸钠，铬酸，重铬酸，三氧化铬，铬酸锌，铬酸钾，铬酸钙，铬酸银，铬酸铅，铬酸钡废物
HW22	含铜废物	指含有铜化合物的废物 ____有色金属采选和冶炼 ____金属、塑料电镀 ____铜化合物生产	含溴化(亚)铜，氢氧化铜，硫酸(亚)铜，碘化(亚)铜，碳酸铜，硝酸铜，硫化铜，氟化铜，硫化(亚)铜，氯化(亚)铜，醋酸铜，氧化铜钾，磷酸铜，二水合氯化铜铵的废物
HW23	含锌废物	含有锌化合物的废物 ____有色金属采选及冶炼 ____金属、塑料电镀 颜料、油漆、橡胶加工 ____锌化合物生产 含锌电池制造业	含溴化锌，碘化锌，硝酸锌，硫酸锌，氟化锌、氯化锌、硫化锌，过氧化锌，高锰酸锌，醋酸锌，草酸锌，溴酸锌，铬酸锌，溴酸锌，磷酸锌，焦磷酸锌，磷化锌的废物
HW24	含砷废物	含砷及砷化合物废物 ____有色金属采选及冶炼 ____砷及其化合物的生产 ____石油化工 ____农药生产 ____染料和制革业	含砷，三氧化二砷，亚砷酐，五氧化二砷，五硫化二砷，硫化亚砷，砷化钙，砷化锌，乙酰基砷铜，砷化铁，砷化铜，砷化铅，砷化银，乙基二氯化砷，(亚)砷酸，三氟化砷，砷酸锌，砷酸铵，砷酸钙，砷酸铁，砷酸钠，砷酸汞，砷酸铅，砷酸镁，三氯化砷，二硫化砷，砷酸钾，砷化(三)氢的废物
HW25	含硒废物	含硒及硒化合物废物 ____有色冶炼及电解 ____硒化合物生产 颜料、橡胶、玻璃生产	含硒，二氧化硒，三氧化硒，四氟化硒，六氟化硒，二氯化二硒，四氯化硒，亚硒酸，硒化氢，硒化钠，硒酸钠，(亚)硒酸钠，二硫化硒，硒化亚铁，亚硒酸钡，硒酸，二甲基硒的废物
HW26	含镉废物	含镉及其化合物废物 ____有色金属采选及冶炼 ____镉化合物生产 ____电池制造业 ____电镀行业	含镉，溴化镉，碘化铬，氢氧化镉，碳酸镉，硝酸镉，硫酸镉，硫化镉，氯化镉，氟化镉，醋酸镉，氧化镉，二甲基镉的废物
HW27	含锑废物	含锑及其化合物废物 ____有色金属冶炼 ____锑化合物生产和使用	含锑，二氧化二锑，亚锑酐，五氧化二锑，硫化亚锑，硫化锑，氟化亚锑，氟化锑，氯化(亚)锑，三氢化锑，锑酸钠，锑酸铅，乳酸锑，亚锑酸钠的废物

	废物类别	废物来源	常见危害组分或废物名称
HW28	含碲废物	含碲及其化合物废物 ____有色金属冶炼及电解 ____碲化合物生产和使用	含碲，四溴化碲，四碘化碲，三氧化碲，六氟化碲，四氯化碲，亚碲酸，碲化氢，碲酸，二乙基碲，二甲基碲的废物
HW29	含汞废物	含汞及其化合物废物 ____化学工业含汞催化剂制造与使用 ____含汞电池制造业 ____汞冶炼及汞回收业 ____有机汞、无机汞化合物生产 ____农药及制造业 ____荧光屏及汞灯制造及使用 ____含汞玻璃计器制造及使用 汞法烧碱生产产生的含汞盐泥	含汞，溴化(亚)汞，碘化(亚)汞，硝酸(亚)汞，氧化汞，硫酸(亚)汞，氯化(亚)汞，硫化汞，氯化乙基汞，氯化汞铵，氯化甲基汞，醋酸(亚)汞，二甲基汞，二乙基汞，氯化高汞的废物
HW30	含铊废物	含铊及其化合物废物 ____有色金属冶炼及农药生产 ____铊化合物生产及使用	含铊，溴化亚铊，氢氧化(亚)铊，碘化亚铊，硝酸亚铊，碳酸亚铊，硫酸亚铊，氧化亚铊，硫化亚铊，三氧化二铊，三硫化二铊，氟化亚铊，氯化(亚)铊，铬酸铊，氯酸铊，醋酸铊的废物
HW31	含铅化合物	含铅及其化合物 ____铅冶炼及电解过程中的残渣及铅尘 ____铅(酸)蓄电池生产中产生的废铅渣及铅酸(污泥) ____报废的铅(酸)蓄电池 ____铅铸造业及制品业的废铅渣及水处理污泥 ____铅化合物制造和使用过程中产生的残余物	含铅，乙酸铅，溴化铅，氢氧化铅，碘化铅，碳酸铅，硝酸铅，氧化铅，硫酸铅，铬酸铅，氯化铅，氟化铅，硫化铅，高氯酸铅，碱性硅酸铅，四烷基铅，四氧化铅，二氧化铅的废物
HW32	无机氟化物废物	含无机氟化物废物（不包括氟化钙、氟化镁）	含氟化铯，氟硼酸，氟硅酸锌，氢氟酸，六氟化硫，氟化钠，五氟化硫，二氟磷酸，氟硫酸，氟硼酸铵，氟硅酸铵，氟化铵，氟化钾，氟化铬，五氟化碘，氟氢化钾，氟氢化钠，氟硅酸钠的废物
HW33	无机氰化物废物	从无机氰化物生产、使用过程中产生的含无机氰化物废物(不包括 HW07 类热处理废物含氰废物) ____金属制品业的电解除油，表面硬化化学沉淀工艺中产生的含氰废物 ____电镀业和电子零件制造业中电镀工艺、镀层剥除工艺中产生的含氰废物 ____金矿开采与筛选过程中产生的含氰废物 ____首饰加工的化学抛光工艺产生的含氰废物 ____其他生产、实验、化验分析过程中产生的含氰废物及包装物	含氢氰酸，氰化钠，氰化钾，氰化锂，氰化汞，氰化铅，氰化铜，氰化锌，氰化钡，氰化钙，氰化亚铜，氰化银，氰溶体，汞氰化钾，氰化镍，铜氰化钠，镍氰化钾，溴化氰，氰化钴的废物

编号	废物类别	废物来源	常见危害组分或废物名称
HW34	废酸	从工业生产、配置、使用过程中产生的废酸液、固态酸及酸渣 (Ph≤2 的液态酸) ____工业化学品制造 ____化学分析及测试 ____金属及其他制品的酸蚀、出光、除锈、(油)及清洗 ____废水处理 ____纺织印染前处理	废硫酸，硝酸，盐酸，磷酸，(次)氯酸，溴酸，氢氟酸，氢溴酸，硼酸，砷酸，硒酸，氰酸，氯磺酸，碘酸，王水
HW35	废碱	从工业生产、配置、使用过程中产生的废碱液、固态碱及碱渣 （Ph≥12.5 的液态碱） ____工业化学品制造 ____化学分析及测试 ____金属及其他制品的碱蚀、出光、除锈(油)及清洗 ____废水处理 ____纺织印染前处理 ____造纸废液	废氢氧化钠、氢氧化钾、氢氧化钙、氢氧化锂、碳酸(氢)钠、碳酸(氢)钾、硼砂、(次)氯酸钠、(次)氯酸钾、(次)氯酸钙、磷酸钠
HW36	石棉废物	从产生和使用过程中产生的石棉废物 石棉矿开采及其石棉产品加工 ____石棉建材生产 ____含石棉设施的保养(石棉隔膜、热绝缘体等) ____车辆制动器衬片的生产与更换	石棉尘，石棉废纤维，废石棉绒，石棉隔热废料，石棉尾矿渣
HW37	有机磷化合物废物	从农药以外其他有机磷化合物生产、配置和使用过程中产生的含有机磷废物 ____生产过程中产生的反应残余物	含氯硫磷，硫磷嗪，磷酰胺，丙基磷酸四乙脂，四磷酸六乙脂，硝基硫磷酯，苯晴磷，磷酸脂类化合物，苯硫磷，异丙磷，三氯氧磷，磷酸三丁酯的废物
HW38	有机氰化物废物	从生产、配置和使用过程中产生的含有机氰化物的废物 ____在合成、缩合等反应中产生的高浓度废液及反应残余物 ____在催化、精馏、过滤过程中产生的废催化剂、釜残及过滤介质物 ____生产、配置生产过程中产生的不合格产品 ____废水处理污泥	含乙晴，丙烯晴，乙二晴，氨丙晴，氯丙烯晴，氰基乙酸，氰基氯戊烷，乙醇晴，丙晴，四甲基琥珀晴，溴苯甲晴，苯晴，乳酸晴，丙酮晴，丁基晴，苯基异丙酸脂，氰酸脂类的废物
HW39	含酚废物	酚、酚化合物(包括氯酚类和硝基酚类) ____生产过程中产生的高浓度废液及反应残余物 ____生产过程中吸附过滤物，废催化剂，精馏釜残渣（包括石油、化工、煤气生产中产生的含酚类化合物废物）	含氨基苯酚，溴酚，氯甲苯酚，煤焦油，二氯酚，二硝基苯酚，对苯二酚，三羟基苯，五氯酚(钠)，硝基苯酚，三氯酚，氯酚，甲酚，硝基苯甲酚，苦味酸，二硝基苯酸钠，苯酚胺的废物

编号	废物类别	废物来源	常见危害组分或废物名称
HW40	含醚类废物	从生产、配置和使用过程中产生的含醚废物 ____生产、配置过程中产生的醚类残液、反应残余物、水处理污泥及过滤渣 ____配置、使用过程中产生的含醚类有机混合溶剂	含苯甲醚，乙二醇单丁醚，甲乙醚，丙烯醚，二氯乙醚，苯甲基醚，二苯醚，二氧基乙醇乙醚，乙二醇甲基醚，乙二醇醚，异丙醚，二氯二甲醚，甲基氯甲醚，丙醚，四氯丙醚，三硝基苯甲醚，乙二醇二乙醚，亚乙醇二醇丁基醚，二甲醚，丙烯基苯基醚，甲基丙基醚，乙二醇异丙基醚，乙二醇苯醚，乙二醇戊基醚，丁醚，乙醚，二干醇二甲基醚，乙二醇二甲基醚，乙二醇单乙醚的废物
HW41	废卤化有机溶剂	从含卤化有机溶剂生产、配置、使用过程中产生的废物 ____生产、配置过程中产生的高浓度残液、吸附过滤物、反应残渣、水处理污泥及废载体 ____生产、配置过程中产生的报废产品 ____生产、配置、使用过程中产生的卤化有机溶剂。包括化学分析，塑橡胶制品制造，电子零件清洗、化工产品制造、印染染料调配，商业干洗、家庭装饰使用的废溶剂	含二氯甲烷，氯仿，四氯化碳，二氯乙烷，二氯乙烯，氯苯，二氯二氟甲烷，溴仿，二氯丁烷，三氯苯，二氯丙烷，二溴乙烷，四氯乙烷，三氯乙烷，三氯乙烯，三氯三氟乙烷，四氯乙烯，五氯乙烷，溴乙烷，溴苯，三氯氟甲烷的废物
HW42	废有机溶剂废物	从有机溶剂的生产、配置和使用中产生的废液(不包括 HW41 类的卤化有机溶剂) ____生产、配置和使用过程中产生的废有机溶剂和残余物。包括化学分析测试，塑橡胶制品制造，电子零件清洗、化工产品制造、印染染料调配、商业干洗和家庭使用过的废溶剂	含糠醛，环己烷，石脑油，苯，甲苯，二甲苯，四氢呋喃，乙酸丁脂，乙酸甲脂，硝基苯，甲基异丁基酮，环己酮，二乙基酮，乙酸异丁脂，丙烯醛二聚物，异丁醇，乙二醇，甲醇，苯乙酮，异戊烷，环戊酮，丙醛，二丙基酮，苯甲酸乙酯，丁酸，丁酸丁脂，丁酸乙脂，丁酸甲脂，异丙醇，N，N-二甲基乙酰胺，甲醛，二乙基酮，丙烯醛，乙酸乙脂，丙酮，甲基乙基酮，甲基乙烯酮，甲基丁酮，甲基丁醇的废物
HW43	含多氯苯并呋喃类废物	含任何多氯苯并呋喃类同系列废物	多氯苯并呋喃同系物废物
HW44	含多氯苯并二恶英废物	含任何多氯苯并二恶英同系物的废物	多氯苯并二恶英同系物废物
HW45	含有机卤化物废物	从其他有机卤化物生产、配制、使用过程中产生的废物(不包括上述 HW39，HW41，HW42，HW43，HW44 类别的废物) ____生产、配制过程中产生的高浓度残液、吸附过滤物、反应残渣、水处理污泥及催化剂、废产品 ____生产、配制过程中产生的报废产品 ____化学分析、塑橡胶制品制造、电子零件清洗、化工产品制造、印染染料调配、商业、家庭使用产生的卤化有机物.	含苄基氯，苯甲酰氯，三氯乙醛，1一氯辛烷，氯代二硝基苯，氯乙酸，氯硝基苯，2一氯丙酸，3一氯丙烯酸，氯甲苯胺，乙酰氯，二溴甲烷，苄基溴，1一溴一2一氯乙烷，二氯乙酰甲脂，氯乙酰胺，二氯萘醌，二氯醋酸，溴萘酚，碘代甲烷，2，4，5-三氯苯酚，三氯酚，1，4-二氯丁烷，2，4，6-三溴苯酚，二氯丁胺，1-氨基-4 溴蒽醌-2-磺酸的废物

编号	废物类别	废物来源	常见危害组分或废物名称
HW46	含镍废物	含镍化合物的废物 ____镍化合物生产过程中产生的反应残余物及废品 ____使用报废的镍催化剂 ____电镀工艺中产生的镍残渣及槽液 ____分析、化验、测试过程中产生的含镍废物	含溴化镍，硝酸镍，硫酸镍，氯化镍，一氯化镍，一氧化镍，氧化镍，氢氧化镍，氢氧化高镍的废物
HW47	含钡废物	含钡化合物的废物(不包括硫酸钡) ____钡化合物生产过程中产生的反应残余物及废品 ____热处理工艺中产生的盐浴渣 ____分析、化验、测试过程中产生的含钡废物	含溴酸钡，氢氧化钡，硝酸钡，碳酸钡，氯化钡，氟化钡，硫化钡，氧化钡，氟硅酸钡，氯酸钡，醋酸钡，过氧化钡，碘酸钡，叠氮钡，多硫化钡的废物

危险废物转移联单管理办法

国家环境保护总局1999年6月22日令

1999年10月1日起施行

第一条 为加强对危险废物转移的有效监督，实施危险废物转移联单制度，根据《中华人民共和国固体废物污染环境防治法》有关规定，制定本办法。

第二条 本办法适用于在中华人民共和国境内从事危险废物转移活动的单位。

第三条 国务院环境保护行政主管部门对全国危险废物转移联单（以下简称联单）实施统一监督管理。

各省、自治区人民政府环境保护行政主管部门对本行政区域内的联单实施监督管理。

省辖市级人民政府环境保护行政主管部门对本行政区域内联单具体实施监督管理；在直辖市行政区域和设有地区行政公署的行政区域，由直辖市人民政府和地区行政公署环境保护行政主管部门具体实施监督管理。

前款规定的省辖市级人民政府、直辖市人民政府和地区行政公署环境保护行政主管部门，本办法以下统一简称为“环境保护行政主管部门”。

第四条 危险废物产生单位在转移危险废物前，须按照国家有关规定报批危险废物转移计划；经批准后，产生单位应当向移出地环境保护行政主管部门申请领取联单。

产生单位应当在危险废物转移前三日内报告移出地环境保护行政主管部门，并同时将预期到达时间报告接受地环境保护行政主管部门。

第五条 危险废物产生单位每转移一车、船（次）同类危险废物，应当填写一份联单。

每车、船（次）有多类危险废物的，应当按每一类危险废物填写一份联单。

第六条 危险废物产生单位应当如实填写联单中产生单位栏目，并加盖公章，经交付危险废物运输单位核实验收签字后，将联单第一联副联自留存档，将联单第二联交移出地环境保护行政主管部门，联单第一联正联及其余各联交付运输单位随危险废物转移运行。

第七条 危险废物运输单位应当如实填写联单的运输单位栏目，按照国家有关危险物品运输的规定，将危险废物安全运抵联单载明的接受地点，并将联单第一联、第二联副联、第三联、第四联、第五联随转移的危险废物交付危险废物接受单位。

第八条 危险废物接受单位应当按照联单填写的内容对危险废物核实验收，如实填写联单中接受单位栏目并加盖公章。

接受单位应当将联单第一联、第二联副联自接受危险废物之日起十日内交付产生单位，联单第一联由产生单位自留存档，联单第二联副联由产生单位在二日内报送移出地环境保护行政主管部门；接受单位将联单第三联交付运输单位存档；将联单第四联自留存档；将联单第五联自接受危险废物之日起二日内报送接受地环境保护行政主管部门。

第九条 危险废物接受单位验收发现危险废物的名称、数量、特性、形态、包装

方式与联单填写内容不符的，应当及时向接受地环境保护行政主管部门报告，并通知产生单位。

第十条 联单保存期限为五年；贮存危险废物的，其联单保存期限与危险废物贮存期限相同。

环境保护行政主管部门认为有必要延长联单保存期限的，产生单位、运输单位和接受单位应当按照要求延期保存联单。

第十一条 省辖市级以上人民政府环境保护行政主管部门有权检查联单运行的情况，也可以委托县级人民政府环境保护行政主管部门检查联单运行的情况。

被检查单位应当接受检查，如实汇报情况。

第十二条 转移危险废物采用联运方式的，前一运输单位须将联单各联交付后一运输单位随危险废物转移运行，后一运输单位必须按照联单的要求核对联单产生单位栏目事项和前一运输单位填写的运输单位栏目事项，经核对无误后填写联单的运输单位栏目并签字。经后一运输单位签字的联单第三联的复印件由前一运输单位自留存档，经接受单位签字的联单第三联由最后一运输单位自留存档。

第十三条 违反本办法有下列行为之一的，由省辖市级以上地方人民政府环境保护行政主管部门责令限期改正，并处以罚款：

（一）未按规定申领、填写联单的；

（二）未按规定运行联单的；

（三）未按规定期限向环境保护行政主管部门报送联单的；

（四）未在规定的存档期限保管联单的；

（五）拒绝接受有管辖权的环境保护行政主管部门对联单运行情况进行检查的。

有前款第（一）项、第（三）项行为之一的，依据《中华人民共和国固体废物污染环境防治法》有关规定，处五万元以下罚款；有前款第（二）项、第（四）项行为之一的，处三万元以下罚款；有前款第（五）项行为的，依据《中华人民共和国固体废物污染环境防治法》有关规定，处一万元以下罚款。

第十四条 联单由国务院环境保护行政主管部门统一制定，由省、自治区、直辖市人民政府环境保护行政主管部门印制。

联单共分五联，颜色分别为：第一联，白色；第二联，红色；第三联。黄色；第四联，蓝色；第五联，绿色。

联单编号由十位阿拉伯数字组成。第一位、第二位数字为省级行政区划代码，第三位、第四位数字为省辖市级行政区划代码，第五位、第六位数字为危险废物类别代码，其余四位数字由发放空白联单的危险废物移出地省辖市级人民政府环境保护行政主管部门按照危险废物转移流水号依次编制。联单由直辖市人民政府环境保护行政主管部门发放的，其编号第三位、第四位数字为零。

第十五条 本办法由国务院环境保护行政主管部门负责解释。

第十六条 本办法自一九九九年十月一日起施行。

危险废物转移联单　　编号_____

第一部分：废物产生单位填写

产生单位_____单位盖章　电话_____
通讯地址_____　邮编_____
运输单位_____　电话_____
通讯地址_____　邮编_____
接受单位_____　电话_____
通讯地址_____　邮编_____

废物名称_____类别编号_____数量 _____
废物特性：_____形态_____包装方式_____
运输目的：中转贮存 ☐ 利用 ☐ 处理 ☐ 处置 ☐
主要危险成分_____禁忌与应急措施 _____
承运人_____运达地_____转移时间____年____月____日

第二部分：废物运输单位填写

运输者须知：你必须核对以上栏目事项，当与实际情况不符时,有权拒绝接受。
第一承运人_____运输日期_____年 ____月_____日
车(船)型：_____牌号_____道路运输证号_____
运输起点_____经由地_____运输终点_____运输人签字_____
第二承运人_____运输日期_____年 ____月_____日
车(船)型：_____牌号_____道路运输证号_____
运输起点_____经由地_____运输终点_____运输人签字_____

第三部分：废物接受单位填写

接受者须知：你必须核实以上栏目内容，当与实际情况不符时,有权拒绝接受。
经营许可证号_____接受人 _____接受日期 _____
废物处理方式 ：利用 ☐ 贮存 ☐ 焚烧 ☐ 安全填埋 ☐ 其他 ☐
单位负责人签字_____单位盖章　　日期_____

第一联　产生单位

危险废物转移联单　　编号_____

第一部分：废物产生单位填写

产生单位_____单位盖章　电话_____
通讯地址_____　邮编_____
运输单位_____　电话_____
通讯地址_____　邮编_____
接受单位_____　电话_____
通讯地址_____　邮编_____

废物名称_____类别编号_____数量_____
废物特性：_____形态_____包装方式_____
外运目的：中转贮存 ☐ 利用 ☐ 处理 ☐ 处置 ☐

主要危险成分_____禁忌与应急措施_____

发运人_____运达地_____转移时间____年____月____日

第二部分：废物运输单位填写

运输者须知：你必须核对以上栏目事项，当与实际情况不符时,有权拒绝接受。
第一承运人_____运输日期_____年____月_____日
车(船)型：_____牌号_____道路运输证号_____
运输起点_____经由地_____运输终点_____运输人签字_____
第二承运人_____运输日期_____年____月_____日
车(船)型：_____牌号_____道路运输证号_____
运输起点_____经由地_____运输终点_____运输人签字_____

第三部分：废物接受单位填写

接受者须知：你必须核实以上栏目内容，当与实际情况不符时,有权拒绝接受。
经营许可证号_____接受人_____接受日期_____

废物处理方式：利用 ☐ 贮存 ☐ 焚烧 ☐ 安全填埋 ☐ 其他 ☐

单位负责人签字_____单位盖章　　日期_____

第一联副联　产生单位

危险废物转移联单　　编号_____

第二联　移出地环保局

第一部分：废物产生单位填写

产生单位_____单位盖章　电话_____
通讯地址_____　邮编_____
运输单位_____　电话_____
通讯地址_____　邮编_____
接受单位_____　电话_____
通讯地址_____　邮编_____

废物名称_____类别编号_____数量 _____
废物特性：_____形态_____包装方式_____
外运目的：中转贮存 ☐ 利用 ☐ 处理 ☐ 处置 ☐
主要危险成分_____禁忌与应急措施 _____
发运人_____运达地_____转移时间____年____月____日

第二部分：废物运输单位填写

运输者须知：你必须核对以上栏目事项，当与实际情况不符时,有权拒绝接受。
第一承运人_____运输日期_____年 ____月_____日
车(船)型：_____牌号_____道路运输证号_____
运输起点_____经由地_____运输终点_____运输人签字_____
第二承运人_____运输日期_____年 ____月_____日
车(船)型：_____牌号_____道路运输证号_____
运输起点_____经由地_____运输终点_____运输人签字_____

第三部分：废物接受单位填写

接受者须知：你必须核实以上栏目内容，当与实际情况不符时,有权拒绝接受。
经营许可证号_____接受人 _____接受日期 _____
废物处理方式 ：利用 ☐ 贮存 ☐ 焚烧 ☐ 安全填埋 ☐ 其他 ☐
单位负责人签字_____单位盖章　　日期_____

危险废物转移联单　　编号_____

第二联 副联 移出地环保局

第一部分：废物产生单位填写

产生单位_____单位盖章　电话_____
通讯地址_____　邮编_____
运输单位_____　电话_____
通讯地址_____　邮编_____
接受单位_____　电话_____
通讯地址_____　邮编_____

废物名称_____类别编号_____数量_____
废物特性：_____形态_____包装方式_____
外运目的：中转贮存 ☐ 利用 ☐ 处理 ☐ 处置 ☐
主要危险成分_____禁忌与应急措施_____
发运人_____运达地_____转移时间____年____月____日

第二部分：废物运输单位填写

运输者须知：你必须核对以上栏目事项，当与实际情况不符时,有权拒绝接受。
第一承运人_____运输日期_____年____月_____日
车(船)型：_____牌号_____道路运输证号_____
运输起点_____经由地_____运输终点_____运输人签字_____
第二承运人_____运输日期_____年____月_____日
车(船)型：_____牌号_____道路运输证号_____
运输起点_____经由地_____运输终点_____运输人签字_____

第三部分：废物接受单位填写

接受者须知：你必须核实以上栏目内容，当与实际情况不符时,有权拒绝接受。
经营许可证号_____接受人_____接受日期_____
废物处理方式：利用 ☐ 贮存 ☐ 焚烧 ☐ 安全填埋 ☐ 其他 ☐
单位负责人签字_____单位盖章　日期_____

危险废物转移联单　　编号_____

第三联　运输单位

第一部分：废物产生单位填写

产生单位_____单位盖章　电话_____
通讯地址_____　邮编_____
运输单位_____　电话_____
通讯地址_____　邮编_____
接受单位_____　电话_____
通讯地址_____　邮编_____

废物名称_____类别编号_____数量_____
废物特性：_____形态_____包装方式_____
外运目的：中转贮存 ☐ 利用 ☐ 处理 ☐ 处置 ☐
主要危险成分_____禁忌与应急措施_____
发运人_____运达地_____转移时间____年____月____日

第二部分：废物运输单位填写

运输者须知：你必须核对以上栏目事项，当与实际情况不符时,有权拒绝接受。
第一承运人_____运输日期_____年____月_____日
车(船)型：_____牌号_____道路运输证号_____
运输起点_____经由地_____运输终点_____运输人签字_____
第二承运人_____运输日期_____年____月_____日
车(船)型：_____牌号_____道路运输证号_____
运输起点_____经由地_____运输终点_____运输人签字_____

第三部分：废物接受单位填写

接受者须知：你必须核实以上栏目内容，当与实际情况不符时,有权拒绝接受。
经营许可证号_____接受人_____接受日期_____
废物处理方式：利用 ☐ 贮存 ☐ 焚烧 ☐ 安全填埋 ☐ 其他 ☐
单位负责人签字_____单位盖章　日期_____

危险废物转移联单　　编号_____

第一部分：废物产生单位填写

产生单位_____单位盖章　电话_____
通讯地址_____　邮编_____
运输单位_____　电话_____
通讯地址_____　邮编_____
接受单位_____　电话_____
通讯地址_____　邮编_____

废物名称_____类别编号_____数量_____
废物特性：_____形态_____包装方式_____
外运目的：中转贮存 ☐ 利用 ☐ 处理 ☐ 处置 ☐
主要危险成分_____禁忌与应急措施_____
发运人_____运达地_____转移时间____年____月____日

第二部分：废物运输单位填写

运输者须知：你必须核对以上栏目事项，当与实际情况不符时,有权拒绝接受。
第一承运人_____运输日期_____年____月_____日
车(船)型：_____牌号_____道路运输证号_____
运输起点_____经由地_____运输终点_____运输人签字_____
第二承运人_____运输日期_____年____月_____日
车(船)型：_____牌号_____道路运输证号_____
运输起点_____经由地_____运输终点_____运输人签字_____

第三部分：废物接受单位填写

接受者须知：你必须核实以上栏目内容，当与实际情况不符时,有权拒绝接受。
经营许可证号_____接受人_____接受日期_____
废物处理方式：利用 ☐ 贮存 ☐ 焚烧 ☐ 安全填埋 ☐ 其他 ☐
单位负责人签字_____单位盖章　　日期_____

危险废物转移联单　　编号_____

第五联　接受地环保局

第一部分：废物产生单位填写

产生单位_____单位盖章　电话_____
通讯地址_____　邮编_____
运输单位_____　电话_____
通讯地址_____　邮编_____
接受单位_____　电话_____
通讯地址_____　邮编_____

废物名称_____类别编号_____数量_____
废物特性：_____形态_____包装方式_____
外运目的：中转贮存 ☐ 利用 ☐ 处理 ☐ 处置 ☐
主要危险成分_____禁忌与应急措施_____
发运人_____运达地_____转移时间____年____月____日

第二部分：废物运输单位填写

运输者须知：你必须核对以上栏目事项，当与实际情况不符时,有权拒绝接受。
第一承运人_____运输日期_____年____月_____日
车(船)型：_____牌号_____道路运输证号_____
运输起点_____经由地_____运输终点_____运输人签字_____
第二承运人_____运输日期_____年____月_____日
车(船)型：_____牌号_____道路运输证号_____
运输起点_____经由地_____运输终点_____运输人签字_____

第三部分：废物接受单位填写

接受者须知：你必须核实以上栏目内容，当与实际情况不符时,有权拒绝接受。
经营许可证号_____接受人_____接受日期_____
废物处理方式：利用 ☐ 贮存 ☐ 焚烧 ☐ 安全填埋 ☐ 其他 ☐
单位负责人签字_____单位盖章　日期_____

危险废物经营许可证管理办法
（征求意见稿）

第一条 为了实施对收集、贮存、利用、处置危险废物的环境管理，防止危险废物污染环境，根据《中华人民共和国固体废物污染环境防治法》的有关规定，制定本办法。

第二条 在中华人民共和国境内从事收集、贮存、利用、处置危险废物经营活动的，必须遵守本办法。

收集、贮存、利用、处置本单位产生的危险废物的不适用本办法。

第三条 国务院环境保护行政主管部门对全国危险废物经营许可证（以下简称许可证）实施统一监督管理。

第四条 从事收集、贮存、利用、处置危险废物经营活动的单位，应当向经营设施所在地的省市级人民政府环境保护行政主管部门提出申请，获准后向省级人民政府环境保护行政主管部门申请许可证。

收集、贮存、处置两个及两个以上的省、自治区、直辖市行政区域危险废物的单位，应当在地方人民政府环境保护行政主管部门审查同意后，向国务院环境保护行政主管部门申请许可证。

第五条 申请收集、贮存、利用、处置许可证的单位，应当是依法成立的企业法人及其分支机构，并应当具备与其申请经营项目相适应的下列条件：

(一) 资金、场所、技术、设施；
(二) 专业技术人员；
(三) 污染防治能力；
(四) 预防和处理经营活动中发生的污染事故和其他突发性事件的能力；
(五) 有关法律、行政法规该地规定的其他条件。

第六条 申请许可证的单位应当领取并填报许可证申请表，同时提交下列材料一式三份：

(一) 企业法人营业执照副本;
(二) 贮存、利用、处置设施的环境保护"三同时"竣工验收材料;
(三) 收集、贮存、利用、处置危险废物能力的评估报告表(以下简称评估报告表);

许可证申请表、评估报告表的内容和格式，由国务院环境保护行政主管部门制定。

✓ **第七条** 评估报告表，应当包括下列内容：

(一) 申请经营的危险废物的特性分析；
(二) 危险废物包装、运输计划；
(三) 危险废物利用的工艺，利用后残余物的处理方法；
(四) 危险废物贮存、予处理、处置工艺；
(五) 污染防治设施；
(六) 预防和处理经营活动中发生的污染事故和其他突发性事件的方案；
(七) 技术力量和管理水平；
(八) 经营能力评价结论。

第八条 从事危险废物经营能力评估工作的单位必须取得国务院环境保护行政主管部门颁发的资格证书，按照证书规定的范围，从事危险废物经营能力评估工作，

对环境影响结论负责。

第九条 地方人民政府环境保护主管部门，应当在收到申请材料之日起十天内，向申请单位作出受理或不受理的答复。不受理的应当说明理由。

省辖市人民政府环境保护行政主管部门应当在受理之日起三十日内，对申请进行审查，签署审查意见，并通知申请单位。

直辖市人民政府环境保护行政主管部门应当在受理之日起四十五日内，对申请进行审查，签署审查意见，并通知申请单位。

需要报上一级机关审批的，应当将申请材料及审核意见报送上一级环境保护行政主管部门。

上一级环境保护行政主管部门为最终审批机关的，应当在收到申请材料之日起三十日内，对申请材料进行审查，签署审查意见，并通知下一级环境保护行政主管部门和申请单位。需要再报上一级机关审批的，应当在收到申请材料之日起十五日内，签署审查意见，将申请材料及审查意见报送上一级环境保护行政主管部门。

第十条 作出批准决定的环境保护行政主管部门向申请单位颁发许可证。许可证的内容和格式，由国务院环境保护行政主管部门规定。

许可证的有效期一般为三年。处置两个及两个以上省、自治区、直辖市行政区域的危险废物的其许可证有效期为五年。

第十一条 持有许可证的单位改变经营危险废物类别或者数量的，应当在九十天以前，向省辖市级人民政府环境保护行政主管部门领取并填报许可证变更申请表，申请变更。

直辖市行政区域内从事收集、贮存、利用、处置危险废物经营活动的单位申请变更事项的，应当向直辖市人民政府环境保护行政主管部门提出申请。

各级环境保护行政主管部门，按照本办法第九条、第十条的规定，受理、审批变更申请。

变更申请被批准的，由发证机关收回原许可证，颁发变更后的许可证。

变更后的许可证有效期不超过原许可证的截止日期。

第十二条 持有许可证的单位改变经营方式、经营场所以及所经营危险废物的类别和数量发生重大变更的，应当按本办法的规定申请领取新的许可证。

第十三条持有许可证的单位终止经营的，应当在停止经营活动三十日内，将许可证交还发证机关。从事处置活动的，还应当在停止经营活动六个月以前向发证机关提交终止经营报告。

终止经营报告应当包括防止危险废物流失、防止对经营设施所在地环境造成污染、防止无关人员进入经营设施的计划、措施和资金安排。

第十四条 县级以上人民政府环境保护行政主管部门有权对行政区内危险废物经营单位进行现场检查。

被检查单位应当如实反映情况，并提供必要的资料。

第十五条 禁止将危险废物提供、委托给无许可证的单位，或者虽有许可证，但其许可证所载明的危险废物类别与所提供、委托的危险废物不符的单位。

第十六条 持有许可证的单位应当备有危险废物经营情况记录簿，载明每日收集、贮存、利用或处置危险废物的类别、数量、危险废物的最终去向、有无事故或其他异常情况等。

危险废物经营情况记录簿的保存期为六年。

第十七条 持有许可证的单位应当在每年三月前向经营设施所在地的县级人民政府环境保护行政主管部门提交上一年度危险废物经营活动年度报表同时抄报发证

机关。

在设区的市人民政府区域内的经营单位，应当向人民政府环境保护行政主管部门提交危险废物经营活动年度报表，同时抄报发证机关。

第十八条 持有许可证的单位在有效期满后继续从事危险废物经营活动的，应当在许可证有效期满60日前，按照本办法的规定申请领取新的许可证。

原持证单位不改变经营方式、经营场所，并且经营危险废物的类别和数量未发生重大变化的，在申请新的许可证时可以不提供评估报告表。

第十九条 禁止伪造、变造、出让、转让、出租、出售、出借、质押许可证。

第二十条 违反本办法规定，有下列行为之一的，由县级以上人民政府环境保护行政主管部门责令停止违法行为，没收违法所得，可以并处违法所得一倍以下的罚款：

(一) 在申请经营许可证过程中弄虚作假的；

(二) 经营单位在许可证有效期满后未领取新的许可证，仍从事经营活动的；

(三) 出让、转让、出租、出借、质押许可证的；

(四) 从事与经营许可证内容不符的经营活动的。

有前款第（三）、（四）项行为的，由发证机关吊销许可证。

第二十一条 违反本办法第十一条的规定，变更危险废物经营类别或数量，未提出申请的，由发证机关责令限期改正，可以并处五千元以下罚款。逾期不改正的，由发证机关吊销许可证，没收违法所得，并处违法所得一倍以下的罚款。

第二十二条 违反本办法第十二条规定，未领取新的许可证的，由县级以上人民政府环境保护行政主管部门责令停止违法行为，收回原许可证，没收违法所得，可以并处违法所得一倍以下罚款。

第二十三条 违反本办法第十三条，终止经营后未交还许可证的，或者从事处置活动的单位终止经营活动而未按规定的时间事先报告的，由发证机关收回许可证，可以并处五千元以下罚款。

第二十四条 违反本办法第十四条，拒绝接受有管辖权的环境保护行政主管部门现场检查，或者在被检查时弄虚作假的，处一万元以下罚款。

第二十五条 违反本办法第十五条，将危险废物提供、委托给无许可证的单位，或者提供、委托给虽有许可证，但其许可证载明的废物类别与所提供、委托的危险废物不符的单位的，由县级以上人民政府环境保护行政主管部门责令停止违法行为、限期改正，并处五万元以下罚款。

第二十六条 违反本办法第十六条，没有危险废物经营情况记录簿、未按要求载明规定事项、或者未按规定的期限保存记录簿的，由县级以上人民政府环境保护行政主管部门责令限期改正，可以并处一万元以下罚款，情节严重的，由发证机关吊销许可证。

第二十七条 未按本办法第十七条规定提交危险废物经营活动年度报表的，由发证机关责令限期改正，可以并处一万元以下罚款，情节严重的，可以由发证机关吊销许可证。

第二十八条 伪造、编造经营许可证的，由县级以上人民政府环境保护行政主管部门处以一万元以上、十万元以下罚款，同时移送司法机关追究刑事责任。

第二十九条 从事危险废物经营能力评估工作的单位，在评估工作中弄虚作假的，由国务院环境保护行政主管部门收回资格证书，并处所收费用一倍以上两倍以下罚款。

第三十条 本办法中下列用语含义：

(一) 收集：是指把分散产生的危险废物从产生地集中到贮存、处置或利用场所的全过程或某一阶段的活动。

(二) 贮存：在危险废物被处置或利用前，将其放置在符合环境保护规定要求的场所或设施中的活动。

(三) 利用：是指把危险废物直接或经过加工，部分或全部转化为原料、产品的活动。包括以向社会提供能源为主要目的，并且以危险废物为燃料的经营活动

第三十一条 各省、自治区、直辖市人民政府环境保护行政主管部门可以根据《中华人民共和国固体废物污染环境防治法》和本办法，结合本地区的实际情况，制订危险废物经营许可证管理实施细则，报同级人民政府批准实施。

第三十二条 本办法由国务院环境保护行政主管部门负责解释。

第三十三条 本办法自　　年　　月　　日起施行。在本办法颁布前已从事收集、贮存、利用、处置危险废物经营活动的，应自本办法颁布之日起　　日内，按本办法的规定申请许可证。

环境保护设施运营资质认可管理办法（试行）

第一章　总则

第一条　为加强对环境保护设施运行状况的监督，提高环境保护设施运行管理水平，发挥环境保护投资效益，促进环境保护设施运营的市场化，根据国务院关于国家环境保护总局建立和组织实施环境保护资质认可制度职责的规定，制定本办法。

第二条　本办法所称环境保护设施运营，是指专门从事环境保护设施运营或污染治理业务的环保企业（服务方）接收排污单位（委托方）的委托，进行环保设施专业化运营或污染物的处理。环境保护设施运营实行社会化有偿服务，服务方自主经营、自负盈亏，承担委托责任，保证环境保护设施正常运行和污染物达标排放。

第三条　本办法所称环境保护设施运营资质认可，是指国家环境保护行政主管部门对从事环境保护设施运营管理单位的技术能力、资金能力、管理水平、人员业务素质等从业条件的审查和认可。在中华人民共和国境内从事环境保护设施运营管理的单位，可申请《环境保护设施运营资质证书》（以下简称《运营证书》）。

第四条　《运营证书》暂分为生活污水、工业废水、除尘脱硫、有毒有害废气、生活垃圾和工业固体废弃物六个专业类别。

第五条　《运营证书》由国家环境保护总局统一管理和核发。各省、自治区、直辖市环境保护行政主管部门配合组织实施。市、县级环境保护主管部门负责《运营证书》使用过程中的查验与监督。

第二章　申请条件和程序

第六条　申请《运营证书》的单位，必须具备下列基本条件：

(一) 符合国家规定，依照法定程序批准设立，具有独立的法人资格，工业企业内部负责环境保护设施专业化、企业化运营管理的单位可以不具备法人资格；

(二) 有稳定的组织机构和固定的工作场所；

(三) 具有良好的银行资信和财务状况，具备与其业务规模相适应的债务偿还能力；

(四) 具有相应的实验或检验设备，有健全的技术和质量管理制度；

(五) 具有从事环境保护设施运营管理的经历，并且负责运营的设施运营正常运行一年以上，达到国家或地方规定的排放标准；

(六) 单位主管人员具备相应的工程设计、调试及运营管理经验，对设施的技术原理、工艺流程、运行影响因素及处置对策措施有比较全面的了解，同时具有相应专业的工程技术人员和经过系统专业培训的上岗操作人员。

第七条　申请《运营证书》的单位，须填写申请表，并同时提供下列有关申报材料：

(一) 企业法人营业执照副本或事业单位法人证书复印件；

(二) 办公、实验或检验场所证明；

(三) 两个（含两个）以上环境保护设施运营管理的实例，包括：运营项目简介，委托运营合同，用户意见，设施运行监测数据；

(四) 上一年财务状况。

第八条 《运营证书》申请单位按照下列程序办理：

(一) 申请单位向环境保护总局提出申请，领取《运营证书申请表》一式三份，并按要求填写。

(二) 申请单位应将《运营证书申请表》和申报材料报所在省、自治区、直辖市环境保护行政主管部门初审并签署意见，然后报国家环境保护总局审核。

(三) 国家环境保护总局经过材料审查和组织现场检查，对符合条件的，核发《运营证书》。

第九条 专业性环境保护企业无环境保护设施运营经历的和工业企业内部负责环境保护设施专业化、企业化运营管理的单位，可参照本办法的规定，申请临时《运营证书》，一年后经审查合格换发《运营证书》。

第三章 管理和监督

第十条 《运营证书》的持证单位，在机构、人员、资产、运营专业范围等资质条件发生较大变化时，应及时向国家环境保护总局备案，办理变更手续。

第十一条 国家环境保护总局对《运营证书》的颁发和使用情况，每年组织年检，并进行不定期的抽查。持证单位每年12月份按照检查内容，提供书面材料，到所在省、自治区、直辖市环境保护行政主管部门办理年检手续。检查和抽查的主要内容为：

(一) 持证单位资质；

(二) 工作人员资质；

(三) 履行合同情况；

(四) 设施运营管理制度及制度执行情况；

(五) 设施运营管理状况；

(六) 设施排放达标情况。

第十二条 持证单位必须按照运营合同的内容负责。如果发现有下列情形之一的，国家环境保护总局视情况轻重，责令限期整改、给予通报批评或者吊销《运营证书》，对造成严重后果的，有关部门依法追究其经济和法律责任：

(一) 因运营管理不当，达不到有关规定和标准，或造成重大环境污染事故和经济损失的；

(二) 因条件变化，已无能力开展设施运营活动的；

(三) 违反本办法有关规定的，涂改、伪造和转借《运营证书》的；

(四) 无正当理由，拒绝接收检查或不按期办理年检的；

(五) 连续两次年检不合格的；

第十三条 《运营证书》有效期为三年。获证单位可在《运营证书》期满前半年向所在省、自治区、直辖市环境保护行政主管部门提出延期申请，由其签署意见后报国家环境保护总局。国家环境保护总局组织对延期申请进行复审，复审合格的，由国家环境保护总局换发《运营证书》。

第四章 附则

第十四条 《运营证书》和《运营证书申请表》由国家环境保护总局统一印制。

第十五条 本办法由国家环境保护总局负责解释，并另行制订实施细则。

第十六条 本办法自发布之日起施行。

国家环境保护总局文件

环发［1999］212号

关于实施《环境保护设施运营资质认可管理办法（试行）》有关问题的通知

各省、自治区、直辖市及计划单列市环境保护局，国务院各有关部门：

为贯彻实施《环境保护设施运营资质认可管理办法（试行）》，规范环境保护设施运营资质认可工作，现将有关事项通知如下：

一、环境保护设施运营资质认可范围包括：生活污水、工业废水、除尘脱硫、有毒有害废气、生活垃圾和工业固体废弃物处理设施运营，生态保护设施及其他环境保护设施运营暂不开展资质认可。

具备资质申请条件的环境保护设施运营单位，可申请其中一个或几个专业类别的环境保护设施运营资质。

二、环境保护设施运营资质证书（以下简称“运营证书”）暂不划分级别。运营证书分为正式证书和临时证书两种。获得临时和正式运营证书的单位可在全国范围内从事证书所规定类别的环境保护设施的运营管理业务。

三、环境保护设施运营资质认可实行“一级发证，分级管理”的原则。

（一）国家环境保护总局管理职责：

1、制订环境保护设施运营资质认可行政管理规章；

2、对环境保护设施运营资质认可的申请进行审批，印制、核发运营证书；

3、组织对获得资质认可的单位进行监督检查，作出收回运营证书的处理决定；

4、指导并监督规范各省市环境保护行政主管部门环境保护设施运营资质管理工作，纠正管理工作中的违规行为；

5、总结和交流环境保护设施运营管理经验。

6、组织制订环保设施操作人员培训大纲，指导地方环境保护行政主管部门的培训工作。

国家环境保护总局科技标准司具体负责环境保护设施运营资质管理的有关工作。

（二）省级（包括计划单列市）环境保护行政主管部门管理职责：

1、贯彻实施和宣传国家环境保护总局环境保护设施运营资质认可有关的规章。

2、受理企业的申请，组织对申报材料进行审查，对申报单位进行现场检查，统一向国家环境保护总局上报申报材料和审查意见，并按国家环境保护总局的审批

结果，统一领取运营证书，向合格的单位发放证书；

3、受国家环境保护总局的委托，组织对持证单位的抽检和年检工作；

4、对重大违规的持证单位作出限期整改的决定或向国家环境保护总局提出收回证书的处理建议；

5、指导并监督地（市）及环境保护行政主管部门环境保护设施运营资质管理工作，纠正违规行为；

6、对培训合格的环保设施操作人员批准发放国家统一格式、省级印制盖章的岗位培训合格证书。

省级环境保护行政主管部门环境保护设施运营资质认可管理工作由主管环保产业的部门负责。

（三）地（市）及环境保护行政主管部门管理职责：

1、宣传贯彻和落实环境保护设施运营资质认可的有关规定；

2、对设施运营状况进行现场检查监督；

3、负责操作人员培训、考核，上报培训考核结果，并接审批结果发放操作人员培训合格证书；

4、查验运营证书及操作人员岗位培训合格证书；

5、经省及环境保护行政主管部门授权对违规运营单位进行处理；

6、配合省级环境保护行政主管部门对持证单位进行抽查和年检。

四、申请环境保护设施运营资质的单位，必须具备下列基本条件：

（一）符合国家规定，依照法定程序批准设立，具有独立的注人资格。工业企业内部；负责环境保护设施专业化、企业化运营管理的单位可以不具备法人资格；

（二）有稳定的组织机构和固定的工作场所；

（三）具有良好的银行资信和财务状况，具备与其业务规模相适应的债务偿还能力；

（四）具有相应的实验或检验设备，有健全的技术和质量管理制度；

（五）具有从事环境保护设施运营专业化、企业化管理的经历，负责运营的设施正常运行一年以上，并稳定达到国家或地方规定的排放标准；

（六）单位主管人员具备相应的工程设计、调试及运营管理经验，对设施的技术原理、工艺流程、运行条件、运行影响因素及处置对策措施有比较全面的了解，同时具有相应专业的工程技术人员和经过系统专业培训的上岗操作人员。

（七）必须建立以下工作制度或工作规程：

1、岗位责任制

2、操作人员培训、考核制度

3、设施运营操作规程

4、设施和监测仪器管理、维护制度

5、设施运营状况记录及监督检查制度

6、安全工作制度

五、申请环境保护设施运营资质认可的单位，须填写申请表，并同时提供下列申报材料：

（一）企业法人营业执照副本或事业单位法人证书。

（二）办公、实验或检验场所证明。

（三）两个（含两个）以上环境保护设施运营管理实例，包括：运营项目简介，

运营合同，用户意见，地方环境保护部门出具的设施运行检测报告。

（四）上一年度财务状况，包括：资产负债表和损益表。

六、运营证书的申请程序。

申请环境保护设施运营资质认可，按属地管理原则，由申请单位向所在辖区省级环境保护行政主管部门领取并填写《环境保护设施运营资质证书申请表》（以下简称“申请表”）一式三份，按要求填写后，分别于上半年四月底前、下半年九月底前将申请表和其他申报材料上报所在辖区的省级环境保护行政主管部门。

省级环境保护行政主管部门受理申报材料后，于三十日内完成对申请单位的现场检查和申请表的初审，签署初步审查意见，对符合规定条件的加盖印章后，将申报材料分别于上半年五月底前、下今年十月底前统一报送国家环境保护总局科技标准司。

国家环境保护总局不直接受理申请单位报送的申报材料和超越申报期限报送的申报材料。

国家环境保护总局科技标准司对申报材料进行登记和形式审查后，根据设施运营资质申请单位的实际情况和工作需要，按照环境保护设施运营检查要求，组织检查组对个别申请单位进行现场抽查。

七、国家环境保护总局每年分别在六月份和十一月份进行两次集中审查。对符合要求的，公布通过资质认可的名单，并颁发运营证书；对不符合规定要求未获资质认可的单位，由国家环境保护总局书面通知有关省级环境保护行政主管部门。未通过评审的申报单位须隔一年以后方可重新申请。

八、关于临时证书。

临时证书的发放对象为：

1、从事环境保护设施专业化、企业化运营管理业务，且与委托方签署了运营合同意向书，但又没有环境保护设施运营经历的环境保护专业公司；

2、工业企业内部实行环境保护设施企业化运行管理的非环境保护专业公司，如对外开展环境保护设施运营业务，并与委托方签署了运营合同意向书，也可申请临时证书。

临时运营证书的有效期为一年。临时运营证书持证单位在证书有效期截止日期三个月前申请换发正式的运营证书。经审查，对符合设施运营资质认可条件的，颁发正式运营证书。未通过审查的，收回临时证书。申请临时证书和申请换证的程序同管理办法第八条。

签署了运营合同意向书但又没有环境保护设施运营经历的临时运营证书持证单位，除符合环境保护设施资质认可条件外，还需正式开展环境保护设施运营业务，方可换发正式证书；工业企业内部实行环境保护设施企业化运营管理的临时运营证书持证单位，除符合环境保护设施资质认可条件外，需正式对外承担环境保护设施运营业务，方可换发正式证书。

九、运营证书的发放。由省级环境保护行政主管部门统一从国家环境保护总局领取证书，向获证单位发放。发放证书时，除证书工本费外，不得向取证单位收取其它费用。

十、省级环境保护行政主管部门受国家环境保护总局委托对辖区内的单位进行年检。受检单位须在十二月底之前提供以下书面材料，到所在辖区的省级环境保护行政主管部门办理年检手续：

（一）持证单位资质的基本情况。

（二）主要技术骨干、工作场所、技术装备变化及内部管理制度的建立与执行情况。

（三）上一年度运营管理的环境保护设施的合同履行情况、设施运行情况和设施所在市、县级环境保护行政主管部门关于设施运行状况的证明材料。

省级环境保护行政主管部门对年检材料进行审查，对年检合格的单位在运营证书副本上加盖年检合格专用章；对年检不合格的单位要求进行限期整改。限期整改达到要求的单位可以通过年检，对超过整改期限仍不合格的，视为年检不合格，在运营证书副本上加盖年检不合格专用章，并向其提出警告。连续两年年检不合格的，收回运营证书。

以下情况视为年检不合格：

1、不执行环境保护设施运营管理制度

2、不履行运营合同

3、运营的环境保护设施未达标排放

省级环境保护行政主管部门在每年二月底之前根据上一年度年检结果，写出年检工作总结，上报国家环境保护总局科技标准司。报告主要包括：年检情况、工作意见和建议。

年检工作每年十二月份开始，次年三月底结束。

十一、在运营证书有效期内，有下列情况之一的，庄及对向所在辖区省级环境保护行政主管部门申请换发证书，由其上报国家环境保护总局，国家环境保护总局根据变更内容，重新该发证书。

（一）组织机构发生变化

（二）法人代表及主要技术负责人发生变化

（三）资产发生变化

（四）运营范围发生变化

十二、运营证书分为正本和副本。运营证书包括运营单位名称、地址、性质、注册资金、业务范围、证书有效期、证书等级和证书编号等内容。

十三、运营证书有效期为三年。持证单位在运营证书期满前六个月内向所在辖区省级环境保护行政主管部门提出书面复查换证申请，由其组织复查。复查程序同管理办法第八条。到期不申请或复审不合格的，收回运营证书。

十四、地方各级环境保护行政主管部门不得颁发运营证书或其他与运营证书效力相同的证件，违反规定的，国家环境保护总局给予通报批评或暂停所委托管理的职权。

十五、环境保护设施运营具体操作人员必须经培训合格，持证上岗。环保法规标准方面的培训由地、市级环保部门负责，业务技术操作规程方面的培训由运营企业自己负责，培训后的考核由地、市级环境保护行政主管部门负责。

十六、环境保护设施运营管理收费暂按照委托服务收费的形式通过签订合同执行，国家有政策规定的按国家政策规定执行。

各级环境保护行政主管部门要认真按本通知的要求，积极组织好环境保护设施运营资质认可申报工作，努力推进环境保护设施运营业的发展。工作中如有问题，请及时与回家环境保护总局科技标准司联系。

一九九九年九月二十四日

主题词：实施　环保　运营　资质　通知

国家环境保护总局　　1999年9月24日印发

⑧

国家环境保护局令

第１０号

《排放污染物申报登记管理规定》已于一九九二年七月三日经国家环境保护局局务会议通过，现予发布，自一九九二年十月一日起施行。

局长　　曲格平

一九九二年八月十四日

排放污染物申报登记管理规定

第一条 为加强对污染物排放的监督管理；根据《中华人民共和国环境保护法》及有关法律法规制定本规定。

第二条 凡在中华人民共和国领域内及中华人民共和国管辖的其它海域内直接或者间接向环境排放污染物、工业和建筑施工噪声或者产生固体废物的企业事业单位（以下简称“排污单位”），按本规定进行申报登记（以下简称“排污申报登记”），法律、法规另有规定的，依照法律、法规的规定执行。

放射性废物生活垃圾的申报登记不适用本规定。

第三条 县级以上环境保护行政主管部门对排污申报登记实施统一监督管理，排污单位的行业主管部门负责审核所属单位排污申报登记的内容。

第四条 排污单位必须按所在地环境保护行政主管部门指定的时间，填报《排污申报登记表》，并按要求提供必要的资料。新建、改建、扩建项目的排污申报登记，应在项目的污染防治设施竣工并经验收合格后一个月内办理。

第五条 排污单位必须如实填写《排污申报登记表》，经其行业主管部门审核后向所在地环境保护行政主管部门登记注册，领取《排污申报登记注册证》。

排放污染物的个体工商户的排污申报登记，由县级以上地方环境保护行政主管部门规定。

排污单位终止营业的，应当在终止营业后一周内向所在地环境保护行政主管部门办理注销登记，并交回《排污申报登记注册证》。

第六条 排污单位申报登记后，排放污染物种类、数量、浓度、排放去向、排放地点、排放方式。噪声源种类、数量和噪声强度、噪声污染防治设施或者固体废物的储藏、利用或处置场所等需作重大改变的，应在变更前十五天，经行业主管部门审核后，向所在地环境保护行政主管部门履行变更申报手续，征得所在地环境保护行政主管部门的同意，填报《排污变更申报登记表》；发生紧急重大改变的，必须在改变后三天内向所在地环境保护行政主管部门提交《排污变更申报登记表》。发生重大改变而未履行变更手续的，视为拒报。

第七条 排放污染物超过国家或者地方规定的污染物排放标准的企业事业单位，在向所在地环境保护部门申报登记时，应当写明超过污染物排放标准的原因及限期治理措施。

第八条 需要拆除或者闲置污染物处理设施的，必须提前向所在地环境保护部门申报，说明理由。环境保护部门接到申报后，应当在一个月内予以批复，逾期末批复的，视为同意。

未经环保部门同意，擅自拆除或者闲置污染物处理设施未申报的，视为拒报。

第九条 法律法规对排污申报登记的时间和内容已有规定的，按已有规定执行。

第十条 建筑施工噪声的申报登记，按《中华人民共和国环境噪声污染防治条例》第二十二条的规定执行。

第十一条 排污单位对所排放的污染物，按国家统一规定进行监测、统计。

第十二条 排污单位的废水排放口、废气排放口、噪声排放源和固体废物储藏、处置场所应适于采样、监测计量等工作条件，排污单位应按所在地环境保护行政主管部门的要求设立标志。

第十三条 县级以上环境保护行政个管部门有权对管辖范围内的排污单位进行现场检查，核实排污申报登记内容。被检查单位必须如实反映情况，提供必要的资料。

进行现场检查的环境保护行政主管部门必须为被检查单位保守技术及业务秘密。

第十四条 县级以上环境保护行政主管部门应建立排污申报登记档案，省辖市级以上的环境保护行政主管部门应建立排污申报登记数据库。

第十五条 排污单位拒报或谎报排污申报登记事项的，环境保护行政主管部门可依法处以三百元以上三千元以下罚款，并限期补办排污申报登记手续。

第十六条 《排污申报登记表》、《排污变更申报登记表》、《排污申报登记注册证》的格式和排污申报登记数据库的建设规范由国家环境保护局统一制定。

第十七条 本办法自一九九二年十月一日起施行。

天津市环境保护条例

（1994年11月10日天津市第十二届人民代表大会
常务委员会第十二次会议通过）

第一章 总 则

第一条 为保护和改善本市的生活环境与生态环境，防治污染和其他公害，保障人民群众身体健康，促进社会主义现代化建设，根据《中华人民共和国环境保护法》和其他法律、法规，结合本市实际情况，制定本条例。

第二条 本条例适用于本市管辖的行政区域和海域。

第三条 环境保护必须坚持预防为主、防治结合、综合防治的方针以及谁污染谁治理和污染者付费的原则。

第四条 市和区、县人民政府应当把环境保护规划纳入国民经济和社会发展计划与城市规划，制定和实施有利于环境保护的经济、技术政策和措施，使环境保护与经济建设、社会发展相协调。

第五条 市和区、县人民政府及有关部门应当推进环境保护科学技术的研究、开发及应用。

第六条 市和区、县人民政府应当扶持、发展环境保护产业和环境标志产品，对资源及工业废弃的综合利用和防治污染的技术改造项目实行优惠政策。

第七条 市和区、县人民政府应当对本行政区的环境质量负责，实行环境保护目标责任制；定期向同级人民代表大会及其常务委员会和上级人民政府报告环境保护工作和环境质量状况。

第八条 市和区、县人民政府和有关部门、单位，对国家规定用于环境保护的资金，应当予以落实并合理安排使用，不得截留或者挪作他用；积极开辟新的资金渠道，逐步增加对环境保护的投入，提高环境保护投资额在国民生产总值中的比例；逐步建立环境污染治理基金。

第九条 市和区、县人民政府应当组织协调各方面的力量，开展以防治工业污染和加强环境基础设施建设为主要内容的环境综合整治，并实行环境综合整治定量考核制度，每年将定量考核结果向社会公布。

第十条 各街道办事处和乡、镇人民政府负责本行政区的环境保护监督工作。

化学危险物品安全管理条例

（１９８７年２月１７日国务院发布）

第一章　总　则

第一条　为了加强对化学危险物品的安全管理，保证安全生产，保障人民生命财产的安全，保护环境，特制定本条例。

第二条　凡在中华人民共和国境内生产、储存、经营、运输和使用化学危险物品的单位和个人，必须遵守本条例。

第三条　本条例所指化学危险物品，系指中华人民共和国国家标准ＧＢ×××××——８６《危险货物分类与品名编号》规定的分类标准中的爆炸品、压缩气体和液化气体、易燃液体、易燃固体、自燃物品和遇湿易燃物品、氧化剂和有机过氧化物、毒害品和腐蚀品七大类。

放射性物品、民用爆炸物品、兵器工业的火药、炸药、弹药、火工产品和核能物资以及国家法律、行政法规有专门规定的，按国家有关规定执行。

第四条　生产、储存、经营、运输和使用化学危险物品的单位，必须建立健全化学危险物品安全管理制度。

第五条　化学危险物品的生产企业、仓库和专用车站、码头必须设在安全地点。

第六条　国务院和地方各级人民政府的有关部门，按照职责范围，负责本条例的贯彻实施和监督检查。

第二章　化学危险物品的生产和使用

第七条　国家对化学危险物品的生产，统一规划，严格管理。

国家对新建、扩建、改建生产剧毒化学危险物品企业实行严格控制。

禁止乡、镇、街道企业生产剧毒化学危险物品。

第八条　新建、扩建、改建生产化学危险物品的企业，必须经所在地省辖市以上（含省辖市）人民政府审查同意，并按照国家有关规定履行审批手续。

第九条　地方新建、扩建，改建生产剧毒化学危险物品的企业，必须经所在省、自治区、直辖市人民政府审批，并报化学工业部备案。

第十条　新建、扩建、改建生产化学危险物品的企业必须向审批单位提交下列文件：

（一）设计任务书（包括工艺、厂区布置、周围建筑情况、厂区周围一千米范围内的居民情况等）；

（二）原料、中间产品和最终产品的理化性能；

（三）对储存、运输、包装的技术要求；

（四）工业卫生、安全和环境保护影响评价；

（五）处理灾害性事故的应急措施。

审批单位必须会同当地化工、公安、卫生、环保、劳动部门进行审议。

项目建成后，有关单位应当组织参加审议的单位进行竣工验收，验收合格方能投产。

第十一条 新建、扩建、改建生产化学危险物品的企业，必须持有省级化学研究（检验）部门测定的产品燃点、自燃点、闪点、爆炸极限、毒性等技术资料，向省、自治区、直辖市化工行政管理部门申请领取生产许可证，并依照有关规定到工商行政管理部门登记注册。

第十二条 生产和使用化学危险物品的企业，应当根据化学危险物品的种类、性能、设置相应的通风、防火、防爆、防毒、监测、报警、降温、防潮、避雷、防静电、隔离操作等安全设施。

生产企业应当根据需要，建立消防和急救组织。

第十三条 生产化学危险物品的企业必须严格执行有关工业产品质量责任的法规，保证产品质量符合国家规定的标准。

第十四条 企业生产化学危险物品所使用的压力容器，必须符合国家有关压力容器的规定，并应经常进行维护和监测。

第十五条 化学危险物品的包装和标志必须符合国家规定。

包装监督检验机构应当加强对包装质量和包装材质的监督检查和定期测试。

第十六条 生产、使用化学危险物品的单位和个人，必须遵守各项安全生产制度和操作规程，严格用火管理制度。

第十七条 生产、使用化学危险物品时，必须有安全防护措施和用具。

第十八条 盛装化学危险物品的容器，在使用前后，必须进行检查，消除隐患，防止火灾、爆炸、中毒等事故发生。

第十九条 生产化学危险物品的装置，应当密闭，并设有必要的防爆、泄压设施。

生产有毒物品应当设有监测、报警、自动联锁、中和、消除等安全及工业卫生设施。

第二十条 生产、使用化学危险物品的企业必须按照环境保护法的规定，妥善处理废水、废气、废渣。

第二十一条 销毁、处理有燃烧、爆炸、中毒和其他危险的废弃化学危险物品，应当采取安全措施，并征得所在地公安和环境保护等部门同意。

第三章 化学危险物品的储存

第二十二条 化学危险物品必须储存在专用仓库、专用场地或专用储存室（柜）内，并设专人管理。

化学危险物品的生产车间、经销商店，可根据需要设立周转性的化学危险物品仓库，其储存限量由当地主管部门与公安部门规定。

交通运输部门的车站、码头，应当修建专用仓库储存化学危险物品。修建专用仓库确有困难又必须在一般仓库短期储存化学危险物品的，应当保持一定的安全距离、隔离存放。

第二十三条 化学危险物品专用仓库、应当符合有关安全、防火规定，并根据物品的种类、性质，设置相应的通风、防爆、泄压、防火、防雷、报警、灭火、防晒、调温、消除静电、防护围堤等安全设施。

第二十四条 储存化学危险物品，应当符合下列要求：

（一） 化学危险物品应当分类分项存放，堆垛之间的主要通道应当有安全距

离，不得超量储存；

（二） 遇火、遇潮容易燃烧、爆炸或产主有毒气体的化学危险物品，不得在露天、潮湿、漏雨和低洼容易积水的地点存放；

（三） 受阳光照射容易燃烧、爆炸或产生有毒气体的化学危险物品和桶装、罐装等易燃液体、气体应当在阴凉通风地点存放；

（四） 化学性质或防护、灭火方法相互抵触的化学危险物品，不得在同一仓库或同一储存室内存放。

第二十五条 化学危险物品入库前，必须进行检查登记，入库后应当定期检查。

第二十六条 储存化学危险物品的仓库内严禁吸烟和使用明火。对进入仓库区内的机动车辆必须采取防火措施。

第二十七条 储存化学危险物品的仓库，应当根据消防条例，配备消防力量和灭火设施以及通讯、报警装置。

第四章 化学危险物品的经营

第二十八条 国家对化学危险物品实行经营许可证制度。

禁止无证经营化学危险物品。

第二十九条 经营化学危险物品的企业必须具备下列条件：

（一）有符合安全要求的经营设施；

（二）有熟悉专业的技术人员；

（三）有相应的管理制度。

第三十条 新建、扩建、改建经营化学危险物品的企业，必须向所在地的县级以上（含县级）商业局提出申请；当地商业局会同有关部门审查同意后，由省、自治区、直辖市商业厅（局）核发经营许可证。

省、自治区、直辖市商业厅（局）应当每隔2至3年会同有关部门对经营许可证复查一次。

第三十一条 化学危险物品的流通，应当遵守下列规定：

（一）计划分配的化学危险物品，按计划供应；

（二）计划外正常供需渠道的化学危险物品，按合同供应；

（三）使用单位临时需要的化学危险物品，需凭该单位县级以上（含县级）主管部门出具的证明（注明品种、数量、用途）采购；

（四）日常生活需要的且购量不超过500克或500毫升（有特殊限量的除外）的零星化学危险物品，可直接向经营企业购买。

第五章 化学危险物品的运输装卸

第三十二条 运输化学危险物品，必须按照国家有关危险货物运输管理规定办理。对不符合规定的，发货人不得托运，运输部门不得承运。

第三十三条 运输装卸化学危险物品，应当遵守下列规定：

（一）轻拿轻放，防止撞击、拖拉和倾倒；

（二）碰撞、互相接触容易引起燃烧、爆炸或造成其他危险的化学危险物品，以及化学性质或防护、灭火方法互相抵触的化学危险物品，不得违反配装限制和混合装运；

（三）逾热、逾潮容易引起燃烧、爆炸或产生有毒气体的化学危险物品，在装

运时应当采取隔热、防潮措施。

第三十四条 装运化学危险物品时不得客货混装。

载客的火车、船舶、飞机机舱不得装运化学危险物品。

禁止乘客随身携带、夹带化学危险物品乘坐上述交通工具。

第三十五条 禁止无关人员搭乘装运化学危险物品的车厢、船舱和飞机机舱。

第三十六条 装运化学危险物品的车辆（火车除外）通过市区时，应当遵守所在地公安机关规定的行车时间和路线，中途不得随意停车。

第三十七条 对质量检验或科学研究需的小量易燃、易爆化学危险物品的样品或试剂，在确保安全的条件下，可按有关规定办理快件托运。

第六章 罚 则

第三十八条 对违反本条例规定的单位视情节轻重，由当地人民政府或有关主管部门责令限期改进或停产、停业整顿；整顿后仍达不到规定要求的，应当吊销其生产许可证或经营许可证。

第三十九条 对违反本条例规定的有关人员，由有关主管部门视情节轻重给予行政处罚，构成犯罪的由司法机关依法追究刑事责任。

第七章 附 则

第四十条 本条例由国家经济委员会负责解释。

第四十一条 国务院有关部门和各省、自治区、直辖市人民政府可依据本条例规定，制定实施细则。

第四十二条 本条例自发布之日起施行。１９６１年1月２８日，国务院批转国家经委、化学工业部、铁道部、商业部、公安部试行的《关于中、小型化工企业安全生产管理规定》、《化学危险物品储存管理暂行办法》、《化学危险物品凭证经营、采购暂行办法》、《铁路危险物品运输规则》、《化学危险物品防火管理规则》、《关于违反爆炸、易燃物品管理规则处罚暂行办法》同时废止。

中华人民共和国公安部令

第18号

《易燃易爆化学物品消防安全监督管理办法》已经１９９４年１月２５日公安部部务会议通过，现予发布，自１９９４年５月１日起施行。

公安部部长　陶四驹

一九九四年三月二十四日

易燃易爆化学物品

消防安全监督管理办法

第一章 总　则

第一条　为加强易燃易爆化学物品的消防安全监督管理，保障国家和人民生命财产安全，根据《中华人民共和国消防条例》《化学危险物品安全管理条例》的规定，制定本办法。

第二条　本办法适用于中华人民共和国境内生产、使用、储存、经营、运输和销毁易燃易爆化学物品的单位和个人。

第三条　本办法所称易燃易爆化学物品，系指国家标准ＧＢ１２２６８－９０《危险货物品名表》中以燃烧爆炸为主要特性的压缩气体和液化气体；易燃液体、易燃固体、自燃物品和遇湿易燃物品、氧化剂和有机过氧化物、毒害品、腐蚀品中部分易燃易爆化学物品。

第四条　新建、扩建、改建的生产、储存易燃易爆化学物品的工厂、仓库和装运易燃易爆化学物品的专用车站、码头，必须设在城镇以外的独立安全地带。对已建成的严重影响城市消防安全的工厂、仓库，应纳入城市改造规划，并分别采取限期搬迁、改变使用性质、限制生产或储存化学物品种类和数量等措施，消除不安全因素。

第五条　生产、储存、经营和运输易燃易爆化学物品的单位和个人，必须填报《易燃易爆化学物品消防安全审核申报表》或《易燃易爆化学物品准运证审核申报表》，经公安消防监督机构审核合格后，分别填发《易燃易爆化学物品消防安全审核意见书》《易燃易爆化学物品安全许可证》或《易燃易爆化学物品准运证》。

无《易燃易爆化学物品消防安全审核意见书》《易燃易爆化学物品消防安全许可证》

《易燃易爆化学物品准运证》的单位和个人不得生产、储存、经营、运输易燃易爆化学物品。

第六条 民用建筑、民用地下建筑不得用于生产、储存易燃易爆化学物品。

第二章 生产、使用监督管理

第七条 生产、使用易燃易爆化学物品的单位和个人，必须具备下列条件：

（一）生产、使用易燃易爆化学物品的建筑和场所必须符合建筑设计防火规范和有关专业防火规范；

（二）生产、使用易燃易爆化学物品的场所必须按照有关规范安装防雷保护设施；

（三）生产、使用易燃易爆化学物品场所的电气设备，必须符合国家电气防爆标准；

（四）生产设备与装置必须按国家有关规定设置消防安全设施，定期保养，校验；

（五）易产生静电的生产设备与装置，必须按规定设置导除静电设施并定期进行检查；

（六）从事生产易燃易爆化学物品的人员必须经主管部门进行消防安全培训，经考试取得合格证，方准上岗。

第八条 易燃易爆化学物品出厂时，必须有产品安全说明书。说明书中必须有经法定检验机构测定的该物品的闪点、燃点、自燃点、爆炸极限等数据和防火、灭火、安全储运的注意事项。

第九条 易燃易爆化学物品的灌装容器、包装及其标志必须符合国家标准或行业标准。

第十条 大量销毁易燃易爆化学物品时，应当征得所在地公安消防监督机构同意。

第二章 储存、经营监督管理

第十一条 易燃易爆化学物品的储存应当遵守《仓库防火安全管理规则》，同时还应当符合下列条件：

（一）专用仓库、货场或其他专用储存设施，必须由经过消防安全培训合格的专人管理；

（二）应根据ＧＢ１２２６８-９０《危险货物品名表》分类、分项储存。化学性质相抵触或灭火方法不同的易燃易爆化学物品，不得在同一库房内储存；

（三）不得超量储存。

第十二条 易燃易爆化学物品的储存单位必须建立入库验收、发货检查、出入库登记制度。凡包装、标志不符合国家标准或破损、残缺、渗漏、变形及物品变质、分解的，严禁出入库。

第十三条 易燃易爆化学物品仓库管理人员在发货时，必须检查提货单位的《易

燃易爆化学物品准运证》，无《易燃易爆化学物品准运证》的不得发货。

第十四条 经营易燃易爆化学物品的单位和个人，必须具备下列条件：

（一）有符合防火防爆要求的储存、经营设施；

（二）有经过消防培训合格的经营人员；

（三）有消防安全管理制度。

第四章 运输监督管理

第十五条 运输易燃易爆化学物品的车辆必须办理《易燃易爆化学物品准运证》，无《易燃易爆化学物品准运证》的车辆不得从事易燃易爆化学物品的运输业务。

第十六条 办理《易燃易爆化学物品准运证》必须具备下列条件：

（一）有主管部门或单位的证明、车辆年检证、驾驶员证、押运员证；

（二）有符合消防安全要求的运输工具和配备相应的消防器材；

（三）有经过消防安全培训合格的驾驶员、押运员。

第十七条 《易燃易爆化学物品准运证》分长期和临时两种，全国通用。长期《易燃易爆化学物品准运证》期限为一年，急需运输的可办一次性临时《易燃易爆化学物品准运证》。

第十八条 《易燃易爆化学物品准运证》由承运单位或个人所在县（含县）以上公安消防监督机构批准填发。

第十九条 运输易燃易爆化学物品，应当遵守下列规定：

（一）运输单位和个人必须对装运物品严格检查，对包装不牢、破损、品名标签、标志不明显的易燃易爆化学物品和不符合安全要求的罐体、没有瓶帽的气体钢瓶不得装运；

（二）轻拿轻放，防止碰撞、拖拉和倾倒；

（三）运输易燃易爆化学物品的车辆、船舶，须彻底清扫冲洗干净后，才能继续装运其他危险物品；

（四）化学性质、安全防护、灭火方法互相抵触的易燃易爆化学物品，不得混合装运；

（五）遇热容易引起燃烧、爆炸或产生有毒气体的化学物品，按夏季限运物品安排，宜在夜间运输，必要时应采取隔热降温措施不宜在阴雨天运输，若必须运输时，除具有良好的装卸条件外，还应有防潮遮雨措施；

（六）遇潮容易引起燃烧、爆炸或产生有毒气体的化学物品。

第二十条 无关人员不得搭乘装有易燃易爆化学物品的运输工具。

第二十一条 运输易燃易爆化学物品的车辆标志，必须符合国家标准ＧＢ１３３９２—92《道路运输危险货物车辆标志》。

第二十二条 运输压缩、液化气体和易燃液体的槽、罐车的颜色，必须符合国家色标要求，并安装静电接地装置和阻火设备。

第五章 罚 则

第二十三条 违反本办法规定的，按照《中华人民共和国治安管理处罚条例》和有关消防法规予以处罚。构成犯罪的，依法追究刑事责任。

第六章 附 则

第二十四条 与本办法相配套的《化学危险物品消防安全监督管理品名表》《易燃易爆化学物品消防安全许可证》《易燃易爆化学物品准运证》由公安部统一制定、印制。

第二十五条 本办法自１９９４年５月１日起施行。

APPENDIX B

COPIES OF TIANJIN'S REGULATIONS/POLICIES ON CHEMICAL/HAZARDOUS MATERIAL MANAGEMENT

天津市人民政府令

第13号

《天津市有毒化学品污染环境防治办法》已经市人民政府批准，现予发布施行。

市　长　李盛霖

一九九九年七月十六日

天津市有毒化学品污染环境防治办法

第一条　为防治有毒化学品污染环境，保障人体健康，根据环境保护的有关法律、法规，结合本市实际，制定本办法。

第二条　在本市行政区域内生产、贮存、经营、运输、使用有毒化学品的，必须遵守本办法。

第三条　按照本办法所管理的有毒化学品，是指列入国家和本市优先环境管理化学品名录的有毒化学品。

第四条　凡生产、贮存、经营、运输、使用有毒化学品的单位或个人，都有保护环境的义务，必须贯彻预防为主、防治结合的方针，建立、健全有毒化学品环境管理制度，完善有毒化学品污染事故应急救援系统，实行清洁生产，防止发生因有毒化学品污染导致对环境和生态的破坏行为。

第五条　市环境保护行政主管部门负责全市有毒化学品污染环境防治工作的统一的监督管理。

各区、县环境保护行政主管部门负责本辖区内有毒化学品污染环境防治工作的监督管理。

天津经济技术开发区、天津港保税区和天津新技术产业园区的华苑产业区的有毒化学品污染环境防治工作，分别由本区管理委员会按照本办法组织实施。

公安、劳动、卫生、工商、交通、铁路、民航等管理部门，依照有关规定对防治有毒化学品污染环境实施管理。

第六条　各级环境保护行政主管部门有权对管辖范围内生产、贮存、经营、运输、使用有毒化学品的单位或个人进行现场检查。被检查单位或个人必须如实反映情况，提供必要的资料。检查部门应当为被检查的单位或个人保守技术和业务秘密。

第七条 市环境保护行政主管部门负责对直接从事生产、贮存、经营、运输、使用有毒化学品环境保护的主管人员进行防治污染的专业培训。

第八条 生产、贮存、经营、使用有毒化学品的单位或个人，必须在生产有毒化学品之日起3个月内，贮存、经营、使用有毒化学品之日起1个月内，向所在区、县环境保护行政主管部门办理环境管理登记手续，并由市环境保护行政主管部门发给登记证明。

凡在本办法实施前已生产、贮存、经营、使用有毒化学品的单位或个人，应在本办法施行之日起3个月内补办环境管理登记手续。

第九条 凡生产、贮存、经营、使用有毒化学品的单位或个人，应于每年3月份向所在区、县环境保护行政主管部门报告上一年度实际生产、贮存、经营、使用有毒化学品的数量以及当年的计划量和其他有关情况，同时接受市环境保护行政主管部门对环境管理登记证明的年度审验。

第十条 单位或个人凡生产、贮存、经营、使用新的有毒化学品种类的，需按国家有关规定进行评审，并持评审结果向市环境保护行政主管部门备案。

第十一条 新建、扩建、改建、迁建、技术改造涉及生产、贮存、经营、使用有毒化学品的建设项目，必须遵守国家和本市建设项目环境保护的有关规定，并向环境保护行政主管部门报送环境影响报告书。

第十二条 凡生产、贮存、经营、使用有毒化学品的单位或个人，应在关闭、停产、停业、合并、转产及停用后2个月内，向市环境保护行政主管部门备案，并接受市环境保护行政主管部门组织的环境保护安全评价。

第十三条 在水源保护区、自然保护区、风景名胜区、文物保护区和其他需要特殊保护的区域内，禁止生产、贮存、经营、使用有毒化学品。

对在前款所列区域内已生产、贮存、经营、使用有毒化学品的，由市和区、县人民政府责令其限期搬迁。

第十四条 单位或个人集中处理废弃有毒化学品包装容器，应向环境保护行政主管部门报告并符合环境保护的有关规定，接受环境保护行政主管部门的监督。

第十五条 违反本办法第六条规定，拒绝环境保护行政主管部门现场检查或者在被检查时弄虚作假的，由环境保护行政主管部门根据不同情节给予警告，并可处1万元以下的罚款。

第十六条 违反本办法第八条规定，不按照本办法规定办理环境管理登记或在申报登记时弄虚作假的，由环境保护行政主管部门责令其限期改正，对逾期仍不改正的，处1万元以下罚款。

第十七条 违反本办法第十四条第二款规定的，由环境保护行政主管部门按照有关规定予以处罚。

第十八条 违反本办法规定，造成重大有毒化学品污染事故的，按照有关法律、法规或规章的规定处理。

第十九条 对被处以罚款的单位和个人，不免除其消除污染、排除危害和赔偿损失的责任。

第二十条 被处罚的单位和个人，对处罚决定不服的，可以依法申请行政复议或直接向人民法院提起诉讼。逾期不申请行政复议也不向人民法院起诉又不履行处罚决定

的，由做出处罚决定的部门申请人民法院强制执行。

第二十一条 环境保护监督管理人员滥用职权、玩忽职守、徇私舞弊的，由其所在单位或其上级主管机关给予行政处分；构成犯罪的，依法追究其刑事责任。

第二十二条 进出口有毒化学品，按照国家《化学品首次进口及有毒化学品进出口环境管理规定》办理，并在向海关报关前持国家环境保护主管部门颁发的《化学品进（出）口环境管理登记证》和《有毒化学品进（出）口环境管理放行通知单》到市环境保护行政主管部门备案。

第二十三条 本办法自发布之日起施行。

天津市环境保护局文件

津环保固[1999]322号

关于颁布《天津市有毒化学品环境管理登记实施办法》的通知

各有关单位：

为更好地贯彻执行《天津市有毒化学品污染环境防治办法》，特制定《天津市有毒化学品环境管理登记实施办法》，现发给你们，请遵照执行。

特此通知。

附：天津市有毒化学品环境管理登记实施办法

一九九九年八月二十九日

天津市有毒化学品环境管理登记实施办法

第一条 为加强对有毒化学品的监督管理，根据《天津市有毒化学品污染环境防治办法》制定本办法。

第二条 凡在本市行政区域内，生产、贮存、经营、使用列入《天津市优先环境管理化学品名录》的有毒化学品的单位或个人，都应按本实施办法进行环境管理登记。

第三条 天津市环境保护局制定并颁布《天津市优先环境管理化学品名录》。

第四条 天津市环境保护局对全市有毒化学品的环境管理登记实施统一监督管理，印制《天津市有毒化学品环境管理登记表》、《天津市有毒化学品环境管理登记年审表》和《天津市有毒化学品环境管理登记证》，

区、县环境保护局组织并监督管理本辖区内有毒化学品的环境管理登记。

第五条 有毒化学品环境管理登记程序如下：

（一）生产、贮存、经营、使用有毒化学品的单位或个人，必须在《天津市有毒化学品污染环境防治办法》规定的期限内，持工商营业执照或事业单位法人登记证或事业单位登记证副本（一式二份）和“三同时”审批文件（一式二份）到所在地区、县环境保护局领取并据实填写《天津市有毒化学品环境管理登记表》（一式三份）。

（二）区、县环境保护局在收到《天津市有毒化学品环境管理登记表》之后1个月内，完成对填报内容的完整性及数据逻辑关系等的审查并签署意见。

（三）区、县环境保护局将审查合格的《天津市有毒化学品环境管理登记表》报市环境

保护局。市环境保护局在收到《天津市有毒化学品环境管理登记表》之后1个月内签署审批意见并对合格者颁发《天津市有毒化学品环境管理登记证》。

(四)对审查不合格的由区、县环境保护局或市环境保护局责令其限期改正。

第六条 对《天津市有毒化学品环境管理登记证》实行年审制度。程序如下：

(一)生产、贮存、经营、使用有毒化学品的单位或个人，应于每年3月份持《天津市有毒化学品环境管理登记证》到所在地区、县环境保护局领取并据实填实《天津市有毒化学品环境管理登记年审表》(一式三份)。

(二)区、县环境保护局在收到《天津市有毒化学品环境管理登记年审表》之后1个月内，签署审查意见。

(三)区、县环境保护局将审查合格的《天津市有毒化学品环境管理登记年审表》报市环境保护局。市环境保护局在收到《天津市有毒化学品环境管理登记年审表》之后1个月内签署审核意见，对合格的在《天津市有毒化学品环境管理登记证》上加盖公章。

(四)年审不合格的由区、县环境保护局或市环境保护局责令其限期改正。

第七条 区、县环境保护局应建立本辖区有毒化学品环境管理登记数据库和档案，汇总的年度登记数据以软盘形式于当年6月份报送市环境保护局。

第八条 本办法自公布之日起实施。

天津市环境保护局文件

津环保固[1999]296号

关于颁布《天津市优先环境管理化学品名录》的通知

各有关单位：

根据《天津市有毒化学品污染环境防治办法》，现公布《天津市优先环境管理化学品名录》，本名录自颁布之日起施行。

附：《天津市优先环境管理化学品名录》

一九九九年八月[illegible]日

天津市优先环境管理化学品名录

表 1

化学类别	名称	化学式	毒性					降解性	水生生物毒性 mg/l
			一般		特殊				
			急性，LD_{50} mg/kg	慢性 TCLo mg/kg	致突变	致畸	致癌		
重金属及其化合物	铅及其化合物 Lead	Pb	160 鸽子口服	0.01	细胞分析—人 细胞分析—猴子	血液淋巴系统发育异常	—	不分解	—
	镉及其化合物 Cadmium	Cd	225	0.75	细胞分析—大鼠；卵巢	血液、淋巴、泌尿生殖系统发育异常、眼耳发育异常	致癌（肌肉、骨骼）—鼠	不分解	—
	铬及其化合物 Chromium	Cr	>2500	—	—	—	疑致肿瘤（肠胃、淋巴）—鼠	不分解	—
	镍及其他合物 Nickel	Ni	12.5	12	瘤转变—大鼠：胚，肾	—	致癌（皮肤、骨骼）—鼠	不分解	—
	铜及其化合物 Copper	Cu	—	0.12	—	中枢神经系统及骨骼发育异常	疑致肿瘤（肺）—鼠	不分解	—
	汞及其化合物 Mercury	Hg	44.3 人	0.15 人	细胞分析—男人。	—	疑致肿瘤—鼠	不分解	—

表 2

化学类别	名称	化学式	性					降解性	水生生物毒性 mg/l
			一般		特殊				
			急性，LD_{50} mg/kg	慢性 TCLo mg/kg	致突变	致畸	致癌		
重金属及其化合	砷及其他合物 Arsenic	As	10	0.6	细胞分析—小鼠	骨骼肌肉发育异常—鼠	致癌瘤(肝、白血病)男人	不分解	0.4
农药	六六六 Hexachlorocyclohexanes	$C_6H_6Cl_6$	88	—	—	—	致癌—小鼠—经口	不分解	—
	滴滴涕 DDT	$C_{14}H_9Cl_5$	113	6	大鼠—口	—	致癌—小鼠—口服	实际不分解	<1
	敌敌畏 DDVP	$C_4H_7Cl_2PO_4$	25	15	DNA 损伤—人：淋巴，性染色体损失和不分裂—果蝇	中枢神经系统发育异常、体壁血液和淋巴系统发育异常	—	实际不分解	—
	乐果 Dimethoate	$C_5H_{12}NO_3PS_2$	140	—	—	—	致癌—大鼠—口服	实际不分解	—
	对硫磷 Parathion	$C_{10}H_{14}NO_5PS$	6	—	—	小鼠—腹腔	—	不分解	—

表 3

化学类别	名称	化学式	毒性					降解性	水生生物毒性 mg/l
			一般		特殊				
			急性，LD_{50} mg/kg	慢性 TCLo mg/kg	致突变	致畸	致癌		
	甲基对硫磷 Parathionmethyl	$C_8H_{10}NO_5PS$	9	—	—	小鼠—腹腔	—	不分解	—
	敌百虫 Trichlorfon	$C_4H_8Cl_3PO_4$	150	2.2	姐妹染色体变化—大鼠：肝，DNA 合成—人：纤维组织母细胞	中枢神经系统，颊面部及肌肉骨骼发育异常	致癌(肝)—鼠	实际不分解	—
	甲拌磷 o,o-Diethyl-S-(Ethylthio)Methyl. Ester	$C_7H_{17}O_2PS_3$	1100ug/kg 大鼠—口	血胆碱酯酶活性降低					
	除草醚 Nithofen	$C_{12}H_7Cl_2NO_3$	740	37.5	微生物突变实验—鼠伤寒杆菌 瘤转变—鼠：胚	内分泌、呼吸及泌尿生殖系统发育异常、体壁发育异常	肝、血管、肺—鼠	—	—
	杀虫脒 Chlordimeform (Acaron)	$C_{10}H_{14}N_2Cl_2$	170 大鼠—口	DNA 抑制—人：Hela 细胞	中枢和末梢神经系统、内脏新生儿缺欠	疑致癌肿			
多环芳烃类	萘 Naphthalene	$C_{10}H_8$	1250 鼠—口、腹	—	DNA 操作—小鼠	肌肉骨骼及心血管系统发育异常	疑致肿瘤(淋巴、子宫)—鼠	—	1—10

SVOCs / PAHs

化学类别	名称	化学式	性					降解性	水生生物毒性 mg/l
			一般		特殊				
			急性，LD_{50} mg/kg	慢性 TCLo mg/kg	致突变	致畸	致癌		
多环芳烃类	荧蒽 Fluoroanthene	$C_{16}H_{10}$	2000	—	微生物突变—鼠伤寒杆菌	—	疑致肿瘤—小鼠	—	—
苯系物	苯 Benzene	C_6H_6	3306	174	姐妹染色体变化—人：淋巴 DNA 抑制—人：白血球	肌肉骨骼发育异常	白血病—人	经长期驯化可分解	10－100
	甲苯 Toluene	$C_6H_5CH_3$	500	1000	DNA 损伤—鼠微核实验—小鼠	肌肉骨骼。颊面部及泌尿系统发育异常	—	经驯化可分解	10－100
	乙苯 Ethylben－zene	$C_6H_5C_2H_5$	3500	454	姐妹染色体变化—人：淋巴	肌肉骨骼发育异常	—	经驯化可分解	—
	邻二甲苯 O－xylene	$C_6H_4(CH_3)_2$	5000	150	—	肌肉骨骼发育异常	—	经驯化可分解	10－100
	间－二甲苯 M－xylene	$C_6H_4(CH_3)_2$	5000	3000	—	肌肉骨骼及颅面部发育异常	—	经驯化可分解	10－100

化学类别	名称	化学式	毒性 一般 急性，LD_{50} mg/kg	毒性 一般 慢性 TCLo mg/kg	毒性 特殊 致突变	毒性 特殊 致畸	毒性 特殊 致癌	降解性	水生生物毒性 mg/kg
苯系物	对－二甲苯 P－xyene	$C_6H_4(CH_3)_2$	3810	150	—	肌肉骨骼及颅面部发育异常	—	经驯化可分解	10－100
卤代苯类	氯苯 Chlorobenzene	C_6H_5Cl	2910	750	基因转换和重排—酵母	肌肉骨骼和胆肝系统发育异常	—	—	1－100
	邻二氯苯 O-Dichlorobenzene	$C_6H_4Cl_2$	500	—	—	—	疑致肿瘤—大鼠	—	—
	对—二氯苯 P-Dichlorobenzene	$C_6H_4Cl_2$	500	—	微生物突变—构巢曲霉素	—	—	实际不分解	—
卤代（烷，烯）烃类	二氯甲烷 Dichloro-methane	CH_2Cl_2	2136	—	DNA 抑制—人：纤维组织母细胞，瘤转变—鼠：胚	肌肉骨骼及泌尿系统发育异常，生殖系统发育异常	内分泌—鼠—吸入	实际不分解	—
	三氯甲烷 Trichloromethane	$CHCl_3$	908	20.1	姐妹染色体变化—人：淋巴，DNA 损伤—哺乳动物	肌肉骨骼，肠胃系统及颅面部发育不正常	白血病—鼠—口服	实际不分解	—

类别	名称	化学式	毒性					降解性	水生生物毒性 mg/l
			一般		特殊				
			急性，LD_{50} mg/kg	慢性 TCLo mg/kg	致突变	致畸	致癌		
卤代（烷，烯）烃类	1.2-二氯乙烷 1.2-Dichloroethane	$C_2H_4Cl_2$	678	1338	DNA 抑制—人：淋巴，哺乳动物细胞突变—人：淋巴	—	肠、胃、皮肤—鼠—口服	实际不分解	—
	1.1.1—三氯乙烷 Tichloroethane	$C_2H_3Cl_3$	5100	43	瘤转变—大鼠：肾	心血管系统、泌尿生殖系统及肌肉骨骼发育异常	—	实际不分解	—
	1.1.2－三氯乙烷 Trichloroethane	$C_2H_3Cl_3$	582	532	DNA 损伤—哺乳动物：淋巴、细胞分析—豚鼠：表皮	—	肝—小鼠—口服	实际不分解	—
	氯乙烯 Chloroethylene	C_2H_3Cl	50 大鼠—口	30 （人）	细胞分析—人 DNA修补	人体可继承遗传损伤对肝、血管、结缔组织	人体致癌		＞1000
	1.1-二氯乙烯 1.1-Dichloro-ethlene	$C_2H_2Cl_2$	200 大鼠—口	25 （人）		对胚胎或胎儿发育影响	疑致肿瘤		100-1000
	三氯乙烯 Trichloroethylene	C_2HCl_3	3670	594	DNA 抑制—人：淋巴，姐妹染色体变化—人：淋巴	肌肉骨骼及泌尿生殖系统发育异常，其他发育异常	肺、皮肤—鼠吸入	可分解	—

表 7

化学类别	名称	化学式	毒性					降解性	水生生物毒性 mg/l
			一般		特殊				
			急性，LD_{50} mg/kg	慢性 TCLo mg/kg	致突变	致畸	致癌		
卤代（烷，烯）烃类	四氯乙烯 Trichloroethylene	C_2Cl_4	3005	21000	DAN 合成—人：肺瘤转变—鼠胚	肌肉骨骼发育异常	白血病、肝—鼠	—	—
	四氯化碳 Carbontetrachloriode	CCl_4	2800	43（人）	DAN 损伤—鼠：肝	肌肉骨骼及肝胆系统发育异常	肝、甲状腺—鼠	实际不分解	—
	氟里昂 Electro-CF11 Electro-CF12	CCl_3F CCl_2F_2	1743 小鼠—腹腔（CF11）	—	—	中枢神经系统、肺纤维组织变化，肝变化（CF12）	—	—	>1000（CF－12）
	三氯硝基甲烷 Nitrotrichloro-methane	CCl_3NO_2	250 鼠—口服	26	—	—	疑致肿瘤—小鼠—口	实际不分解	10－1
酚类	苯酚 Phenol	C_6H_5OH	317	300	姐妹染色体变化—人：淋巴。其他突变实验—人类：细胞	肌肉骨骼发育异常	皮肤—鼠—皮	可分解	—
	五氯酚 Pentachlorophenol	C_6Cl_5OH	27	50	细胞突变实验—鼠伤寒杆菌（阳性）基因转换和丝状分裂重排—酵母	肌肉骨骼发育异常	疑致肿瘤（肺、肝）—鼠—皮下	—	1

表 8

化学类别	名称	化学式	性					降解性	水生生物毒性 mg/l
			一般		特殊				
			急性，LD_{50} mg/kg	慢性 TCLo mg/kg	致突变	致畸	致癌		
酚类	甲酚 Cresol (mixed isomers)	$C_6H_4CH_3OH$	242	143	—	胎儿毒性	致肿瘤—小鼠—皮肤	可分解	—
	对硝基酚 P-Nitrophenol	$C_6H_4NO_2OH$	250	10	DNA 损伤—大肠杆菌，DAN 抑制—小鼠；纤维组织母细胞	—	—	—	—
酞酸酯类	酞酸二丁酯 Di-n-butyl-phthalate	$C_6H_4(COOC_4H_9)_2$	8000	140	微生物突变—鼠伤寒杆菌。细胞分析—大鼠；纤维组织母细胞	肌肉骨骼发育异常，中枢神经系统发育异常	—	—	100-1000
	酞酸二辛酯 Dioctylphthalate	$C_6H_4(COOC_8H_{15})_2$	6513	5000	—	眼耳发育异常、其他发育异常	—	—	—
硝基苯类	硝基苯 Nitrobenzene	$C_6H_5NO_2$	489	35	细胞分析—酵母	—	—	实际不分解	—
	对硝基氯苯 P-Nitrochlorobenzene	$C_6H_4ClNO_2$	420	—	DAN 损伤—小鼠	—	致癌—小鼠—口服	不分解	—

表 9

化学类别	名称	化学式	毒性					降解性	水生生物毒性 mg/l
			一般		特殊				
			急性，LD_{50} mg/kg	慢性 TCLo mg/kg	致突变	致畸	致癌		
硝基苯类	2.4-二硝基氯苯 2.4-Dinitro-1-chlorobenzene	$C_6H_3Cl(NO_2)_2$	1070	—	DNA 损伤—鼠：腹腔瘤转变—大鼠：肾	—	—	—	—
	对硝基甲苯 P-Nitro-toluene	$C_6H_4CH_3NO_2$	1960	—	DNA 修复—枯草杆菌、微生物突变—鼠伤寒杆菌	—	—	—	—
苯胺类	苯胺 Aniline	$C_6H_5NH_2$	250	150	姐妹染色体变化—鼠：肝。DNA 损伤—鼠：腹腔	—	致肿瘤（膀胱）—小鼠	可分解	—
	对硝基苯胺 P-Nitroaniline	$C_6H_4NH_2NO_2$	750	—	DNA 修复—枯草杆菌、微生物突变—鼠伤寒杆菌	—		—	—
环烷烃类	环氧乙烷 Ethylene Oxide	C_2H_4O	270（豚鼠—口）		姐妹染色体交换—人：成纤维细胞遗传损害—人	（对胎儿肌肉骨骼系统影响）中枢神经系统	—致肿瘤，淋巴瘤，敷药部位肿瘤（人体致癌）	—	10-100
醇、醛、酮类	甲醇 Methanol	CH_3OH	300（人）		—	中枢神经系统眼睛失明	—	—	>1000

表 10

化学类别	名称	化学式	性					降解性	水生生物毒性 mg/l
			一般		特殊				
			急性，LD_{50} mg/kg	慢性 TCLo mg/kg	致突变	致畸	致癌		
醇、醛、酮类	甲醛 Fomaldehyde	CH_2O	36 人—口		姐妹染色体交换—人：淋巴细胞 DNA 损伤—鼠—口入	新生儿行为、肺水肿	疑致肿瘤（鼻肿瘤）	—	10－100
	丙酮 Acetone	C_3H_6O	500 大鼠—腹腔		—	中枢神经系统、血红细胞	—	—	＞1000
其它	二硫化碳 CarbonDisulfide	CS_2	14 人—口		—	中枢神经系统肌肉、骨骼、肺部异常	—	—	—
	丙烯腈 Acrylonitrile	C_3H_3N	78 鼠—口服	37.9	染色体损失和不分裂—面菌。微核实验—大鼠：卵巢	肌肉、骨骼心血管中枢神经发育异常	致癌（脑）—鼠	经长期驯化可分解	—
	氰化物 Cyanide	－CN	6.44	0.7	—	肌肉骨骼及心血管系统、中枢神经系统发育异常	—	—	—
	亚硝酸钠 Sodiumnitrite	$NaNO_2$	—	—	姐妹染色单体变控—大鼠：成纤维细胞 DNA 损伤—哺乳动物：淋巴细胞	脾脏发生变化甲状腺机能减退	疑致肿瘤（皮肤丸瘤）	—	—

表 11

化学类别	名称	化学式	毒性					降解性	水生生物毒性 mg/l
			一般		特殊				
			急性，LD_{50} mg/kg	慢性 TCLo mg/kg	致突变	致畸	致癌		
其它	石棉 Asbestos	$2Sio_2 \cdot 3MgO \cdot 2H_2O$	—	1.2 根纤维/cc/19-y-e 人—吸入	—	肺纤维化(尘肺)	人体致癌物(肺癌、肉皮瘤)	—	—

天津市有毒化学品环境管理登记表

填报说明

一、前言：

1、根据天津市人民政府令(13号)对化学品实行申报登记管理。

2、凡在本市生产或在商品市场流通并已列入《天津市优先环境管理化学品名录》的化学品需要申报登记。

3、凡是生产(包括产品、付产品、中间产品、三废组分)、使用、经营(包括销售、运输、贮存、废弃)《天津市优先环境管理理化学品名录》中的化学品的部门和个人均应办理申请登记手续，该项工作目前首先在企业中进行。

4、市、区(县)环保局主管和受理化学品环境管理登记工作。

5、对于拒报、瞒报的企业或个人，一旦发现，将根据法令规定给予处罚。

6、全市化学品申报登记工作将进行计算机联网管理，因此登记内容必须据实、准确、工整、清晰、到位。

7、填表人员对栏目要求不清楚时，应及时与所在地区环保局主管人员联系，对不了解的栏目内容，应与本企业主管人员商讨，不得以"不详"为由空项。

8、全套报表共13页，一般情况下对各类企业需填报的表格要求如下：

化学品生产企业：除表9外，需要全部填报

非化学品生产企业：不填报表3和表9

专职化学品仓储企业：只填写表1、表11－13

专职运输企业：只填写表1、表10、表12－13

化学品销售企业：填写表1、表9、表11－13

特殊情况下，例如销售企业也有化学品运输手段，并自行运输，亦要填报表10。

9、表中所涉及的动态数据，以1999年的统计数字为基准。

10、申报者统一使用黑色(或兰色)墨水笔填写，不得用铅笔、圆珠笔。

11、表中各页如不够用，可自行复印加页。

二、填表细则

1、企业概况

①企业法人代码：填写参照国家标准GB11714－89《全国企业、事业单位和社会团体代码编制规则》，(详见附件1)。具体各企业的法人代码已由天津市技术监督局发布。

②企业名称：填写全称，不可简化。例如天津化工厂(√)，"天化"(×)。

③企业地址：包括行政区，街道，里弄，门牌号。

④企业类型：按登记工作规定划分为五类，具体类别详见附表1

⑤行业分类：填写参照国家标准GB/T4754－94《国民经济行业分类与代码》(详见附件2)，只填写到大类，即A01－P99大类。

⑥企业行政区划：即目前天津市设置的18个区县及开发区、保税区，行政区划与代码详见附表2。

⑦企业注册类型代码：按照国家环保局公布的分类原则填报，详见附表3。

⑧主管部门：按照登记工作规定填写，详见附表4

⑨卫生防护距离：无组织排放源所在的生产单元（生产区、车间、工段、危险物品仓库等）与居民居住区之间应设置的隔离距离。填写可参照本企业的“三同时”环境影响评价报告书。或按照国家推荐标准GB/T13201－91《制定地方大气污染物排放标准的技术方法》中规定计算（见附件3）。

⑩企业持持：以问答形式填写，企业持哪种证，则在其后的方框中划“√”，不持证者划“×”，不能空栏，然后再填入证件名称与号码。

2、企业应急事故管理

表中各栏目均以问答形式填写，是者在其后方框中划“√，否者划“×”，不得空置。

3、企业化学品生产车间

①操作车间：填写企业内部命名的全称

②直接生产人员：脱产管理人员除外的车间全体员工

③生产时间：每个工作日以8小时计算

④化学品名称：包括产品、原料、中间产品、付产品的化学品名称，全部按化学命名填写全称，不得填写简称或俗称，例如：

氢氧化钠（√）　火碱（×）　亚铁氰化钾（√）　黄血盐钾（×）

氯化钠（√）　食盐（×）

1.1.2三氯化烯（√）　干洗剂（×）　γ－丁内酯（√）　稀料（×）

2－萘胺－4,8二磺酸（√）　C酸（×）

⑤分子式：由化学元素符号组成，可参照产品说明或包装标签填写。

⑥化学品（产品）分类：参照本说明后附件4，《化学物质部分分类明细》填报，该分类（节选）基本复盖了所登记的化学品。

⑦危险性分类：根据化学品的物理、化学性质规定的常用危险性化学品，共分为8类，可参照国家标准GB13690－92《常用危险化学品的分类及标志》（见附件5），和GB/T15098－94《危险货物分类和品名编号》（见附件6）填报。

⑧包装容器与材料：按照企业产品出厂时的实际包装填报，可参考部颁标准JT3130－88《汽车危险货物运输规则》（见附件7）和国家标准GB/T15098－94《危险货物运输包装类别划分原则》（附件8）。

⑨包装标志与注释：是指标示危险性货物危险性的图型标志及其文字说明，例如一般标志：防潮（画有雨伞图形）或向上（画有向上箭头）等字样。按照企业上市化学品外包装的图形标志，请对照国家标准GB190－90《危险货物包装标志》（见附图2）填写包装标志号码。

⑩产品检验方法：说明产品检验时使用的国家标准或部颁标准方法的名称和标准号，不需要填写方法的操作过程。

⑪化学付产品：与主化学产品在同一工艺流程中同时生成的另一种化学品，经过分离等处理后，可做为商品的。

中间化学产品：化学反应过程中生成的化学品，一般在工艺过程中循环使用，不做为商品。个别品种经过处理亦可上市出售。

化学付产品与中间产品均应按化学命名填报。

⑫物料衡算：说明本工艺最终排放的生产性废物量和工艺过程中流失量，单位以吨产品表示。填报时可参照本企业的“三同时”环境影响评价报告书，或请生产主管部门提供。

⑬操作方式、接触途径、接触时间、接触方式以及化合物，混合物等栏目以问答形式填写。在各栏目提出的问题后均留有一方框，肯定回答时在其中划“√”，否定时在其中划“×”，不得空留。

混合物：由二种或以上化学物质混合而成，例如：油漆多由各种树脂和稀料、固化剂、催干剂等混合而成。

混合物中主成分：应填写《优先环境管理化学品名录》中的含量最高的一种化学物质。例如硝基漆以硝酸纤维素为基本成膜物质与树脂、增韧剂溶于各种有机混合溶剂调制而成，为混合物。其中主成分含量应填写稀释剂使用的苯、二甲苯或甲苯中的某一种。不得空置。

4、企业化学品使用车间

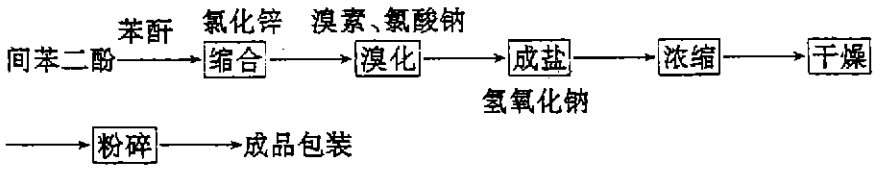
①废物化学名称：企业排放三废中的化学物质名称，亦应按化学命名或规范名称填报。

②操作方式、接触方式、接触时间、接触途径的填报方法同与化学品生产车间。

5、生产工艺（化学品生产，使用企业）

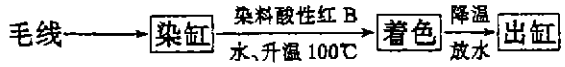
①生产化学品的工艺流程图：用直线连接各个方框的形式填写，方框内注明工艺步骤名称，连线处注明反应条件，各工艺流程图前应注明化学产品名称和在登记表中的序号。

例：1、弱酸性红 A 工艺流程图：



②使用化学品的工艺流程图：即生产工艺流程图，以方框图表示，必须注明化学品出现的环节。工艺流程图前应注明化学原料名称及其在登记表中的序号。

例 3 酸性红 B 染色工艺流程图（使用化学品）



6、企业三废排放与治理

①三废排放量：治理前排放量，即未经治理直接排放的三废量，治理后的排放量为经过治理再排放的三废量。不论治理前后，如果不排放，需填入“0”不得空栏。

②废物中化学组分：即三废中主要污染物的化学名称。

③治理前后浓度：应填写实际监测数据，有治理设施的企业治理前后浓度与去除率、回收量均应填报，其中

$$去除率=\frac{治理前浓度-治理后浓度}{治理前浓度}（治理前后三废排放量相同时）$$

回收量：若上面经治理的去除部分全部回收，则回收量等于去除量，否则该项应按实

际情况填报。

③三废排放数据，应为企业设置的三废排口，或总排口或直接进入外环境的车间排口的测定值为准。（例如含重金属废水从车间进入处理设施前后排水的测定值）

7、企业三废处理与处置

表格各项均按问答形式填报，在三废处理处置方法中选择本企业使用的方法，并在其后的方框中划"√"，其余的划"×"，不得空置。处理后三废去向，按同样形式填写。

8、企业化学品生产与使用

①凡化学品生产企业，四个统计量（使用量、产量、销售量、结余量），均要填报，其中产量既包括产品，也包括上市或在企业内部使用的付产品及中间产品。非化学品生产企业，一般不需要填写产量与销售量，主要填报做为原料的化学使用品量，及其节余量，特殊情况应据实填报。

②此表按化学品名称填报，同时注明所属类别，类别划分参见（附件4）。

9、企业化学品销售

①按化学品名称填报1999年的统计数字。

②货源地与销售地、分为天津市和外埠两种情况，外埠只需填写至×××省×××市（地区）即可。

10、企业化学品运输

1、运送批次与运送化学品量：可按一种化学品填写，但应注明危险性分类及化学品类别，亦可按一类化学品填写。对某一企业而言，应前后一致，尊循一种原则，化学品类品与危险性分类可参照附件（4－5），不得自行分类。

2、运输方式、运输手段、警式标志，均以问答形式填写，填写要求同前。其中：警示标志：在运输过程中，在运输工具上出示的表明货物危险性的警告标志。

11、企业化学品仓储：

①按化学品名称填报仓储数量，同时注明化学品分类与危险性分类，可参照附件（4－5）填报。

②贮存方式：以问答形式填写，要求同前。其中：

化学性质相容性具体说明见附图1。

化学性质相同：即指有同一物理、化学性质。例：高锰酸钾的重铬酸钾均具有氧化还原性。硫酸、盐酸、氢氟酸均具腐蚀性。氢气、乙炔气均属易燃、易爆气体。

混合存放：不同种类，性质的化学品在一起存放。

12、企业化学品事故登记

①化学事故类型，按照本次登记工作分类填写，可参照附表5

②直接原因包括一切主客观因素在内，例如违章操作，设备故障，劳动保护及违法行为等。

③引发化学品：导致事故发生的化学物质

④化学物质释放量：事故发生后，进入环境中的化学物质总量可以是一种，亦可能是多种化学物质（例如反应釜爆炸）

⑤环境化学污染物检出状况：事故发生时，现场 环境中与事故有关的化学物质的检测结果。

⑥现场处理记录：由专业人员组成的事故调查组对事故现场的处置和对受污染环境的处理意见，并有主管人员签章。

⑦事故处理结果：对事故及环境污染问题的处理结论。

13、企业应急事故联络：

联络图：即企业所处区域平面图，应标明：

①座标

②厂外街道及卫生防护距离

③厂区内操作车间、办公区，仓库、三废处理场位置

④安全消防设施配置（以消防器械为主）。

《填表细则》附录

附录：

一、附表：

1、企业类型划分与代码；

2、天津市行政区划与代码；

3、企业注册类型与代码；

4、企业主管部门与代码；

5、化学事故分类与代码；

二、附图

1、有害物质的相容性图示

2、危险货物包装标志图例

三、附件

1、GB11717－89《全国企业，事业单位和社会团体代码编制规则》

2、GB/T4754－94（国民经济行业分类）

3、GB/T13201－91《制定地方大气污染物排放标准的技术方法》

4、化学物质部分分类名细

5、GB13690－92《常用危险化学品的分类及标志》

6、GB/6944－86《危险货物分类和品名编码》

7、JT3130－88《汽车危险货物运输规则》

8、GB/T15098－94《危险货物运输包装类别划分原则》

9、JT3145－91《汽车危险货物运输、装卸作业规程》

一、附表

1 天津市生产(使用)经营化学品企业分类代码

代码	01	02	03	04	05
分类名称	化学品生产	化学品使用	化学品运输	化学品仓储	化学品销售

2 天津市区、县划分与代码

行政区	代码	行政区	代码
和平区	101	东丽区	110
河东区	102	西青区	111
河西区	103	津南区	112
南开区	104	北辰区	113
河北区	105	宁河县	221
红桥区	106	武清县	222
塘沽区	107	静海县	223
开发区(塘沽)	107a	宝坻县	224
保税区(塘沽)	107b	蓟县	225

3 企业注册类型代码

代码	企业注册类型	代码	企业注册类型
110	国有企业	160	股份有限公司
120	集体企业	170	私营企业
130	股份合作企业	190	其他企业
140	联营企业	200	港、澳、台、商投资企业
150	有限责任公司	300	外商投资企业

4 企业主管部门及代码

代码	10	20	30	40	50
主管部门代码	直属中央各部(局、总公司)	属市局(公司、集团)	市区、县(局)	市、街道镇、乡	其它

5 化学事故分类及代码

代码	A	B	C	D	E	F
化学事故	爆炸	火灾	泄漏	排放	废弃	其它

二、附图

附图(2)：几种有害物质的相容性图示

1	氧化性无机酸	1											
2	碱	▲	2										
3	芳香烃	▲ X		3									
4	卤代烃	▲ X●	▲ ○		4								
5	金　属	○ ▲X			▲ X	5							
6	有毒金属	□	□				6						
7	饱和脂肪烃	▲ X						7					
8	饱和脂肪烃	▲ X							8				
9	强氧化剂		▲	▲ X		▲ X		▲		9			
10	强还原剂	▲ X●			▲ ●				○ ▲	▲ X*	10		
11	水和含水混合物	▲			▲ *		□				○ ●	11	
12	遇水反应物质	反应性极强物质不要与任何化学品或废物混合											12

图示说明：

*	发生爆炸	●	产生有毒气体
*	着火	▲	放热
○	产生易燃气体	□	毒物溶解

危险货物包装标志

(GB 190—90)

(1)

(符号: 黑色; 底色: 橙红色)

(2)

(符号: 黑色; 底色: 橙红色)

(3)

(符号: 黑色; 底色: 橙红色)

(4)

(符号: 黑色或白色; 底色: 正红色)

(5)

(符号: 黑色或白色; 底色: 绿色)

(6)

(符号: 黑色; 底色: 白色)

(7)

(符号: 黑色或白色; 底色: 正红色)

(8)

(符号: 黑色; 底色: 白色红条)

(9)

(符号: 黑色; 底色: 上白下红)

(10)

(符号: 黑色或白色; 底色: 蓝色)

(11)

(符号: 黑色; 底色: 柠檬黄色)

(12)

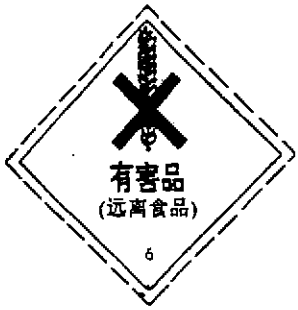
(符号: 黑色; 底色: 柠檬黄色)

(13)

(符号: 黑色; 底色: 白色)

(14)

(符号: 黑色; 底色: 白色)



(15)

(符号: 黑色; 底色: 白色)

(16)

(符号: 黑色; 底色: 白色)

(17)

(符号: 黑色; 底色: 白色; 附一条红竖条)

(18)

(符号: 黑色; 底色: 上黄下白; 附二条红竖条)

(19)

(符号: 黑色; 底色: 上黄下白; 附三条红竖条)

(20)

(符号: 上黑下白; 底色: 上白下黑)

(21)

(符号: 黑色; 底色: 柠檬黄色)

国家《全国企业、事业单位和社会团体代码编制规则》

（GB11714－89）

1 主题内容与适用范围

1.1 主要内容

本标准规定了全国企业、事业单位和社会团体代码的赋予对象、编码方法和管理办法，使全国各企业、事业单位和社会团体均获得一个唯一的、始终不变的法定代码，以适应政府部门的统一管理和业务单位实行计算机自动化管理的需要。

1.2 适用范围

本标准适用于各级企业法人登记主管机关、机构编制主管机关和社会团体登记主管机关。

2 代码赋予对象

2.1 根据《中华人民共和国企业法人登记管理条例》的有关规定，经登记主管机关核准的、具备企业法人条件的全民所有制、集体所有制企业，私营有限责任公司、中国境内设立的中外合资经营企业，中外合作经营企业，外资企业及其他依法需要办理企业法人登记的企业。

2.2 经各级机构编制主管机关批准成立的，具有法人资格的各类事业单位。

2.3 经各级社会团体登记主管机关批准成立的、具有法人资格的各类社会团体。

3 代码的结构和表示形式

3.1 代码的结构

全国企业、事业单位和社会团体代码由八位数字本体代码和一位数字（字符）校验码组成。

3.1.1 本体代码采用系列（即分区段）顺序编码方法。

3.1.2 校验码按下列公式计算：

$$C_9 = 11 - MOD(\sum_{i=1}^{8} C_i \times W_i \cdot 11)$$

式中：MOD—求余函数；

i—代码字符从左至右位置序号；

C_i—第 i 位置上的代码字符的值。

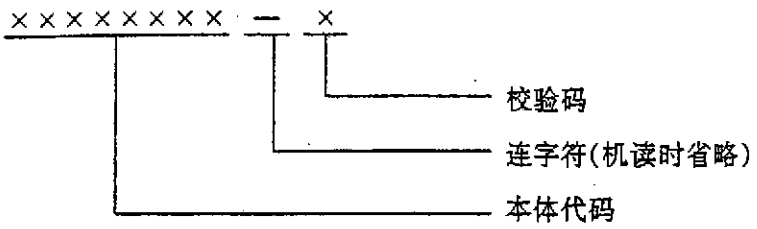
C_9—校验码；

W_i—第 i 位置上的加权因子，其数值如下表；

i	1	2	3	4	5	6	7	8
W_i	3	7	9	10	5	8	4	2

当 MOD 函数值为 1(即 $C_9=10$)时校验码应用大写拉丁字母×表示;当 MOD 函数值为 0(即 $C_9=11$)时,校验码仍用 0 表示。

3.2 代码的表示形式 为便于人工识别,应使用一个连字符"—"分隔本体代码与校验码;机读时,连字符省略。表示形式为:



附 录

全国企业、事业单位和社会团体代码的编制和管理办法

AⅠ 代码的管理机关

AⅠ.1 国家技术监督局是全国企业、事业单位和社会团体代码的编制主管机关,负责整个编码工作的组织与协调。

国家技术监督局中国标准化与信息分类编码研究所是国家信息自动化管理系统一运行保障分系统的归口管理单位,负责全国企业、事业单位和社会团体代码编码区段的分配、控制、管理以及代码数据库的建设。

AⅠ.2 各级企业法人登记主管机关是企业法人代码的赋予机关。

AⅠ.3 各级机构编制主管机关是事业单位代码的赋予机关。

AⅠ.4 各级社会团体登记主管机关是社会团体代码的赋予机关。

AⅠ.5 各级代码赋予机关有义务定期向国家信息自动化管理系统一运行保障分系统的归口管理单位提交本机关编码区段内企业、事业单位和社会团体代码的赋予结果。

A2 编码区段的分配

A2.1 全国企业、事业单位和社会团体代码的编码区段,由国家技术监督局中国标准化与信息分类编码研究所向级代码赋予机关统一分配。

A2.2 各级代码赋予机关应按规定,向国家技术监督局中国标准化与信息分类编码研究所提交本机关核(批)准的、具有法人资格的企业、事业单位和社会团体实际数量,以获取本相关相应的编码区段。

A2.3 国家技术监督局中国标准化与信息分类编码研究所根据各级代码赋予机关提交的企业、事业单位和社会团体的实际数量,再按一定比例附加值,向各级代码赋予机关分配编码区段。

A2.4 当已分配的编码区段将被完全占用时,各级代码赋予机关应在编码区段占满

前六个月通知国家技术监督局中国标准化与信息分类编码研究所，以获取新的编码区段。

A2.5　为满足各系统管理上的特殊需要，本标准规定本体代码 800000[illegible]至 99999999 为自定义区，供各系统自行赋予代码使用。

A3　**代码的赋予**

A3.1　各代码赋予机关应按本标准的有关规定，在所分配的编码区段内，向经本机关登记或批准成立的具备法人条件的企业、事业单位和社会团体赋予代码。代码的使用顺序，按所分配的编码区段内代码数值（不含校验数值）的大小次序。

A3.2　经注销（撤销）的企业、事业单位和社会团体，各级代码赋予机关应废置其代码，代码一经废置，不得重新赋予其它企业、事业单位和社会团体。

A3.3　不需注销（撤销）而变更的企业、事业单位和社会团体，其代码不变。

附加说明：

本标准由国家技术监督局、国家统计局提出。

本标准由国家技术监督局中国标准化与信息分类编码研究所、国家信息中心、国家统计局制度方法司、国家工商行政管理局企业登记司、人事部中央机构编制司、民政部社团管理司和国家科委综合计划司负责起草。

本标准由国家技术监督局负责解释。

中华人民共和国国家标准

GB/T 4754－94

国民经济行业分类与代码(节选)

门类	大类	中类	小类	类别名称
A				农、林、牧、渔业
	01			农业
		011	0110	种植业
		019	0190	其他农业
	02	020	0200	林业
	03			畜牧业
		031	0310	牲畜饲养放牧业
		032	0320	家禽饲养业
		033	0330	狩猎业
		039	0390	其他畜牧业
	04			渔业
		041		海洋渔业
			0411	海水养殖业
			0412	海洋捕捞业
		042		淡水渔业
			0421	淡水养殖业
			0422	淡水捕捞业
	05			农、林、牧、渔服务业
		051	0510	农业服务业
		052	0520	林业服务业
		053	0530	畜牧兽医服务业
		054	0540	渔业服务业
		059	0590	其他农、林、牧、渔服务业
B				采掘业
	06			煤炭采选业
		061	0610	煤炭开采业
		062	0620	煤炭洗选业
	07			石油和天然气开采业
		071	0710	天然原油开采业
		072	0720	天然气开采业
		073	0730	油页岩开采业
	08			黑色金属矿采选业
		081	0810	铁矿采选业
		082		其他黑色金属矿采选业
			0821	锰矿采选业
			0822	铬矿采选业
	09			有色金属矿采选业
		091		重有色金属矿采选业
			0911	铜矿采选业
			0912	铅锌矿采选业
			0914	镍钴矿采选业
			0915	锡矿采选业
			0916	锑矿采选业
			0197	汞矿采选业
			0919	其他重有色金属矿采选业
		093		轻有色金属矿采选业
			0931	铝矿采选业
			0932	镁矿采选业
			0933	钛矿采选业
			0939	其他轻有色金属矿采选业
		095		贵金属矿采选业
			0951	金矿采选业
			0952	银矿采选业
			0959	其他贵金属矿采选业
		096		稀有稀土金属矿采选业
			0961	钨钼矿采选业
			0962	稀有轻金属矿采选业
			0963	稀有高熔点金属矿采选业
			0964	稀散金属矿采选业
			0965	稀土金属矿采选业
			0966	稀有放射性金属矿采选业
			0969	其他稀有稀土金属矿采选业
	10			非金属矿采选业
		101		土砂石开采业
			1011	石灰石开采业
			1012	建筑装饰用石开采业
			1013	耐火土石开采业

门类	大类	中类	小类	类别名称	门类	大类	中类	小类	类别名称
			1019	其他土砂石开采业				1319	其他饲料制造业
		102		化学矿采选业			132		植物油加工业
			1021	硫矿采选业				1321	食用植物油加工业
			1022	磷矿采选业				1322	非食用植物油加工业
			1023	天然钾盐采选业			133		制糖业
			1024	硼矿采选业				1331	甘蔗糖业
			1029	其他化学矿采选业				1332	甜菜糖业
		103		采盐业				1334	加工糖业
			1031	海盐业			134		屠宰及肉类蛋类加工业
			1032	湖盐业				1341	屠宰业
			1033	井盐业				1342	肉制品加工业
			1034	矿盐业				1343	肉类副产品加工业
		109		其他非金属矿采选业				1344	蛋品加工业
			1091	石棉采选业			135		水产品加工业
			1092	云母采选业				1351	冷冻水产品加工业
			1093	石墨采选业				1352	干制水产品加工业
			1094	石膏采选业				1353	腌制水产品加工业
			1095	宝石、玉石采选业				1354	鱼糜及鱼糜制品加工业
			1096	水晶采选业				1359	其他水产品加工业
			1097	滑石采选业			136	1360	盐加工业
			1099	其他类未包括的非金属矿选业			139	1390	其他食品加工业
						14			食品制造业
	11	110	1100	其他矿采选业			141		糕点、糖果制造业
	12			木材及竹材采运业				1411	糖果业
		121	1210	木材采运业				1412	糕点业
		122	1220	竹材采运业				1413	饼干业
C				制造业				1414	方便主食品业
	13			食品加工业				1415	蜜饯业
		131		粮食及饲料加工业				1419	其他糕点、糖果制品业
			1311	碾米业			142	1420	乳制品制造业
			1312	磨粉业			143		罐头食品制造业
			1313	面、米制品业				1431	肉类罐头制造业
			1314	配合及混合饲料制造业				1432	禽类罐头制造业
			1315	蛋白饲料制造业				1433	水产罐头制造业

门类	大类	中类	小类	类别名称	门类	大类	中类	小类	类别名称
			1434	水果罐头制造业				1522	天然矿泉水制造业
			1435	蔬菜罐头制造业				1523	果菜汁饮料制造业
			1439	其他罐头食品制造业				1524	固体饮料制造业
		144		发酵制品业				1529	其他软饮料制造业
			1441	氨基酸制造业			155	1550	制茶业
			1442	味精制造业			159	1590	其他饮料制造业
			1443	柠檬酸制造业		16			烟草加工业
			1444	酵母制品业			161	1610	烟叶复烤业
			1445	酶制剂制造业			162	1620	卷烟制造业
			1449	其他发酵制品业			169	1690	其他烟草加工业
		145		调味品制造业		17			纺织业
			1451	酱油、酱类制造业			171		纤维原料初步加工业
			1452	食醋制造业				1711	轧花业
			1453	调味料制造业				1712	洗毛业
			1454	调味油制造业				1713	亚麻纤维初步加工业
			1459	其他调味品制造业				1714	苎麻纤维初步加工业
		149		其他食品制造业				1719	其他纤维原料初步加工业
			1491	豆制品制造业			172		棉纺织业
			1492	淀粉及淀粉制品业				1721	棉纺业
			1493	代乳品制造业				1722	棉织业
			1495	制冰业				1723	印染业
			1497	淀粉糖业				1724	棉制品业
			1498	冷冻饮品制造业				1725	棉线带制造业
			1499	其他类未包括的食品制造业				1726	帘子布制造业
	15			饮料制造业				1729	其他棉纺织业
		151		酒精及饮料酒制造业			174		毛纺织业
			1511	酒精制造业				1741	毛条加工业
			1512	白酒制造业				1742	毛纺业
			1513	啤酒制造业				1743	毛织业
			1514	黄酒制造业				1744	毛染整业
			1515	葡萄酒制造业				1745	工业用呢、工业毡制造业
			1516	果露酒制造业				1749	其他毛纺织业
		152		软饮料制造业			176		麻纺织业
			1521	碳酸饮料制造业				1761	苎麻纺织业

门类	大类	中类	小类	类别名称	门类	大类	中类	小类	类别名称
			1762	亚麻纺织业				1932	毛皮服装业
			1763	黄、洋、青麻纺织业				1939	其他毛皮制品业
			1769	其他麻纺织业			195		羽毛(绒)加工及制品业
		177		丝绢纺织业				1951	羽毛(绒)加工业
			1771	缫丝业				1952	羽毛(绒)制品业
			1772	绢纺业		20			木材加工及竹、藤、棕、草制品业
			1773	丝织业			201		锯材、木片加工业
			1774	丝印染业				2011	锯材加工业
			1775	丝制品业				2012	木片加工业
			1779	其他丝绢纺织业			202		人造板制造业
		178		针织品业				2021	胶合板制造业
			1781	棉针织品业				2022	纤维板制造业
			1782	毛针织品业				2023	刨花板制造业
			1783	丝针织品业				2029	其他人造板制造业
			1789	其他针织品业			203		木制品业
		179	1790	其他纺织业				2031	生产用木制品业
	18			服装及其他纤维制品制造业				2033	生活用木制品业
		181	1810	服装制造业				2033	生活用木制品业
		182	1820	制帽业			204	2040	竹、藤、棕、草制品业
		183	1830	制鞋业		21			家具制造业
		189	1890	其他纤维制品制造业			211	2110	木制家具制造业
	19			皮革、毛皮、羽绒及其制品业			212	2120	竹、藤家具制造业
		191		制革业			213	2130	金属家具制造业
			1911	轻革业			214	2140	塑料家具制造业
			1912	重革业			219	2190	其他家具制造业
			1919	其他制革业		22			造纸及纸制品业
		192		皮革制品制造业			221	2210	纸浆制造业
			1921	皮鞋制品业			222		造纸业
			1923	革皮服装制品业				2221	机制纸及纸板制造业
			1924	皮箱制品业				2223	手工纸制造业
			1925	皮包制造业				2224	加工纸制造业
			1929	其他类未包括的皮革制品业			223	2230	纸制品业
		193		毛皮鞣制及制品业		23			印刷业、记录媒介的复制
			1931	毛皮鞣制业			231		印刷业

门类	大类	中类	小类	类别名称	门类	大类	中类	小类	类别名称
			2311	书、报、刊印刷业				2617	无机盐制造业
			2312	包装装潢印刷业				2619	其他基本化学原料制造业
			2319	其他印刷业			262		化学肥料制造业
		232	2320	记录媒介的复制				2621	氮肥制造业
	24			文教体育用品制造业				2622	磷肥制造业
		241		文化用品制造业				2623	钾肥制造业
			2411	文具制造业				2624	复合肥料制造业
			2413	本册制造业				2625	微量元素肥料制造业
			2415	笔制造业				2629	其他化学肥料制造业
			2417	教学标本、模型制造业			263		化学农药制造业
			2419	其他文化用品制造业				2631	农药原药制造业
		242		体育用品制造业				2633	农药制剂制造业
			2421	球类制造业			265		有机化学产品制造业
			2423	体育器材制造业				2651	有机化工原料制造业
			2429	其他体育用品制造业				2652	涂料制造业
		243		乐器及其他文娱用品制造业				2653	油墨制造业
			2431	中乐器制造业				2654	颜料制造业
			2433	西乐器制造业				2655	染料制造业
			2435	电子乐器制造业				2659	其他有机化学产品制造业
			2439	其他乐器及文娱用品制造业			266		合成材料制造业
		244	2440	玩具制造业				2661	聚烯烃塑料制造业
		245	2450	游艺器材制造业				2662	热固性树脂及塑料制造业
		249	2490	其他类未包括的文教体育用品制造业				2663	工程塑料制造业
								2664	功能高分子制造业
	25			石油加工及炼焦业				2665	有机硅氮材料制造业
		251	2510	人造原油生产业				2666	合成橡胶制造业
		252	2520	原油加工业				2667	合成纤维单(聚合)体制造业
		253	2530	石油制品业				2669	其他合成材料制造业
		257	2570	炼焦业			267		专用化学产品制造业
	26			化学原料及化学制品制造业				2671	化学试剂、助剂制造业
		261		基本化学原料制造业				2672	专项化学用品制造业
			2611	无机酸制造业				2673	林产化学产品制造业
			2613	烧碱制造业				2674	炸药及火工产品制造业
			2615	纯碱制造业				2675	信息化学品制造业

门类	大类	中类	小类	类别名称	门类	大类	中类	小类	类别名称
			2676	放射化学产品制造业				2859	其他渔具制造业
			2677	添加剂制造业		29			橡胶制品业
		268		日用化学产品制造业			291	2910	轮胎制造业
			2681	肥皂及皂粉、合成洗涤剂制造业			292	2920	力车胎制造业
			2682	合成脂肪酸制造业			293	2930	橡胶板、管、带制造业
			2683	硬脂酸、硬化油制造业			294	2940	橡胶零件制品业
			2684	香料、香精制造业			295	2950	再生橡胶制造业
			2685	化妆品制造业			296	2960	橡胶靴鞋制造业
			2686	牙膏制造业			297	2970	日用橡胶制品业
			2687	火柴制造业			298		橡胶制品翻修业
			2688	动物胶制造业				2981	轮胎翻新业
			2689	其他日用化学产品制造业				2989	其他橡胶制品翻修业
	27			医药制造业			299	2990	其他橡胶制品业
		271	2710	化学药品原药制造业		30			塑料制品业
		272	2720	化学药品制剂制造业			301	3010	塑料薄膜制品业
		273	2730	中药材及中成药加工业			302	3020	塑料板、管、棒材制造业
		274	2740	动物药品制造业			303	3030	塑料丝、绳及编织品制造业
		275	2750	生物制品业			304	3040	泡沫塑料及人造革、合成革制造业
	28			化学纤维制造业			305	3050	塑料包装箱及容器制造业
		281		纤维素纤维制造业			306	3060	塑料鞋制造业
			2811	化纤浆粕制造业			307	3070	日用塑料杂品制造业
			2812	粘胶纤维制造业			308	3080	塑料零件制造业
			2819	其他纤维素纤维制造业			309	3090	其他塑料制品业
		282		合成纤维制造业		31			非金属矿物制品业
			2821	锦纶纤维制造业			311	3110	水泥制品业
			2822	涤纶纤维制造业			312		水泥制品和石棉水泥制品业
			2823	腈纶纤维制造业				3121	水泥制品业
			2824	维纶纤维制造业				3123	砼结构构件制造业
			2829	其他合成纤维制造业				3124	石棉水泥制品业
		285		渔具及渔具材料制造业				3129	其他水泥制品业
			2851	渔具用丝制造业			313		砖瓦、石灰和轻质建筑材料制造业
			2852	渔具用线制造业				3131	砖瓦制造业
			2853	渔具用绳制造业				3132	石灰制造业
			2854	渔网制造业				3133	建筑用石加工业

门类	大类	中类	小类	类别名称	门类	大类	中类	小类	类别名称
			3134	轻质建筑材料制造业			322	3220	炼钢业
			3135	防水密封建筑材料制造业			324	3240	钢压延加工业
			3136	隔热保温材料制造业			326	3260	铁合金冶炼业
			3139	其他砖瓦、石灰和轻质建筑材料制造业		33			有色金属冶炼及压延加工业
							331		重有色金属冶炼业
		314		玻璃及玻璃制品业				3311	铜冶炼业
			3141	建筑用玻璃制品业				3312	铅冶炼业
			3142	工业技术用玻璃制造业				3314	镍钴冶炼业
			3143	光学玻璃制造业				3316	锡冶炼业
			3145	玻璃仪器制造业				3317	锑冶炼业
			3147	日用玻璃制品业				3318	汞冶炼业
			3148	玻璃保温容器制造业				3319	其他重有色金属冶炼业
			3149	其他玻璃及玻璃制品业			332		轻有色金属冶炼业
		315		陶瓷制品业				3321	铝冶炼业
			3151	建筑、卫生陶瓷制造业				3322	镁冶炼业
			3153	工业用陶瓷制造业				3323	钛冶炼业
			3155	日用陶瓷制造业				3329	其他轻有色金属冶炼业
			3159	其他陶瓷制品业			333		贵金属冶炼业
		316		耐火材料制品业				3331	金冶炼业
			3161	石棉制品业				3332	银冶炼业
			3163	云母制品业				3339	其他贵金属冶炼业
			3169	其他耐火材料制品业			334		稀有稀土金属冶炼业
		317		石墨及碳素制品业				3341	钨钼冶炼业
			3171	冶金用碳素制品业				3349	其他稀有稀土金属冶炼业
			3172	电工用碳素制品业			336	3360	有色金属合金业
			3179	其他石墨及碳素制品业			338		有色金属压延加工业
		318		矿物纤维及其制品业				3381	重有色金属压延加工业
			3181	玻璃纤维及其制品业				3383	轻有色金属压延加工业
			3182	玻璃钢制品业				3385	贵金属压延加工业
			3189	其他矿物纤维及制品业				3387	稀有稀土金属压延加工业
		319	3190	其他类未包括的非金属矿物制品业		34			金属制品业
							341	3410	金属结构制造业
	32			黑色金属冶炼及压延加工业			342	3420	铸铁管制造业
		321	3210	炼铁业			343		工具制造业

门类	大类	中类	小类	类别名称	门类	大类	中类	小类	类别名称
			3431	切削工具制造业				3515	内燃机零部件及配件制
			3434	模具制造业				3519	其他锅炉及原动机制造业
			3435	手工具制造业			352		金属加工机械制造业
			3439	其他工具制造业				3521	金属切削机床制造业
		344		集装箱和金属包装物品制造业				3523	锻压设备制造业
			3441	集装箱制造业				3525	铸造机械制造业
			3442	金属包装物品及容器制造业				3526	机床附件制造业
		345	3450	金属丝绳及其制品业				3529	其他金属加工机械制造业
		346		建筑用金属制品业			353		通用设备制造业
			3461	建筑小五金制造业				3531	起重运输设备制造业
			3463	水暖管道零件制造业				3532	工矿车辆制造业
			3465	金属门窗制造业				3533	泵制造业
			3469	其他建筑用金属制造业				3534	风机制造业
		347	3470	金属表面处理及热处理业				3535	气体压缩机及气体分离设备
		348		日用金属制品业					制造业
			3481	搪瓷制造业				3536	冷冻设备制造业
			3482	铝制品业				3537	风动工具制造业
			3483	不锈钢制品业				3538	电动工具制造业
			3484	刀剪制造业				3539	其他通用设备制造业
			3485	制锁业			354		轴承、阀门制造业
			3486	炊事用具制造业				3541	轴承制造业
			3487	燃气用具制造业				3542	阀门制造业
			3488	理发用具制造业			356		其他通用零部件制造业
			3489	其他日用金属制品业				3561	液压件及液力件制造业
		349		其他金属制品业				3562	气动元件制造业
			3491	铁制小农具制造业				3563	密封件制造业
			3495	焊条制造业				3564	粉末冶金制品业
			3499	其他类未包括的金属制品业				3565	紧固件制造业
	35			普通机械制造业				3566	弹簧制造业
		351		锅炉及原机动制造业				3567	链条制造业
			3511	锅炉制造业				3568	齿轮制造业
			3512	内燃机制造业				3569	其他类未包括的通用零部件
			3513	汽轮机制造业					制造业
			3514	水轮制造业			357		铸锻件制造业

门类	大类	中类	小类	类别名称	门类	大类	中类	小类	类别名称
			3571	铸件制造业				3636	照明器具工业专用设备制造业
			3572	锻件制造业				3637	日用硅酸制品工业专用设备制造业
		358	3580	普通机械修理业				3638	制浆、造纸工业专用设备制造业
		359	3590	其他普通机械制造业				3639	日用化学工业专用设备制造业
	36			专用设备制造业			364		农、林、牧、渔、水利业机械制造业
		361		冶金、矿山、机电工业专用设备制造业				3641	拖拉机制造业
			3611	矿山设备制造业				3642	机械化农机具制造业
			3613	冶金工业专用设备制造业				3643	营林机械制造业
			3615	电子专用设备制造业				3644	畜牧机械制造业
			3617	电子工业专用设备制造业				3645	渔业机械制造业
			3619	其他机电工业专用设备制造业				3646	水利机械制造业
		362		石化及其他工业专用设备制造业				3647	拖拉机配件制造业
			3621	石油工业专用设备制造业				3649	其他农、林、牧、渔、水利业机械制造业
			3622	化学工业专用设备制造业			365		医疗器械制造业
			3623	化学纤维工业专用设备制造业				3651	手术器械制造业
			3624	橡胶工业专用设备制造业				3652	医疗仪器、设备制造业
			3625	塑料工业专用设备制造业				3653	诊断用品制造业
			3626	森林工业专用设备制造业				3654	医用材料及医疗用品制造业
			3627	印刷工业专用设备制造业				3655	假肢、矫形器制造业
			3628	制药工业专用设备制造业			367		其他专用设备制造业
			3629	建筑材料及其他非金属矿物制品专用设备制造业				3671	建筑机械制造业
		363		轻纺工业专用设备制造业				3672	地质专用设备制造业
			3631	食品、饮料、烟草工业专用设备制造业				3673	畜牧兽医医疗器械制造业
			3632	粮油工业专用设备制造业				3674	缝纫机制造业
			3633	饲料工业专用设备制造业				3675	商业、饮食业、服务业专用机械制造业
			3634	包装工业专用设备制造业				3676	邮政机械及器材制造业
			3635	纺织、服装、皮革工业专用设备制造业				3677	环境保护机械制造业
								3678	社会公共安全设备

门类	大类	中类	小类	类别名称	门类	大类	中类	小类	类别名称
				及器材制造业				3762	内河船制造业
			3679	其他类未包括的专用				3763	渔轮制造业
				设备制造业				3764	船舶机械设备制造业
		368		专用机械设备修理业				3765	海洋石油平台制造业
			3681	工业专用设备修理业			377		航空航天器制造业
			3683	农、林、牧、渔、水利				3771	飞机制造业
				机械修理业				3779	其他航空航天器制造业
			3684	其他专用机械设备修理业			378		交通运输设备修理业
			3685	医疗器械修理业				3781	铁路运输设备修理业
	37			交通运输设备制造业				3782	汽车修理业
		371		铁路运输设备制造业				3783	摩托车修理业
			3711	机车制造业				3784	电车修理业
			3712	客车制造业				3785	船舶修理业
			3713	货车制造业				3786	飞机修理业
			3714	机车车辆配件制造业				3789	其他交通运输设备修理业
			3715	铁路信号设备制造业			379		其他交通运输设备制造业
			3716	铁路专用设备制造业				3791	航标器材制造业
			3717	铁路专用器材制造业				3792	潜水装备制造业
			3719	其他铁路运输设备制造业				3793	公路标志制造业
		372		汽车制造业		39	390	3900	武器弹药制造业
			3721	载重汽车制造业		40			电气机械及器材制造业
			3722	客车制造业			401		电机制造业
			3723	小轿车制造业				4011	发电机制造业
			3724	微型汽车制造业				4012	电动机制造业
			3725	特种车辆及改装汽车制造业				4013	微电机制造业
			3726	汽车车身制造业			402		输配电及控制设备制造业
			3627	汽车零部件及配件制造业				4021	压器制造业
	373			摩托车制造业				4022	整流器制造业
			3731	摩托车整车制造业				4023	电容器制造业
			3732	摩托车零部件及配件制造业				4024	开关控制设备制造业
		374	3740	自行车制造业				4027	电器设备元件制造业
		375	3750	电车制造业				4029	其他输配电及控制
		376		船舶制造业					设备制造业
			3761	海洋运输船制造业			404		电工器材制造业

门类	大类	中类	小类	类别名称	门类	大类	中类	小类	类别名称
			4041	电线电缆制造业					部件制造业
			4043	绝缘制品业			413	4130	广播电视设备制造业
			4045	蓄电池制造业			414		电子计算机制造业
			4046	原电池制造业				4141	电子计算机整机制造业
			4049	其他电工器材制造业				4143	电子计算机外部设备制造业
		406		日用电器制造业			415		电子器件制造业
			4061	洗衣机制造业				4151	电真空器件制造业
			4062	吸尘器制造业				4153	半导体器件制造业
			4063	电冰箱制造业				4155	集成电路制造业
			4064	电风扇制造业			416	4160	电子元件制造业
			4065	空调器制造业			417		日用电子器具制造业
			4066	排油烟制造业				4171	电视机、录像机、摄像
			4069	其他日用电器制造业					机制造业
		407		照明器具制造业				4172	收音机、录音机制造业
			4071	电光源制造业				4173	电子计算器制造业
			4071	灯头、灯座制造业			418		电子设备及通信设备修理业
			4073	灯具制造业				4181	通信设备修理业
			4074	灯用电器附件制造业				4182	广播电视设备修理业
			4079	其他照明器具制造业				4183	电子计算机修理业
		408	4080	电气机械修理业				4189	其他电子设备修理业
		409		其他电气机械制造业			419	4190	其他电子设备制造业
			4091	电焊机制造业		42			仪器仪表及文化、办公用
			4092	工业用电炉制造业					机械制造业
			4099	其他类未包括的电气			421		通用仪器仪表制造业
				机械制造业				4211	工业自动化仪表制造业
	41			电子及通信设备制造业				4212	电工仪器、仪表制造业
		411		通信设备制造业				4213	光学仪器制造业
			4111	传输设备制造业				4214	计时仪器制造业
			4112	交换设备制造业				4215	分析仪器制造业
			4113	通信终端设备制造业				4216	试验机制造业
			4119	其他通信设备制造业				4217	实验室仪器及装置制造业
		412		雷达制造业				4218	实用仪器仪表元件、器件
			4121	雷达整机制造业					制造业
			4122	雷达专用配套设备及				4219	其他通用仪器仪表制造业

门类	大类	中类	小类	类别名称	门类	大类	中类	小类	类别名称
		422		专用仪器仪表制造业				4313	漆器工艺品制造业
			4221	环境保护仪器仪表制造业				4314	花画工艺品制造业
			4222	汽车仪器仪表制造业				4315	竹、藤、棕、草工艺品制造业
			4223	导航、制导仪器制造业				4316	抽纱刺绣工艺品制造业
			4224	农、林、牧、渔仪器仪表制造业				4317	地毯制造业
			4225	地质勘探、钻采、地震专用仪器制造业				4318	首饰制造业
								4319	其他工艺美术品制造业
			4226	气象、海洋、水文、天文测量仪器制造业			435		日用杂品制造业
								4351	制镜业
			4227	教学仪器制造业				4353	眼镜制造业
			4228	核子及核辐射测量仪器制造业				4355	制伞业
								4357	羽毛加工及制刷业
			4229	专用仪器仪表元件、器件制造业			439		其他生产、生活用品制造业
								4391	生产用其他产品制造业
		423	4230	电子测量仪器制造业				4392	生活用其他产品制造业
		424		计量器具制造业	D				**电力、煤气及水的生产和供应业**
			4241	传递标准用计量仪器制造业					
			4242	量具量仪制造业		44			电力、蒸汽、热水的生产和供应业
			4243	衡器制造业			441		电力生产业
		425		文化、办公用机械制造业				4411	火力发电业
			4251	电影机械制造业				4412	水力发电业
			4252	幻灯机及投影仪制造业				4413	核力发电业
			4254	照相机及器材制造业				4419	其他电业
			4256	复印机制造业			442	4420	电力供应业
			4257	打字机及油印机制造业			443	4430	蒸汽、热水生产和供应业
			4259	其他文化、办公用机械制造业		45			**煤气生产和供应业**
		426	4260	钟表制造业			451	4150	煤气生产业
		428	4280	仪器仪表及文化、办公用机械修理业			452	4520	煤气供应业
						46			**自来水的生产和供应业**
		429	4290	其他仪器仪表制造业			461	4610	自来水生产业
	43			**其他制造业**			462	4620	自来水供应业
		431		工艺美术品制造业	E				**建筑业**
			4311	雕塑工艺品制造业		47			**土木工程建筑业**
			4312	金属工艺品制造业			471	4710	房屋建筑业

门类	大类	中类	小类	类别名称	门类	大类	中类	小类	类别名称
		472	4720	矿山建筑业			551	5510	远洋运输业
		473	4730	铁路、公路、隧道、桥梁建筑业			552	5520	沿海运输业
		474	4740	堤坝、电站、码头建筑业			553	5530	内河、内湖运输业
		479	4790	其他土木工程建筑业			559	5590	其他水上运输业
	48			线路、管道和设备安装业					航空运输业
		481	4810	线路、管道安装业			561	5610	航空客货运输业
		482	4820	设备安装业			562	5620	通用航空业
	49	490	4900	装修装饰业		57			交通运输辅助业
F				地质勘查业、水利管理业			571	5710	公路管理及养护业
	50			地质勘查业			572		港口业
		501	5010	区域地质勘查业				5721	沿海港口业
		502	5020	海洋地质勘查业				5722	内河、内湖港口业
		503		矿产地质勘查业			573	5730	水运辅助业
			5031	石油、天然气地质勘查业			574	5740	机场及航空运输辅助业
			5032	煤炭地质勘查业			575	5750	装卸搬运业
			5033	黑色金属矿产地质勘查业			579	5790	其他类未包括的交通运输
			5034	有色金属矿产地质勘查业					辅助业
			5035	贵金属矿产地质勘查业		58	580	5800	其他交通运输业
			5036	其他金属矿产地质勘查业		59	590	5900	仓储业
			5037	非金属矿产地质勘查业		60			邮电通信业
			5038	水文地质勘查业			601	6010	邮政业
		504	5040	工程地质勘查业			602	6020	电信业
		505	5050	环境地质勘查业			603	6030	邮电业
		506	5060	地球物理和地球化学勘查业	H				批发和零售贸易、餐饮业
		509	5090	地质工程技术及其他		61			食品、饮料、烟草和家庭用品
				技术服务业					批发业
	51	510	5100	水利管理业			611		食品、饮料、烟草批发业
G				交通运输、仓储及邮电通信业				6111	粮食、食用油批发业
	52	520	5200	铁路运输业				6112	糕点、糖果和饮料批发业
	53			公路运输业				6113	肉、禽、蛋及其制品批发业
		531	5310	汽车运输业				6114	水产品批发业
		539	5390	其他公路运输业				6115	蔬菜、果品批发业
	54	540	5400	管道运输业				6116	茶叶批发业
	55			水上运输业				6117	烟草及其制品批发业

门类	大类	中类	小类	类别名称	门类	大类	中类	小类	类别名称
			6118	盐及调品批发业				6281	汽车批发业
			6119	其他食品、饮料、烟草批发业				6282	摩托车批发业
		612		棉、麻、土畜产品批发业				6289	汽车、摩托车零配件批发业
			6121	棉、麻批发业			629		其他批发业
			6122	畜产品批发业			631	6310	工艺美术品批发业
		613		纺织品、服装和鞋帽批发业			632	6320	图书报刊批发业
			6131	纺织品批发业			633	6330	农业生产资料批发业
			6132	服装批发业			639	6390	其他类未包括的批发业
			6133	鞋帽批发业		64			零售业
		614		日用百货批发业			641		食品、饮料和烟草零售业
			6141	百货批发业				6411	粮食食品零售业
			6142	文化用品、钟表眼镜批发业				6412	副食品零售业
			6149	其他日用百货批发业				6419	其他食品、饮料和烟草零售业
		615	6150	日用杂品批发业			642		日用百货零售业
		616	6160	五金、交电、化工批发业				6421	百货零售业
		617		药品及医疗器械批发业				6422	文化体育用品零售业
			6171	西药批发业				6423	钟表、眼镜及照相器件零售业
			6172	中草药及制品批发业				6429	其他日用百货零售业
			6173	医疗器械批发业			643	6430	纺织品、服装和鞋帽零售业
	62			能源、材料和机械电子			644	6440	日用杂品零售业
				设备批发业			645	6450	五金、交电、化工零售业
		621		能源批发业			647	6470	药品及医疗器械零售业
			6211	石油及制品批发业			648	6480	图书报刊零售业
			6212	煤炭及制品批发业			649		其他零售业
			6219	其他能源批发业				6491	家具零售业
		622	6220	化工材料批发业				6492	煤炭零售业
		623	6230	木材批发业				6493	石油制品零售业
		624	6240	建筑材料批发业				6494	汽车、摩托车及其零配件
		625	6250	矿产品批发业					零售业
		626		金属材料批发业				6495	计算机及软件、办公设备
			6261	黑色金属材料批发业					零售业
			6262	有色金属材料批发业				6496	信托业
		627	6270	机械、电子设备批发业				6497	首饰业
		628		汽车、摩托车及零配件批发业				6499	其他类未包括的零售业

门类	大类	中类	小类	类别名称	门类	大类	中类	小类	类别名称
	65	650	6500	商业经纪与代理业				7514	市内轮渡业
	67			餐饮业				7519	其他市内公共交通业
		671	6710	正餐			752	7520	园林绿化业
		672	6720	快餐			753	7530	自然保护区管理业
		679		其他餐饮业			754	7540	环境卫生业
			6791	小吃			755	7550	市政工程管理业
			6793	冷饮			756	7560	风景名胜区管理业
			6795	茶馆			759	7590	其他公共服务业
			6799	其他类未包括的餐饮业		76			居民服务业
I				金融、保险业			761	7610	理发及美容化妆业
	68			金融业			762	7620	沐浴业
		681	6810	中央银行			763	7630	洗染业
		682	6820	商业银行			764	7640	摄影及扩印业
		683	6830	其他银行			765	7650	托儿所
		684	6840	信用合作社			766	7660	日用品修理业
		685	6850	信托投资业			767	7670	家务服务业
		686	6860	证券经纪与交易业			768	7680	殡葬业
		687		其他非银行金融业			769	7690	其他居民服务业
			6871	财务公司		78	780	780	旅馆业
			6872	融资租赁公司		79	790	790	租赁服务业
			6873	典当业		80	800	8000	旅游业
			6879	其他类未包括的非		81	810	8100	娱乐服务业
				银行金融业		82			信息、咨询服务业
	70	700	7000	保险业			821	8210	广告业
J				房地产业			822		咨询服务业
	72	720	7200	房地产开发与经营业				8221	公证业
	73	730	7300	房地产管理业				8222	律师事务所
	74	740	7400	房地产经纪与代理业				8223	会计、审计、统计咨询业
K				社会服务业				8224	社会调查业
	75			公共设施服务业			829	8290	其他类未包括的信息咨询服务业
		751		市内公共交通业		83			计算机应用服务业
			7511	市内公共汽电工业			831	8310	软件开发咨询业
			7512	出租汽车业			832	8320	数据处理业
			7513	轨道交通业			833	8330	数据库服务业

门类	大类	中类	小类	类别名称	门类	大类	中类	小类	类别名称
		834	8340	计算机设备维护咨询业				8921	[illegible]
	84			其他社会服务业				8922	[illegible]
		841	8410	市场管理服务业				8923	[illegible]业中学
		849	8490	其他类未包括的社会服务业				8924	[illegible]
L				卫生、体育和社会福利业				8925	成[illegible]等学校
	85			卫生				8926	工读学校
		851		医院			893		初等教育
			8511	综合医院				8931	小学校
			8512	专科医院				8932	成人初等学校
			8513	中医医院			894	8940	学前教育
			8514	门诊部			895	8950	特殊教育
			8519	其他医院			899	8990	其他教育
		852	8520	疗养院		90			文化艺术业
		853	8530	专科防治所(站)			901	9010	艺术
		854	8540	卫生防疫站			902	9020	出版
		855	8550	妇幼保健所(站)			903	9030	文物保护
		856	8560	药品检验所(室)			904	9040	图书馆
		859	8590	其他卫生			905	9050	档案馆
	86	860	8600	体育			906	9060	群众文化
	87			社会福利保障业			907	9070	新闻
		871		社会福利业			908	9080	文化艺术经纪与代理业
			8711	干部休养所			909	9090	其他文化艺术业
			8712	福利收容院		91			广播电影业
			8713	社会服务业			911	9110	广播
		872	8720	社会保险和救济业			912	9120	电影
		879	8790	其他类未包括的社会			913	9130	电视
				福利保障业	N				科学研究和综合技术服务业
M				教育、文化艺术及广播		92			科学研究业
				电影电视业			921	9210	自然科学研究
	89			教育			922	9220	社会科学研究
		891		高等教育			923	9230	其他科学研究
			8911	普通高等教育		93			综合技术服务业
			8912	成人高等教育			931	9310	气象
		892		中等教育			932	9320	地震

门类	大类	中类	小类	类别名称	门类	大类	中类	小类	类别名称
		933	9330	测绘					
		934	9340	技术监督					
		935	9350	海洋环境					
		936	9360	环境保护					
		937	9370	技术推广和科技交流服务业					
		938	9380	工程设计业					
		939	9390	其他综合技术服务业					
O				国家机关、政党机关和社会团体					
	94	940	9400	国家机关					
	95	950	9500	政党机关					
	96	960	9600	社会团体					
	97			基层群众自治组织					
		971	9710	居民委员会					
		972	9720	村民委员会					
P				其他行业					
	99			其他行业					
		991	9910	企业管理机构					
		999	9990	其他类未包括的行业					

中华人民共和国国家标准

GB/T 13201－91

《制定地方大气污染物排放标准的技术方法》(节选)

7.(有害气体无组织排放控制与工业企业卫生防护距离标准的制定方法

7.1 凡不通过排气筒或通过15m高度以下排气筒的有害气体排放，均属无组织排放。工业企业应采用合理的生产工艺流程，加强生产管理与设备维护，最大限度地减少有害气体的无组织排放。

7.2 无组织排放的有害气体进入呼吸带大气层时，其浓度如超过GB3095与TJ36规定的居住区容许浓度限值，则无组织排放源所在的生产单元(生产区、车间或工段)与居住区之间应设置卫生防护距离。

7.3 卫生防护距离在100m以内时，级差为50m；超过100m，但小于或等于1000m时，级差为100m；超过1000m以上，级差为200m。

7.4 各类工业、企业卫生防护距离按式(31)计算：

$$\frac{Q_C}{C_m}=\frac{1}{A}(BL^C+0.25r^2)^{0.50}L^D\cdots\cdots(31)$$

式中：

C_m——标准浓度限值，$mg\cdot m_N^{-3}$；

L——工业企业所需卫生防护距离m；

r——有害气体无组织排放源所在生产单元的等效半径，m。根据该生产单元占地面积$S(m^2)$计算，$r=(S/\pi)^{0.5}$；

A、B、C、D——卫生防护距离计算系数，无因次，根据工业企业所在地区近五年平均风速及工业企业大气污染源构成类别从表5查取。

Q_C——工业企业有害气体无组织排放量可以达到的控制水平，$kg\cdot h^{-1}$。

表5 卫生防护距离计算系数

计算系数	工业企业所在地区近五年平均风速 m/s	卫生防护距离L.m								
		L≤1000			1000<L≤2000			L>2000		
		工业企业大气污染源构成类别								
		Ⅰ	Ⅱ	Ⅲ	Ⅰ	Ⅱ	Ⅲ	Ⅰ	Ⅱ	Ⅲ
A	<2	400	400	400	400	400	400	80	80	80
	2～4	700	470	350	700	470	350	380	250	190
	>4	530	350	260	530	350	260	290	190	140
B	<2	0.01			0.015			0.015		
	>2	0.021			0.036			0.036		

计算系数	工业企业所在地区近五年平均风速 m/s	卫生防护距离 L.m								
		L≤1000			1000<L≤2000			L>2000		
		工业企业大气污染源构成类别								
		Ⅰ	Ⅱ	Ⅲ	Ⅰ	Ⅱ	Ⅲ	Ⅰ	Ⅱ	Ⅲ
C	<2	1.85			1.79			1.79		
	>2	1.85			1.77			1.77		
D	<2	0.78			0.78			0.57		
	>2	0.84			0.84			0.76		

注:1)工业企业大气污染源构成分为三类:

Ⅰ类:与无组织排放源共存的排放同种有害气体的排气筒的排放量,大于标准规定的允许排放量的三分之一者。

Ⅱ类:与无组织排放源共存的排放同种有害气体的排气筒的排放量,小于标准规定的允许排放量的三分之一,或虽无排放同种大气污染物之排气筒共存,但无组织排放的有害物质的容许浓度指标是按急性反应指标确定者。

Ⅲ类:无排放同种有害物质的排气筒与无组织排放源共存,且才组织排放的有害物质的容许浓度是按慢性反应指标确定者。

Q_0 取同类企业中生产工艺流程合理,生产管理与设备维护处于先进水平的工业企业,在正常运行时的无组织排放量。当按式(31)计算的 L 值在两级之间时,取偏大的一级。

5 无组织排放多种有害气体的工业企业,按 Q_C/C_m 的最大值计算其所需卫生防护距离,但当按两种或两种以上的有害气体的 Q_C/C_m 值计算的卫生防护距离在同一级别时,该类工业企业的卫生防护距离级别应提高一级。

6 地处复杂地形条件下的工业企业所需卫生防护距离,应由建设单位主管部门与建设项目所在省、市、自治区的卫生与环境保护主管部门,根据环境影响评价报告书共同确定。

三、附件：化学物质部分分类

1.无机物分类

类别名称	代表化学品
①无机单质	金属钠、铝、硫磺、汞、铬、砷。
②无机气体	氨、氯、氧、氢、氮。
③氧化物与过氧化物	氧化钙、过氧化氢(双氧水)。
④氢氧化物	氢氧化钠、氢氧化铅、氢氧化铝。
⑤无机酸	硫酸、盐酸、硝酸、氢氟酸、磷酸。
⑥无机盐	硫酸钡、碘化钾、氰化物，亚硝酸钠。
⑦稀土元素化合物	氧化铈、硝酸铈、氯化镧。
⑧其它无机化合物	铝酸钠、锑酸钠、石棉。

2.有机物分类：

类别名称	代表化学品
①脂肪族化合物：	
脂肪族烃类	甲烷、正已烷、异辛烷、乙炔、丁烯。
脂肪族卤代衍生物	二氯甲烷、三氯甲烷、四氯化碳、二氟二氯甲烷(F－12)氯乙烯，三氯硝基甲烷。
酯肪族醇、醚及其衍生物	甲醇、叔丁醇、氧化丙烯(1、2－环氧丙烷)、二异丙烷、环氧乙烷。
酯肪族醛、酮及其衍生物	甲醛、甲基异丁基甲酮、氯丙酮、丙酮。
酯肪族羧酸及其衍生物	乙酸(醋酸)、月桂酸(十二烷酸)、柠檬酸、醋酸锌、草酸钠、异辛酸钴、磷酸三丁酯、邻苯二甲酸酯类。
脂肪族含氮化合物	三硝基甲烷、乙醇胺、已二腈、异氰酸甲酯、丙烯腈。
脂肪族含硫化合物	二硫化碳，甲磺酰氯。
②脂环族化合物及其衍生物	环已烷、环已酮、环烷酸。
③芳香族化合物	
芳香族烃类	苯、烷基苯、蒽、联苯萘、甲苯、乙苯、二甲苯。
芳香族卤素衍生物	氯苯、邻氯甲苯、六氯苯、二氯苯、五氯酚。
酚、芳香醇及其衍生物	苯酚、邻、间、对甲酚
芳香族醛、酮及其衍生物	苯甲醛、蒽醌。
芳香族羧酸及其衍生物	苯甲酸、水杨酸、邻苯二甲酸酐，对苯二甲酰氯，烷基磺酸苯酯。

类别名称	代表化学品
芳香族含氮化合物及其衍生物	硝基苯，对硝基苯酚、对硝基甲苯、2，4－二硝基氯苯、对硝基氯苯、苯胺、对硝基苯胺。
芳香族含硫化合物	苯磺酸，烷基苯、磺酸钠，尼文酸、克列夫氏酸。
④杂环化合物	四氢呋喃、糠醛、4－苯基脲唑（稳定剂Ⅱ），糖精、樟脑。
⑤助剂	N－苯基－α萘胺（防老剂A）、二硫化二苯并噻唑（促进剂DM）
⑥元素有机化合物	甲基氯硅烷、氧化双三丁基锡等
⑦其它	碳化钙（电石），盐酸羟胺、水合肼（水合联氨）等。

3.农药

类别名称	代表化学品*（例）
①杀虫剂：	
有机氯杀虫剂	林丹，六六六、滴滴涕。
有机磷杀虫剂	敌敌畏、敌百虫、对硫磷、甲胺磷、甲拌磷、采果、敌百虫、甲基对石礼磷。。
氨基甲酸酯杀虫剂	涕灭威、速灭威。
拟除虫菊酯	溴氰菊酯、氯氰菊酯。
熏蒸剂	氯化苦，磷化铝、对二氯苯。
其它杀虫剂	杀虫脒。
增效剂	增效磷
②杀螨剂	三氯杀螨醇
③杀虫、杀螨剂混剂	
④杀鼠剂	磷化锌、杀鼠灵。
⑤杀菌剂	
无机杀菌剂	硫黄，波尔多液、石硫合剂。
有机硫杀菌剂	代森胺、福美双、代森锌。
有机砷、磷杀菌剂	克瘟散、福美肿、稻瘟净。
取代苯类杀菌剂	甲基硫菌灵、百菌清。
唑类杀菌剂	多菌灵。
⑥抗生素	天瘟素，多抗霉素。
⑦其他杀菌剂	叶枯净、灭菌丹。
⑧杀菌剂混剂	

类别名称	代表化学品*(例)
⑨除草剂	
苯氧致酸类除草	2.4－滴丁酯、2甲4氯
酰胺类除草剂	敌草胺
取代脲类除草剂	甲磺隆、异丙隆
苯胺类除草剂	氟乐灵
氨基甲酸酯类除草剂	杀草丹、野麦畏
有机磷类除草剂	草甘膦
二苯醚类除草剂	除草醚
三嗪(三氮苯)类除草剂	西玛津、扑草净
其它除草剂	燕麦枯、五氯酚钠
除草剂混剂	
⑩植物生长调节剂	

* 代表化学品使用商品名称标出，为避免化学命名的名称过长，表格篇幅太大。

4.化肥

类别名称	代表化学品
氮肥	尿素、碳酸氢氨
磷肥	磷酸钙
钾肥	氯化钾，硫酸钾
复合肥	磷酸一铵等
微量元素肥料	硫酸铜，硫酸锌
腐殖酸肥料	泥炭营养土，腐殖酸钠

5.染料、有机颜料

类别名称	代表化学品*
染料	
1.酸性染料	
一般酸性染料	酸性红B、酸性黑10B
弱酸性染料	弱酸性艳红3B、弱酸性嫩黄G
酸性络合染料	酸性络合桃红B、酸性络合兰BN
2.中性染料	中性深蒸GRL、中性红－BR
3.冰染染料	色酚AS、兰色盐B
4.碱性染料	碱性品红、碱性玫瑰精

类别名称	代表化学品*
5.阳离子染料	阳离子黄、阳离子艳兰
6.直接染料	直接枣红、直接耐晒绿
7.分散染料	分散荧光黄 GL、分散翠兰 GL
8.食用染料	食用靛兰、辣椒红
9.缩聚染料	缩聚棕 RD
10.酸性媒介染料	酸性媒介黑 A、酸性媒介紫红
11.毛皮染料	毛皮黑 D
12.皮革喷涂染料	皮革喷涂黑 RL
13.活性染料	活性橙 X－GN、活性金蒸 X－G
14.硫化染料	硫化黄 GC、水溶性硫化兰
15.还原染料	还厚深兰 VB、还厚棕 G
16.其它染料	酞菁素紫
有机颜料	
一般有机颜料	耐晒黄 G、联苯胺橙
17.预分散型有机颜料	3851 予分散绿
18.色淀颜料	永固红 2BL、主索尔紫红
溶剂颜料	油溶性橙、苯胺黑
涂料色浆	9103 荧光金黄、FR9201、荧光桃红 2B

6.涂料

类别名称	代表化学品*
一、油酯漆	
二、天然树脂漆	
三、酚醛树脂漆	
四、沥清漆	
五、醇酸树脂漆	
六、氨基树脂漆	
七、硝基漆	
八、过氯乙烯漆	
九、烯树脂漆	
十、丙烯酸漆	

类别名称	代表化学品*
十一、聚酯漆	
十二、环氧树脂漆	
十三、聚氨酯漆	
十四、元素有机硅漆	
十五、橡胶漆	
十六、其他漆	
十七、辅助材料	

* 涂料大部分为混合物，这里不再例举代表品。

7. 工业表面活性剂

类别名称	代表化学品(例)
一、阳离子表面活性剂	氯化十二烷基二甲基苄基铵，聚季铵盐。
二、阴离子表面活性剂	月桂基硫酸钠，烷基磺酸铵、表面活性剂 AS。
三、两性离子活性剂	发泡剂 TML、柔软剂 IS，缓触剂 M
四、非离子表面活性剂	平平加 O，均染剂－OH；
五、复配表面活性剂	破乳剂 KN－1，抗静电剂 HZ－1

8. 合成树脂与塑料(略)

中华人民共和国国家标准

(GB13690－92)

常用危险化学品的分类及标志(节选)

1、主题内容与适用范围

本标准对常用危险化学品按其主要危险特性进行了分类，并规定了危险品的包装标志。在附录部分列出了997种常用危险化学品分类明细表。表中给出每种危险化学品的品名、别名、英文名、分子式、主要危险性类别、次要危险性类别、危险特性及危险标志。

本标准适用于常用危险化学品的分类及包装标志，也适用于其它化学品的分类和包装标志。

2、引用标准

GB190 危险货物包装标志

3、分类

常用危险化学品按其主要危险特性分为8类：

3.1 第1类　爆炸品

本类化学品指在外界作用下(如受热、受压、撞击等)，能发生剧烈的化学反应，瞬时产生大量的气体和热量，使周围压力急骤上升，发生爆炸，对周围环境造成破坏的物品，也包括无整体爆炸危险，但具有燃烧、抛射及较小爆炸危险的物品。

3.2 第2类　压缩气体和液化气体

本类化学品系指压缩、液化或加压溶解的气体，并应符合下述两种情况之一者：

a.临界温度低于50℃，或在50℃时，其蒸气压力大于294kPa的压缩或液化气体；

b.温度在21.1℃时，气体的绝对压力大于275kPa，或在54.4℃时，气体的绝对压力大于715kPa的压缩气体；或在37.8℃时，雷德蒸气压力大于275kPa的液化气体或加压溶解的气体。

3.3 第3类　易燃液体

本类化学品系指易燃的液体、液体混合物或含有固体物质的液体，但不包括由于其危险特性已列入其它类别的液体。其闭杯试验闪点等于或低于61℃。

3.4 第4类　易燃固体、自然物品和遇湿易燃物品

易燃固体系指燃点低，对热、撞击、摩擦敏感，易被外部火源点燃，燃烧迅速，并可能散发出有毒烟雾或有毒气体的固体，但不包括已列入爆炸品的物品。

自燃物品系指自燃点低，在空气中易发生氧化反应，放出热量，而自行燃烧的物品。

遇湿易燃物品系指遇水或受潮时，发生剧烈化学反应，放出大量的易燃气体和热量的物品。有的不需明火，即能燃烧或爆炸。

3.5 第5类　氧化剂和有机过氧化物

氧化剂系指处于高氧化态，具有强氧化性，易分解并放出氧和热量的物质。包括含有过氧基的无机物，其本身不一定可燃，但能导致可燃物的燃烧，与松软的粉末状可燃物能组成爆炸性混合物，对热、震动或摩擦较敏感。

有机过氧化物系指分子组成中含有过氧基的有机物，其本身易燃易爆，极易分解，对热、震动或摩擦极为敏感。

3.6 第6类　有毒品

本类化学品系指进入肌体后，累积达一定的量，能与体液和器官组织发生生物化学作用或生物物理学作用，扰乱或破坏肌体的正常生理功能，引起某些器官和系统暂时性或持久性的病理改变，甚至危及生命的物品。经口摄取半数致死量：固体 $LD_{50}\leqslant 500mg/kg$，液体 $LD_{50}\leqslant 2000mg/kg$；经皮肤接触24h，半数致死量 $LD_{50}\leqslant 1000mg/kg$；粉尘、烟雾及蒸气吸入半数致死量 $LC_{50}\leqslant 10mg/L$ 的固体或液体。

3.7 第7类　放射性物品

本类化学品系指放射性比活度大于 $7.4\times 10^4Bq/kg$ 的物品。

3.8 第8类　腐蚀品

本类化学品系指能灼伤人体组织并对金属等物品造成损坏的固体或液体。与皮肤接触在4h内出现可见坏死现象，或温度在55℃时，对20号钢的表面均匀年腐蚀率超过6.25mm/年的固体或液体。

对于未列入分类明细表中的危险化学品，可以参照已列出的化学性质相似，危险性相似的物品进行分类。

4. 标志

4.1 标志的种类

根据常用危险化学品的危险特性和类别，它们的标志设主标志16种和副标志11种，见附录B(补充件，略)。

4.2 标志的图形

主标志由表示危险特性的图案、文字说明、底色和危险品类别号四个部分组成的菱形标志。副标志图形中没有危险品类别号。

4.3 标志的尺寸、颜色及印刷

按GB190的有关规定执行。

4.4 标志的使用

4.4.1 标志的使用原则

当一种危险化学品具有一种以上的危险性时，应用主标志表示主要危险性类别，并用副标志来表示重要的其它的危险性类别。

4.4.2 标志的使用方法

按GB190的有关规定执行。

5、危险特性

略

中华人民共和国国家标准

GB 6944－86

危险货物分类和品名编号

1、适用范围

1.1 本标准适用于危险货物运输中类、项的划分和品名的编号。

1.2 凡具有爆炸、易燃、毒害、腐蚀、放射性等性质，在运输、装卸和贮存保管过程中，容易造成人身伤亡和财产损毁而需要特别防护的货物，均属危险货物。

2、分类

2.1 危险货物分为九类

2.1.1 第1类 爆炸品(explosives)

2.1.2 第2类 压缩气体和液化气体(compressed gases and liquefied gases)

2.1.3 第3类 易燃液体(flammable liquids)

2.1.4 第4类 易燃固体、自然物品和遇湿易燃物品(flammable solids substances liable to spontansous combustion and substances emitting flammable gases when wet)

2.1.5 第5类 氧化剂和有机过氧化物(oxidizing substances and organic peroxides)

2.1.6 第6类 毒害品和感染性物品(poisons and infectious substances)

2.1.7 第7类 放射性物品(radioactive substances)

2.1.8 第8类 腐蚀品(corrosives)

2.1.9 第9类 杂类(miscellaneous dangerous substances)

2.2 各类可分为若干项(division)

3 第1类 爆炸品

3.1 本类货物系指在外界作用下(如受热、撞击等)，能发生剧烈的化学反应，瞬时产生大量的气体和热量，使周围压力急骤上升，发生爆炸，对周围环境造成破坏的物品，也包括无整体爆炸危险，但具有燃烧、抛射及较大爆炸危险，或仅产生热、光、音响或烟雾等一种或几种作用的烟火物品。

3.2 本类货物按危险性分为五项。

3.2.1 第1项 具有整体爆炸危险的物质和物品(substances and articles which have a mass explosion hazard)

3.2.2 第2项 具有抛射危险，但无整体爆炸危险的物质和物品(substances and articles which have a projection hazard but not a mass explosion hazard)

3.2.3 第3项 具有燃烧危险和较小爆炸或较小抛射危险，或两者兼有，但无整体爆炸危险的物质和物品(substances and articles which have a fire hazard and either a minor blast hazard or a minor projection hazard or both, but not a mass explosion hazard)

3.2.4 第4项 无重大危险的爆炸物质和物品(substances and articles which present no significant hazard)

本项货物危险性较小，万一被点燃或引爆，其危险作用大部分局限在包装件内部，而

对包装件外部无重大危险。

3.2.5 第5项 非常不敏感的爆炸物质(very insensitive substances)

本项货物性质比较稳定,在着火试验中不会爆炸。

4、第2类 压缩气体和液化气体

4.1 本类货物系指压缩、液化或加压溶解的气体,并应符合下述两种情况之一者:

4.1.1 临界温度低于50℃,或在50℃时,其蒸气压力大于294kPa的压缩或液化气体。

4.1.2 温度在21.1℃时,气体的绝对压力大于275kPa,或在54.4℃时,气体的绝对压力大于715kPa的压缩气体;或在37.8℃时,雷德蒸气压(reid vapour pressure)大于275kPa的液化气体或加压溶解的气体。

4.2 本类货物分为三项:

4.2.1 第1项 易燃气体(plammable gases)

4.2.2 第2项 不燃气体(non-flammable gases)

本项货物系指无毒、不燃气体,包括助燃气体。

4.2.3 第3项 有毒气体(poisonous gases)

本项货物的毒性指标与第6类毒性指标相同。

5、第3类 易燃液体

5.1 本类货物系指易燃的液体、液体混合物或含有固体物质的液体,但不包括由于其危险特性已列入其它类别的液体。其闭环试验闪点等于或低于61℃,但不同运输方式可确定本运输方式适用的闪点,而不得低于45℃。

5.2 本类货物按闪点分为三项:

5.2.1 第1项 低闪点液体(liquids in low flashpoint group)

本项货物系指闭杯试验闪点低于-18℃的液体。

5.2.2 第2项 中闪点液体(liquids in intermediate flashpoint group)

本项货物系指闭杯试验闪点在-18℃至低于23℃的液体。

5.2.3 第3项 高闪点液体(liquids in high flashpoint group)

本项货物系指闭杯试验闪点在23℃至61℃的液体。

6、第4类 易燃固体、自燃物品和遇湿易燃物品

6.1 第1项 易燃固体

本项货物系指燃点低,对热、撞击、摩擦敏感,易被外部火源点燃,燃烧迅速,并可能散发出有毒烟雾或有毒气体的固体,但不包括已列入爆炸品的物质。

6.2 第2项 自燃物品

本项货物系指自燃点低,在空气中易于发生氧化反应,放出热量,而自行燃烧的物品。

6.3 第3项 遇湿易燃物品

本项货物系指遇水或受潮时,发生剧烈化学反应,放出大量的易燃气体和热量的物品。有些不需明火,即能燃烧或爆炸。

7、第5类 氧化剂和有机过氧化物

7.1 第1项 氧化剂

本项货物系指处于高氧化态，具有强氧化性，易分解并放出氧和热量的物质。包括含有过氧基的无机物，其本身不一定可燃，但能导致可燃物的燃烧；与松软的粉末状可燃物能组成爆炸性混合物，对热、震动或摩擦较敏感。

7.2 第2项 有机过氧化物

本项货物系指分子组成中含有过氧基的有机物，其本身易燃易爆，极易分解，对热、震动或摩擦极为敏感。

8、第6类 毒害品和感染性物品

8.1 第1项 毒害品

本项货物系指进入肌体后，累积达一定的量，能与体液和组织发生生物化学作用或生物物理学变化，扰乱或破坏肌体的正常生理功能，引起暂时性或持久性的病理状态，甚至危及生命的物品。经口摄取半数致死量：固体 $LD_{50}\leqslant500mg/kg$，液体 $LD_{50}\leqslant2000mg/kg$；经皮肤接触24h，半数致死量 $LD_{50}\leqslant1000mg/kg$；粉尘、烟雾及蒸气吸入半数致死浓度 $LC_{50}\leqslant10mg/L$ 的固体或液体，以及列入危险货物品名形的农药。

8.2 第2项 感染性物品

本项货物系指含有致病的微生物，能引起病态，甚至死亡的物质。

9、第7类 放射性物品

本类货物系指放射性比活度大于 $7.4\times10^4Bq/kg$ 的物品

10、第8类 腐蚀品

10.1 本类货物系指能灼伤人体组织并对金属等物品造成损坏的固体或液体。与皮肤接触在4h内出现可见坏死现象，或温度在55℃时，对20号钢的表面均匀年腐蚀率超过6.25mm/y的固体或液体。

10.2 本类货物按化学性质分为三项：

10.2.1 第1项 酸性腐蚀品(corrosives presenting acidic properties)

10.2.2 第2项 碱性腐蚀品(corrosives presenting alkalinous properties)

10.2.3 第3项其它腐蚀品(other corrosives)

11、第9类 杂类

11.1 本类货物系指在运输过程中呈现的危险性质不包括在上述八类危险性中的物品。

11.2 本类货物分为两项：

11.2.1 第1项 磁性物品

本项货物系指航空运输时，其包装件表面任何一点距2.1米处的磁场强度 $H\geqslant0.159A/m$。

11.2.2 第2项 另行规定的物品

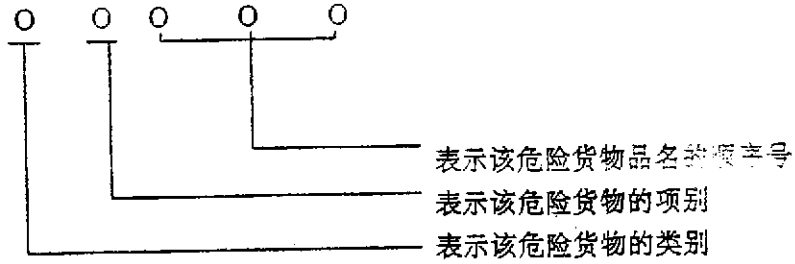
本项货物系指具有麻醉、毒害或其它类似性质，能造成飞行机组人员情绪烦燥或不适，以致影响飞行任务的正确执行，危及飞行安全的物品。

12、危险货物品编号

12.1 编号的组成

危险货物品名编写由五位阿拉伯数字组成，表明危险货物所属的类别、项号和顺序号。

12.2　编号的表示方法



12.3　编号的使用

每一危险货物指定一个编号，但对其性质基本相同，运输条件和灭火、急救方法相的危险货物，也可使用同一编号。

12.4　举例

品名×××，属第4类，第3项，顺序号100，该品名的编号为43100，该编号表明该险货物属于第4类第3项遇湿易燃物品。

中华人民共和国交通部部标准

JT 3130—88

汽车危险货物运输规则

Rules of Transportation of Dangerous Goods by Automobile

1 适用范围

本标准规定了汽车危险货物运输的技术管理规章、制度、要求与方法，除军运或国际联运另有规定外，均按本标准执行。凡具有爆炸、易燃、毒害、腐蚀、放射性等性质，在运输、装卸和储存保管过程中，容易造成人身伤亡和财产损毁而需要特别防护的货物，均属危险货物。

2 引用标准

GB 6944—86　危险货物分类和品名编号

GB 190—85　危险货物分装标志

GB 191—85　包装储运图示标志

GB 6388—86　运输包装收发货标志

JT ＊＊＊＊—87 公路、水路危险货物运输包装基本要求和性能试验

3 分类和分项

3.1 分类。按 GB6944—86 的规定，并根据汽车运输特点，暂不设第 9 类（杂类），共分为 8 类：

第 1 类　爆炸品；

第 2 类　压缩气体和液化气体；

第 3 类　易燃液体；

第 4 类　易燃固体、自燃物品和遇湿易燃物品；

第 5 类　氧化剂和有机过氧化物；

第 6 类　毒害品和感染性物品；

第 7 类　放射性物品；

第 8 类　腐蚀品。

3.2 分项。按交通部《汽车危险货物品名表》执行。

4 包装和标志

4.1 包装。

4.1.1 按 JT0017—88 的规定执行。包装必须坚固、完整、严密不漏、外表面清洁、不粘附有害的危险物质，并应符合如下要求：

a. 包装的材质、规格、型式、方法和单件质量（重量）应与所装危险货物的性质相适应，并应便于装卸和运输；

b. 包装应具有足够的强度，其构造和封闭装置应能承受正常运输条件和装御作业要求，并能经受一定范围的气候变化；

c.包装的封口和衬垫材料应与所装货物不溶解、无抵触，具有充分的吸收、缓冲、支撑固定和保护作用；

d.对必须装有通气孔的危险货物包装，通气孔的设计和安装应能防止所装货物泄漏或杂质进入，排出的气体不得造成危险或污染；

e.容器灌装液体时，应留有足够的其膨胀余量(预留容积应不少于总容积的5%)。

4.1.2 危险性质或消防方法相抵触的货物，不得混装在同一包装内。

4.1.3 对包装发生争议时，应当由国家授权的检验部门进行检验，合格的出具证明如附录A(参考件)，并经有关省、自治区、直辖市交通运输主管部门认可后方可使用，并报交通部备案。

4.1.4 国外进口危险货物的包装，如完整无损，符合安全运输要求的，应在运单上注明"进口原包装"字样，可按原包装运输。

4.1.5 凡重复使用的包装，除应符合4.1.1款规定外，还必须符合下列要求：

a.所装货物必须与原装货物无抵触；

b.所装货物与原装货物的品名或性质不同时，必须将原包装的标记、标志覆盖，并重新标贴。

4.1.6 危险货物成组包装必须具有能经受多次搬运的强度，并适宜于机械装卸。

4.1.7 盛装压缩气体和液化气体的压力容器，其设计、制造、检验、漆色、充灌应符合1979年国家劳动人事部发布的《气瓶安全监察规程》的规定。气瓶集装格应有防止管路和阀门受到碰撞的防护装置，总管路应装有总阀门，每组气瓶应有分阀门，气瓶、管路阀门和接头不得松动移位。

4.1.8 放射性货物运输包装应符合国家《放射性物质安全运输规定》的要求。

4.2 标志。

4.2.1 按GB190—85、GB191—85和GB6388—86的规定执行。

4.2.2 危险货物标志应标贴在包装件的明显部位上。集装箱和罐(槽)体应在显著部位标有相应加大的危险货物包装标志。

5 车辆和设备

5.1 装运危险货物的车辆技术状况应符合下列要求：

a.车厢、底板必须平坦完好，周围栏板必须牢固，铁质底板装运易燃、易爆货物时应采取衬垫防护措施，如铺垫木板、胶合板、橡胶板等，但不得使用谷草、草片等松软易燃材料；

b.机动车辆排气管必须装有有效的隔热和熄灭火星的装置，电路系统应有切断总电源和隔离电火花的装置；

c.车辆左前方必须悬挂黄底黑字"危险品"字样的信号旗，如附录B(补充件)；

d.根据所装危险货物的性质，配备相应的消防器材和捆扎、防水、防散失等用具。

5.2 装运危险货物的罐(槽)应适合所装货物的性能，具有足够的强度，并应根据同货物的需要配备泄压阀、防波板、遮阳物、压力表、液位计、导除静电等相应的安装置；罐(槽)外部的附件应有可靠的防护设施。必须保证所装货物不发生"跑、冒、滴、漏"并在阀门口装置积漏器。

5.3 使用装运液化石油气和有毒液化气体的罐(槽)车及其设备，必须符合国家

动人事部1981年发布的《液化石油气汽车槽车安全管理规定》的要求。

5.4 应定期对装运放射性同位素的专用运输车辆、设备、搬运工具、防护用品进行放射性污染程度的检查，当污染量超过规定的允许水平时，不得继续使用。

5.5 装运集装箱、大型气瓶、可移动罐(槽)等的车辆，必须设置有效的紧固装置。

5.6 各种装卸机械、工属具要有足够的安全系数，装卸易燃、易爆危险货物的机械和工属具，必须有消除产生火花的措施。

6 托运和单证

6.1 托运人应向具有从事危险货物运输经营许可证的运输单位办理托运。危险性质或消防方法相抵触的货物必须分别托运。

6.2 未列入交通部《公路危险货物品名表》的危险货物，托运时应提交生产或经营单位的主管部门审核的《危险货物鉴定表》如附录C(参考件)，经省、自治区、直辖市交通运输主管部门批准后办理运输，并由批准单位报交通部备案。

6.3 盛装过危险货物的空容器，未经消除危险处理的，仍按原装货物条件办理托运，其包装容器内的残留物不得泄漏，容器外表不得粘有导致危害的残留物。

6.4 要求使用罐(槽)车运输的危险货物，必要时托运人应提供有关资料或样品，并在运单上注明对装载的质量要求。

6.5 高度敏感或能自发引起剧烈反应的爆炸性物品，未采取有效抑制措施的禁止运输。对已采取有效的抑制或防护措施的危险货物，应在运单上注明。需控温运输的危险货物，托运人应在运单上注明控制温度和危险温度，并与承运人商定控温方法。

6.6 托运下列危险货物，应按如下规定办理：

a.食用、药用的危险货物应在运单上注明“食用”、“药用”字样；

b.托运“半衰期”短的放射性货物，应在运单上注明允许运送期限，其期限不得少于运输送达所需时间；

c.集装箱装运危险货物，托运人应提交装箱证明书如附录D(补充件)。

6.7 运输下列危险货物，应持有技术证件：

a.运输爆炸品和需凭证运输的化学危险物品，应有运往地县、市公安部门签发的《爆炸物品准运证》或《化学危险物品准运证》；

b.运输放射性货物(包括同位素空容器和作普通物品运输的装过放射性货物的空容器)，应持有省、自治区、直辖市指定的卫生防疫部门核发的包装件表面污染及辐射水平检查证明书如附录E(补充件)。

放射性化学试剂、制品和放射性矿石、矿砂等货物，其运输包装等级和放射性强度每次都相同时，允许一次测定剂量，再次运输时，可以提出原辐射水平检查证明书复制件。

6.8 符合下列情况者，可按普通货物运输：

a.货物的部分配件或部分材料属于危险物品，经县、市交通运输主管部门会同有关部门确认在运输中不致发生危险，并在货物运单上注明的；

b.根据国家《放射性物质安全运输规定》所规定的可按普通货物运输的放射性货物或装过放射性同位素的空容器，以及部分涂有放射性发光剂的工业成品；

c.经发货人确认已经清洗、消毒、消除危险的空容器，并由发货人在货物运单上注明承担责任的；

d.凡属二级无机氧化剂、二级易燃固体、有毒固体物品、二级腐蚀性固体物品等危险货物其内包装净重不超过0.5kg，每箱净重不超过20kg，其包装标志符合本规则规定，经托人在货物运单上注明“小包装化学品”字样，一批发运量不超过100kg的；

e.除爆炸品、烈性有机过氧化物和6.8d条已有规定外，其它危险货物，其包装要求、限制数量经承托运双方共同商定，采取严密保护措离，确保运输过程中不致发生危害，并报请当地县以上交通运输主管部门批准的。

7 承运和交接

7.1 受理托运时应认真核对运单上所填写货物的编号、品名、规格、件重、净重、总重、收发货地点、时间以及所提供的单证是否符合规定。

7.2 承运人自受货后至送达交付前应负保管责任。货物交接双方，必须点收点交，签证手续完备。收货人在收货时如发现差错、破损，应协助承运人采取有效的安全措施，及时处理，并在运输单证上批注清楚。

7.3 危险货物运达卸货地点后，因故不能及时卸货，在待卸期间行车和随车人员应负责看管车辆和所装危险货物，同时承运人应及时与托运人联系妥善处理。危及安全时，承运人应立即报请当地交通运输主管部门，并由当地交通运输主管部门会同公安、物资主管部门处理。

8 运输和装卸

8.1 运输危险货物时，必须严格遵守交通、消防、治安等法规。车辆运行应控制车速，保持与前车的距离，严禁违章超车，确保行车安全。对在夏季高温期间限运的危险货物，应按当地公安部门规定进行运输。

8.2 装载危险货物的车辆不得在居民聚居点、行人稠密地段、政府机关、名胜古迹、风景游览区停车。如必须在上述地区进行装卸作业或临时停车，应采取安全措施并报当地公安部门同意。运输爆炸品、放射性物品及有毒压缩气体、液化气体，禁止通过大中城市的市区和风景游览区。如必须进入上述地区，应事先报经当地县、市公安部门批准，按照指定的路线、时间行驶。

8.3 三轮机动车、全挂汽车列车、人力三轮车、自行车和摩托车不得装运爆炸品、一级氧化剂、有机过氧化物；拖拉机不得装运爆炸品、一级氧化剂、有机过氧化物、一级易燃物品；自卸汽车除二级固体危险货物外，不得装运其它危险货物。

8.4 运输危险货物必须配备随车人员。运输爆炸品和需要特殊防护的烈性危险货物，托运人须派熟悉货物性质的人员指导操作、交接和随车押运。

危险货物如有丢失、被盗，应立即报告当地交通运输主管部门，并由交通运输主管部门会同公安部门查处。

8.5 运输危险货物的车辆严禁搭乘无关人员，途中应经常检查，发现问题及时采取措施；车辆中途临时停靠、过夜，应安排人员看管。

运输危险货物，车上人员严禁吸烟。运输忌火危险货物，车辆不得接近明火、高温场所。

8.6 危险货物运输应优先安排，对港口、车站到达的危险货物应迅速疏远。行车人员不准擅自变更作业计划，严禁擅自拼装、超载。对装运一级易燃、易爆、放射性货物的车辆应优先过渡。

8.7 危险货物装车前应认真检查包装(包括封口)的完好情况,如发现破损,应由发货人调换包装或修理加固。

8.8 装运不同性质危险货物(包括按普通货物运输的危险货物)的配装要求如附录F(补充件)。

8.9 装运危险货物应根据货物性质,采取相应的遮阳、控温、防爆、防火、防震、防水、防冻、防粉尘飞扬、防撒漏等措施。

8.10 装运危险货物的车厢必须保持清洁干燥,车上残留物不得任意排弃,被危险货物污染过的车辆及工属具必须洗刷消毒,其操作要求如附录G(参考件)。未经彻底消毒,严禁装运食用、药用物品、饲料及活动物。

8.11 危险货物装卸作业,必须严格遵守操作规程,轻装、轻卸,严禁摔碰、撞击、重压、倒置;使用的工属具不得损伤货物,不准粘有与所装货物性质相抵触的污染物。货物必须堆放整齐、捆扎牢固,防止失落。操作过程中,有关人员不得擅离岗位。

8.12 危险货物装卸现场的道路、灯光、标志、消防设施等必须符合安全装卸的条件。罐(槽)车装卸地点的储槽口应标有明显的货名牌;储槽注入、排放口的高度、容量和路面坡度应能适合运输车辆装卸的要求。

9 保管和消防

9.1 运输、装卸危险货物的单位必须认真贯彻安全第一、预防为主的方针。建立健全安全和消防管理制度,对管理、行车人员应进行安全消防知识的教育和业务技术培训。

9.2 存放危险货物的仓库或场地,必须符合中华人民共和国《消防条例》的有关规定,并经所在地区公安部门批准。

9.3 危险货物的库、场或装卸现场,应配备必要的消防设施。库场必须通风良好,清洁干燥,周围应划定禁区,设置明显的警告标志;库场应配备专职人员看管,负责检查、保养、维修工作,并采取严格的安全措施。

9.4 行车人员必须掌握所装危险货物的消防方法,在运输过程中如发生火警应立即扑救,及时报警。

9.5 装运爆炸品、易燃物品的车辆、机械及装过易燃物品而未经消除危险处理的空罐(槽),检修时不得动用明火,不得使用易产生火花的工具敲击。

10 劳动防护和医疗急救

10.1 运输、装卸危险货物的单位,必须配备必要的劳动防护用品和现场急救用品。特殊的防护用品和急救用具应由托运人提供。

10.2 进行危险货物装卸操作时,必须穿戴相应的防护用品,并采取相应的人身肌体保护措施;防护用品使用后,必须集中进行清洗;对被剧毒物品、放射性物品和恶臭物品污染的防护用品应分别清洗、消毒。

10.3 承运危险货物运输的专业单位,应配备或指定医务人员负责对装运现场人员定期进行保健检查,并进行预防急救知识的培训教育工作。

10.4 对直接从事危险货物运输生产的人员(包括现场人员)应根据国家劳动人事部门的规定发给保健津贴(食品)或岗位津贴。

10.5 危险货物一旦对人体造成灼伤、中毒等危害,应立即进行现场急救,必要时迅速送医院治疗。

11 监督和管理

11.1 本规则由各级交通运输主管部门组织实施，加强监督管理。由各有关主管部门及其所属单位贯彻执行。

11.2 从事危险货物运输、装卸的单位应严格执行本规则；违反者，要分别情节轻重，予以批评教育、经济制裁、行政处罚；构成犯罪者，提交司法部门，依法追究刑事责任。

附 录 A
包装检验证明书
（参考件）

包装生产单位			
申请检验单位			
型　　式		规　　格	
材　　质		包装类别	
自　　重		包装重量	

试 验 项 目	试 样 数 量	试 验 结 果

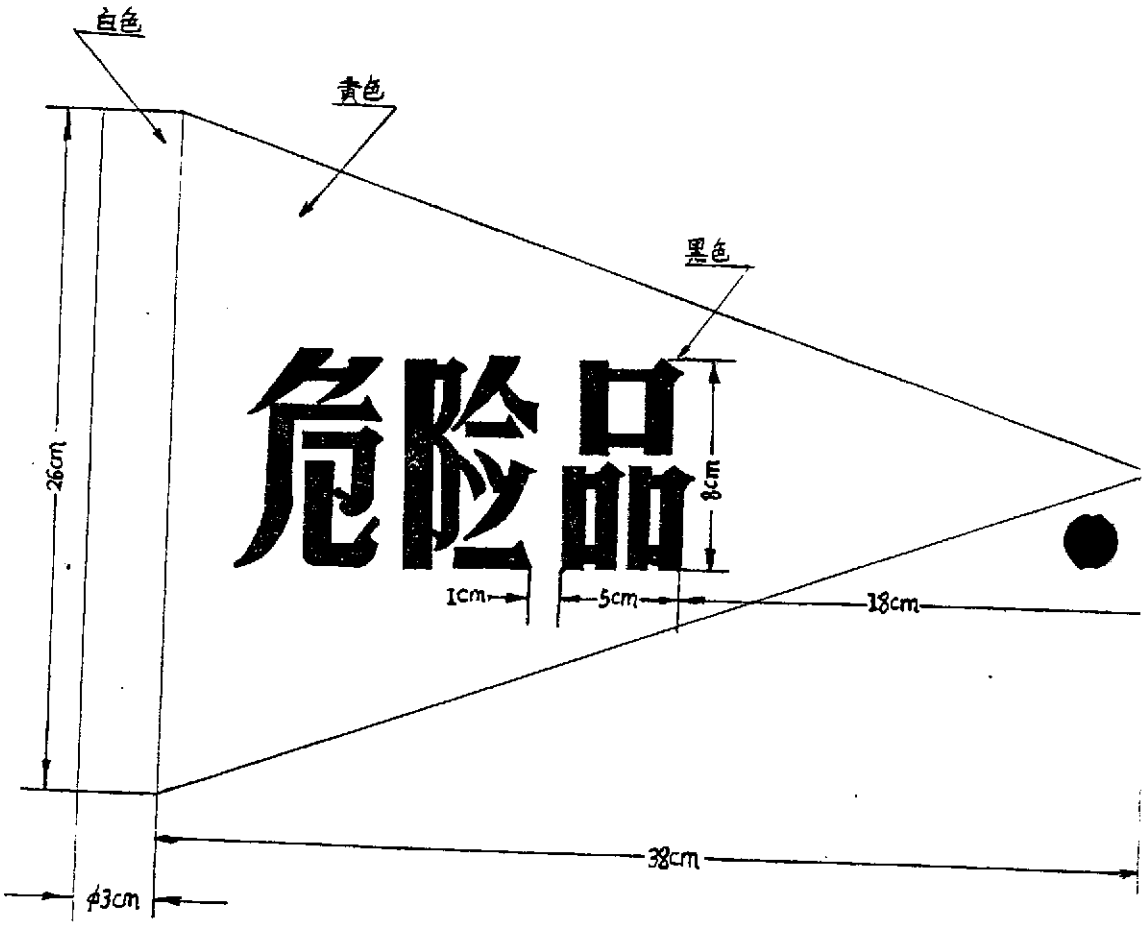
检验单位意见

年　　月　　日（盖章）

附 录 B

危险品三角旗图样

（补充件）



比例1:3

附 录 C
危险货物鉴定表
（参考件）

品　　名		别　　名	
英 文 名		分 子 式	
理化性能 1)			
主要成份 2)			
包装方法 3)			
中毒急救措施			
撒漏处理 和 消防方法			
运输注意事项 4)			
鉴定单位意见	属　于……类……项危险货物 比　照……品名办理 比照危规第……号 包 装	鉴定单位 主管部门 审核意见	（公章）
交通运输 部门意见			

鉴定单位及鉴定人_____（盖章）　年　月　日

发货单位_____（盖章）　年　月　日

注：1)性能包括色、味、形态、比重、熔点、沸点、闪点、燃点、爆炸极限、急性中毒极限及危险程度。

2)凡危险货物系混合物，应详细填写所含危险货物的主要成份。

3)包装方法应注明材质、形状、厚度、封口、内部衬垫物、外部加固情况及内包装单位质量（重量）等。

4)对该种货物遇到何种物质可能发生的危险，提出防护措施。

附 录 D

集装箱危险货物装箱证明书

（补充件）

集装箱型号　　编号：

兹证明下列危险货物集装箱符合：

1. 集装箱干燥、清洁、适用于装运危险货物；
2. 箱内所装货物性质无抵触；
3. 货物包装经外部检查干燥、完好无损；
4. 箱内货物积载适当，衬垫支撑牢固、所用衬垫材料适用于所装货物；
5. 箱内货物和集装箱均标贴有明显的标志，标明货物的危险性质，此外集装箱还标有所装物的正确学名。

货物名称	包装形式	件　数	总　重	备　注

声　　明

兹声明：移交时集箱箱和货物处于完好状态；

装箱单位：　　签发单位：

年　　月　　日

附 录 E

放射性物质包装件表面污染及辐射水平检查证明书

（补充件）

发放单位	编　号
货物名称	件　数
放射性类别：α、β、γ、快中子	物理状态：固体、液体、粉末、气体、结晶体
放射性比活度： Bq/kg(ci/kg)	放射性总活度： Bq(mci)半衰期：

编号	放射性活度 Bq(mci)	包装件表面污染情况 Bq/cm²(uci/cm²)		包装等级	包装件表面辐射水平 mSv/h(srem/h)	运输指数	包装类型
		α	β				

检查单位　　核查单位

检查人员＿＿＿＿＿＿＿＿＿＿＿＿　检查人员＿＿＿＿＿＿＿＿＿＿＿＿

签发日期　　年　　月　　日

附 录 F

危险货物配装表 1)

（补充件）

类别		品名	序号	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
危险货物	爆炸品	起爆器材	1																														
危险货物	爆炸品	炸药及爆炸性药品	2	×																													
危险货物	爆炸品	其他爆炸品	3	×	×																												
危险货物	压缩气体和液化气体	剧毒气体	4	×	×	×																											
危险货物	压缩气体和液化气体	易燃气体	5	×	×	△																											
危险货物	压缩气体和液化气体	助燃气体	6	×	×	×		×																									
危险货物	压缩气体和液化气体	不燃气体	7	×	×																												
危险货物	易燃固体	易燃液体	8	×	×	×	×		×																								
危险货物	易燃固体	易燃固体	9	×	×	△	×		×																								
危险货物	易燃固体	易自燃物品	10	×	×	×	×	×	×																								
危险货物	易燃固体	遇潮湿时放出易燃气体物品	11	×	×	×	△	△	×		8)	8)	×																				
危险货物	氧化剂	氧化剂：硝酸盐类	12	×	×	×	×	×			×	×	×	×																			
危险货物	氧化剂	氧化剂：亚硝、亚氯、次亚氯酸盐类	13	×	×	×	×	×			×	×	×	×	×																		
危险货物	氧化剂	氧化剂：其他氧化剂	14	×	×	×	×	×			×	×	×	×		×																	
危险货物	氧化剂	有机过氧化物	15	×	×	×	×	×	×		×	×	×	×	×	×	×																
危险货物	毒害品	无机毒害品	16	△	△	△									△	△	△																
危险货物	毒害品	有机毒害品	17	×	×	×			×				△		×	×	×																
危险货物	毒害品	易感染物品	18	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×													
危险货物	腐蚀物品	无机酸性：溴	19	×	×	×		△			△	△	×	×	△	△	△	×	×	△	×												
危险货物	腐蚀物品	无机酸性：硝酸、发烟硝酸	20	×	×	×	×	×	×	×	×	×	×	×		×	×	×	×	×	×	△											
危险货物	腐蚀物品	无机酸性：硫酸、发烟硫酸、氯磺酸	21	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	△	×										
危险货物	腐蚀物品	无机酸性：其他无机酸性腐蚀物品	22	×	×	×	×	×	×	×	×	×	×	×	△	△	△	×	×	×	×		×	×									
危险货物	腐蚀物品	有机酸性腐蚀物品	23	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×		×	×	×	×	×								
危险货物	腐蚀物品	碱性腐蚀物品	24											△							×	×	×	×	×	×							
危险货物	腐蚀物品	其他腐蚀物品	25											△							×	×	×	×	△	△							
普通货物		化学可燃物品	26	×	×	△	×		×				△	8)	×	×	×	×			×	×	×	×	×	×							
普通货物		非化学可燃物品	27	×	×	△			×				△	×	×	×	×	×			×	×	×	×	×	×	△						
普通货物		饮食品、饲料、药品、药材	28	×	×	△	×				7)	7)		×	×	×	×	×	×	×	×	×	×	×	×	×	×	△					
普通货物		活动物	29	×	×	△	×	×			7)	7)		×	×	×	×	×	×	×	×	×	×	×	×	×	×	×					
普通货物		其他货物	30											8)							×	×	×	×									

注：1)表内无符号表示可以配装，"×"符号表示不得配装，"△"表示可以配装，但堆放时必须隔离 2m 以上。

2)不同的炸药及爆炸性药品相互间不得配装。

3)其他爆炸品中的点火绳、点火线等点火器材与本项的其他爆炸物品，隔离 2m 以上。

4)其中液氯和液氨不得配装。

5)易自燃物品中的黄磷，不得与其他易自燃、易燃物品配装，必须配装时要隔离。

6)生石灰、漂白粉与起爆器材、炸药及爆炸性药品、其他爆炸品、易燃液体隔离配载。

7)有恶臭及有毒易燃液体及易燃固体，不得与活动物、饮食物、饲料、药品、药材等配装。

8)含水的易燃物品和用水、泡沫、二氧化碳作主要灭火方法的物品，不得与遇潮湿时易放出易燃气体的物品配载。

9)放射性货物与其他危险货物不可在同一车厢内配装，与普通货物应按下列条件隔离：

对象 \ 隔开距离 \ 包装等级	一 级	二 级	三 级
行李包裹	不隔离	不隔离	不得配装
普通货物	不隔离	不隔离	1.5m
未定影的照相底片和感光材料	0.5m	1m	5m

附 录 G

车辆清洗消毒方法

（参考件）

G1 凡装过危险货物的车辆，装卸后必须进行清扫、洗刷和消毒工作。

G2 对洗刷、消毒的车辆，车辆四周根据原装危险货物的性质，对渗留的残货彻底清扫后，分别采用水（一定压力的水）、酸、碱溶液或其它药剂以及高压空气、水蒸汽进行洗刷、消毒，具体方法见下表。

车辆清洗消毒方法表

编 号	用 品	方 法
1	水（具有一定压力的水，如自来水）	用大量水冲刷
2	稀盐酸（如浓盐酸用水冲淡 20 倍）	药剂浸湿车辆木板后，用大量一定压力的水冲刷
3	碱或肥皂水烧碱或纯碱（用水冲淡 50 倍）	
4	硫代硫酸钠（用水冲淡 30 倍）	
5	硫酸铜（用水冲淡 30 倍）	
6	高温高压水蒸汽	冲熏，尤其注意木板缝隙内的残留物
7	高压空气（5kg 左右）	
8	放射性货物用大量水冲洗，遇有放射性物质散落污染时，须先用肥皂水洗刷后，再用大量水冲洗。	

G3 洗刷、消毒要求：

G3.1 凡经洗刷、消毒的车辆，必须达到水清无异味，无污染的痕迹。

G3.2 检查方法，用眼看、鼻嗅。对放射性货物污染的车辆，洗后用仪器测定。

G4 车辆洗刷、消毒后作好记录，注明原装危险货物品名和洗刷消毒方法及日期。

G5 经常办理危险货物的车队，应备有一定设备和材料，指定专人负责，建立责任制度。

G6 洗刷、消毒作业必须在指定的地点进行，对洗刷消毒后的污水，应妥善处理。

G7 在远离车队的运输中途需对车辆洗刷消毒时，收货单位或货主单位应提供水源、污水处理等方便。

附加说明：

本标准由交通部公路局提出，由交通部标准计量研究所归口。

本标准由交通部公路局组织起草。

本标准主要起草人：王毅、周有才、张文慧、朱志良、谭尚林、陈铖、刘敏文。

中华人民共和国国家标准

GB/T 15098－94

危险货物运输包装类别划分原则

1、主题内容与适用范围

本标准规定了划分各类危险货物运输包装类别的基本原则。

本标准适用于危险货物生产、贮、运输和检验部门对危险货物运输包装进行性能试验和检验时确定包装类别的依据。

本标准不适用于：

a.盛装压缩气体和液化气体的压力容器；

b.盛装感染性物品的运输包装；

c.盛装放射性物质的运输包装；

d.盛装杂类物品的运输包装；

e.净重大于 400kg 的包装；

f.容积大于 450L 的包装。

2、引用标准

GB6944　危险货物分类和品名编号

GB11806　放射性物质安全运输规定

GB12268　危险货物品名表

GB12463　危险货物运输包装通用技术条件

3、术语

3.1　自反应物质　self－reactive substances

系指 GB6944 的经 4.1 项(以下简称 4.1 项，其他类、项同)中在常温或高温下由于运输温度太高而容易引起激烈的放热分解的物质。

3.2　退敏爆炸品 desensitized explosives

系指 4.1 项中的用水或酒精湿润或用其他物质稀释以抑制其爆炸性质的第 1 类物质。

3.3　自热物质 self－heating substances

系指 4.2 项中与空气接触不需要能源供应便能够自己发热的物质。

4、包装类别

危险货物按其危险程度划分为三个包装类别：

Ⅰ类包装：货物具有大的危险性，包装强度要求高。

Ⅱ类包装：货物具有中等危险性，包装强度要求较高。

Ⅲ类包装：货物具有小的危险性，包装强度要求一般。

5、包装类别的划分

按 GB6499 中危险货物的不同类项及有关的定量值，确定其包装类别。但各类中性质特殊的货物其包装类可另行规定。

5.1 第1类 爆炸品

爆炸品所使用的包装容器，除另有规定外，其强度应符合Ⅱ类包装。

5.2 第2类 压缩气体及液化气体

5.2.1 盛装压缩气体和液化气体的钢质气瓶

钢质气瓶的设计、制造、充装、运输、储存必须符合中华人民共和国劳动部颁布的《气瓶安全监察规程》。

盛装乙炔气的钢瓶应符合中华人民共和国劳动部颁布的《溶解乙炔气瓶安全监察规程》的有关规定。

5.2.2 外包装为木箱或纸箱，内容器为安瓿瓶或装有压缩气体或液化气体的容器

a.2.1项 易燃气体(品名编号21001～21999)：Ⅱ类包装；

b.2.2项 不燃气体(品名编号22001～22999)：Ⅲ类包装；

c.2.3项 有毒气体(品名编号23001～23999)：Ⅱ类包装。

5.3 第3类 易燃液体

5.3.1 3.1项 低闪点液体(闪点＜－18℃)(品名编号31001～31999)：Ⅰ类包装；

5.3.2 3.2项 中闪点液体(－18℃≤闪点＜23℃)(品名编号32001～32999)；

初沸点≤35℃：Ⅰ类包装；

初沸点＞35℃：Ⅱ类包装；

5.3.3 3.3项 高闪点液体(23℃≤闪点≤61℃)(品名编号33001～33999)：Ⅲ类包装。

5.4 第4类 易燃固体、自燃物品和遇湿易燃物品

5.4.1 4.1项 易燃固体

a.一级易燃固体(品名编号41001～41500)：Ⅱ类包装；

b.二级易燃固体(品名编号41501～41999)：Ⅲ类包装。

注：4.1项中的退敏爆炸品：Ⅰ类或Ⅱ类包装；自反应物质：Ⅱ类包装。

5.4.2 4.2 自燃物品

a.一级自燃物品(品名编号42001～42500)：Ⅰ类包装；

b.二级自然物品(品名编号42501～42999)：Ⅱ类包装；

c.二级自然物品中的含油、含水纤维或碎屑类物持：Ⅲ类包装。

注：4.2项中的自热物质：Ⅱ类或Ⅲ类包装。

5.4.3 4.3项 遇湿易燃物品

a.一级遇湿易燃物品(品名编号43001～43500)：Ⅰ类或Ⅱ类包装；

b.二级遇湿易燃物品(品名编号43501～43999)：Ⅱ类包装。

注：二级遇湿易燃物品中危险性小的：Ⅲ类包装。

5.5 第5类 氧化剂和有机过氧化物

5.5.1 5.1项 氧化剂

a.一级氧化剂(品名编号51001～51500)：Ⅰ类包装；

b.二级氧化剂(品名编号51501～51999)：Ⅱ类包装。

注：二级氧化剂中危险性小的：Ⅲ类包装。

5.5.2 5.2项 有机过氧化物

有机过氧化物：Ⅱ类包装。

5.6 第6类 毒害品和感染性物品

5.6.1 6.1项 毒害品

a.一级毒害品(剧毒品)(品名编号61001～615000)见表1。

表1

包装类别	口服毒性 LD_{50} mg/kg	皮肤接触毒性 LD_{50} mg/kg	吸入粉尘或烟雾毒性 LC_{50} mg/L
Ⅰ	≤5	≤40	≤0.5
Ⅱ	>5～50	>40～200	>0.5～2

b.二级毒害品(有毒品)(品名编号61501～61999)见表2。

表2

包装类别	口服毒性 LD_{50} mg/kg	皮肤接触毒性 LD_{50} mg/kg	吸入粉尘或烟雾毒性 LD_{50} mg/L
Ⅲ	固体：>50～500 液体：>50～2000	>200～1000	>2～10

c.闪点<23℃的液态一级毒害品：Ⅰ类包装；

闪点<23℃的液态二级毒害品：Ⅱ类包装。

5.6.2 6.2项 感染性物品

该类物品所应使用的包装容器、包装类别、对容器的试验项目、试验要求及合格标准应与运输主管部门商定。

5.7 第7类 放射性物品

放射性物品包装容器的材料、设计、制造、试验项目及方法、定期检验等应符合GB 11806，并应与运输主管部门商定。

5.8 第8类 腐蚀品

5.8.1 8.1项 酸性腐蚀品

a.一级酸性腐蚀品(品名编号81001～81500)：Ⅰ类包装；

b.二级酸性腐蚀品(品名编号81501～81999)：Ⅱ类包装。

5.8.2 8.2项 碱性腐蚀品

a.一级碱性腐蚀品(品名编号82001～82500)：Ⅱ类包装；

b.二级碱性腐蚀品(品名编号82501～82999)：Ⅲ类包装。

5.8.3 8.3项 其他腐蚀品：Ⅲ类包装。

5.9 第9类 杂类

该类物品所应使用的包装容器、包装类别、对容器的试验项目、试验要求及合格标准应与运输主管部门商定。

中华人民共和国交通行业标准

JT 3145－91

汽车危险货物运输、装卸作业规程

Rules of transportation, loading and unloading of dangerous goods by automobile

1 主题内容与适用范围

本标准规定了汽车危险货物运输、装卸的安全作业要求。

本标准适用于汽车危险货物运输和装卸的安全质量管理。

其它道路运输工具从事危险货物运输、装卸时，也应参照本标准。

2 引用标准

GB6944 危险货物分类和品名编号

GB4387 工业企业 厂内运输安全规程

GB7258 机动车运行安全技术条件

GB11806 放射性物质安全运输规定

JT3130 汽车危险货物运输规则

3 运输、装卸作业基本要求

3.1 汽车危险货物运输、装卸应符合 JT3130《汽车危险货物运输规则》的有关规定。

3.2 从事危险货物运输、装卸的人员，必须按国家有关规定进行岗位培训，凭专业岗位操作证书上岗作业。

中华人民共和国交通部 1991－05－10 批准　　1991－11－01 实施

3.3 从事危险货物运输、装卸人员对所运危险货物要掌握其化学和物理性质及应急措施。

3.4 运输、装卸作业时，必须正确使用劳动防护用品。

3.5 进入装卸作业区，不准随身携带火种，装卸易燃、易爆危险货物时，不准穿带有铁钉的工作鞋和穿着易产生静电的工作服。

3.6 夏季高温季节装运易燃易爆的危险货物，应按当地有关部门规定执行。

4 运输作业要求

4.1 出车前的准备与检查

4.1.1 对车辆安全技术状况必须按 GB7258《机动车运行安全技术条件》的有关规定进行严格检查，发现故障必须排除后，才能投入运行。

4.1.2 携带的运输危险货物有关的证件必须齐全。

4.1.3 随车携带的遮盖、捆扎、防潮等工属具必须齐全、有效。

4.1.4 车厢栏板必须平整牢固，车厢内不得有与所装货物性质相抵触的残留物。

4.2 装卸过程中的要求

4.2.1 车辆进入危险货物装卸作业区，应按该区有关安全规定驶入装卸货区。

4.2.2 车辆停靠货垛时，应听从作业区指定人员的指挥，车辆与货垛之间要留有安全距

离，待装、待卸车辆与装卸货物的车辆应保持足够的安全距离并不准堵塞安全通道。驾驶员不准离开车辆。

4.2.3 装卸过程中，车辆的发动机必须熄灭并切断总电源。在有坡度的场地装卸货物，必须采取防止车辆溜坡的有效措施。

4.2.4 在装卸过程中，驾驶员负责监装监卸，办理货物交接鉴证手续时要点收点交。装车完毕，驾驶员必须对货物的堆码、遮盖、捆扎等安全措施及对影响车辆运动的不安全因素进行检查。

4.2.5 装卸过程中需要移动车辆时，应先关上车厢门或栏板。若原地关不上时，必须有人监护，在保证安全情况下才能移动车辆，起步要慢。停车要稳。

4.2.6 禁止在装卸作业区内维修车辆。

4.2.7 危险货物运达卸货地点后，因故不能及时卸货，在待卸期间，行车人员应会同押运人员负责看管货物。

4.2.8 工矿企业厂内进行危险货物运输，应按 GB4387《工厂企业厂内运输安全规程》执行。

4.3 行车过程中的要求

4.3.1 驾驶员必须严格遵守《中华人民共和国道路交通管理条例》的有关规定。

4.3.2 押运人员必须乘座在指定位置上，车上严禁搭乘无关人员，不得携带与所装货物性质相抵触物品。

4.3.3 根据车辆装载情况，途中应进行检查，发现问题及时采取措施。中余临时停车应与其它车辆、高压线、人口聚集地等保持一定的安全距离，应停放在有利于安全防护的地方。

4.3.4 运输过程中，必须的指定位置设置危险品信号标志。

4.3.5 运输途中遇天气发生变化，应根据货物特性及时采取相应的防护措施。遇有雷雨时，不得在树下、电杆、高压线、铁塔、高层建筑及容易遭到雷击和产生火花的地点停车。若要避雨时，应选择安全地点。

4.3.6 车辆发生故障需修车时，应选择安全地点。需进行修理厂时，不准载货进入厂内。

4.3.7 运输途中发生货物丢失或泄漏等情况时，应及时报告有关部门并进行应急处理。

4.3.8 危险货物运输、装卸过程中，一旦发生事故，应立即组织抢救及负责维护现场并及时向当地有关部门如实报告。

装卸作业要求

5.1 包装件装卸作业要求

5.1.1 基本要求

5.1.1.1 作业前应详细核对货物名称、规格、数量是否与托运单证相符，并认真检查货物包装标志的完整状况。包装不符合安全规定的应拒绝装车。

5.1.1.2 装卸操作时应根据货物包装的类型、体积、重量、件数的情况，并根据包装上储运图示标志的要求，轻拿轻放、谨慎操作、严防跌落、摔碰、禁止撞击、拖拉、翻滚、投掷。同时，必须做到：

a. 堆码整齐、靠紧妥贴。易于点数；

b. 堆码时，桶口、箱盖朝上，允许横倒的桶口及袋装货物的袋口应朝里；

c.装载平衡,高山栏板的最上一层包装件,堆码时应从车厢两面向内错位骑缝堆码,超出车厢前挡板的部分不得大于包装件高度的二分之一;

d.装运高出车厢栏板的货物,装车后,必须用绳索捆扎牢固。易滑动的包装件,须用防散失的网罩覆盖并用绳索捆扎牢固或用苫布覆盖严密,须用两块苫布覆盖货物时,中间接缝处须有大于15cm的重叠覆盖,且车厢前半部分苫布需压在后半部分苫布上;

e.装有通气孔的包装件,不准倒置、侧置,防止所装货物泄漏或进入杂质造成危害。

5.1.1.3 机械装饰作业时,必须按核定负荷量减载25%,装卸人员必须服从现场指挥,防止货物剧烈晃动、碰撞、跌落。

5.1.2 爆炸品装卸要求

5.1.2.1 装运前,要根据所装卸货物的品类、数量、特性和运载工具等情况。按已拟定的安全装运计划装卸。

5.1.2.2 应在监装、监卸人员的指导下进行装卸,应分清品类、批号、堆码整齐,不得倒置、侧置,放置稳固、紧凑、码平。车厢包装件总堆码高度不超过1.5m。火箭弹和旋上引信的炮弹应横装,与车辆进行方向垂直。

5.1.2.3 使用手推车等搬运工具时,应码放平稳、牢固,严防翻车倒箱。

5.1.2.4 包装不良或散装在木箱内的弹药、火工品严禁装运。在装卸过程中,凡从1.5m以上高度跌落的带引信的炮弹及单独包装的引信,必须与其它弹药、引信隔离单独存放,并及时报告,请示处理,严禁继续装运。

5.1.2.5 装车后,应用苫布覆盖严密,并用大绳捆扎牢固。

5.1.3 压缩气体和液化气体装卸要求

5.1.3.1 车厢内不得沾有油脂污染物及强酸残留物。

5.1.3.2 装车时要旋紧瓶帽,注意保护气瓶阀门。防止撞坏。车下人员须待车上人员将瓶放妥后,才能继续往车上装瓶。在同一车厢不准有二人同时单独往车上装瓶。除允许竖装的气瓶(如民用液化石油气等)外,车上气瓶均应横向平放,装载平衡,妥善固定,防止滚动。阀门应朝向一方,最上层气瓶不得超过车厢栏板高度。

5.1.3.3 卸车时,要在气瓶落地点铺上铅垫或橡皮垫,必须逐个卸车,严禁溜放。

5.1.3.4 装卸操作时,不要把阀门对准人身,注意防止气瓶安全帽脱落,气瓶应竖立转动,不准脱手滚瓶或传接,气瓶竖放时必须稳妥。

5.1.3.5 装运大型气瓶(盛装净重在0.5t以上的)或成组集装气瓶时,瓶与瓶、集装架与集装架之间需填牢木塞,集装架的瓶口应朝向行车的右方,在车厢前后挡板与气瓶空隙处必须有固定支撑物,并用紧绳器紧固,严防气瓶滚动,重瓶不准多层装载。

5.1.4 易燃液体装载要求

5.1.4.1 车厢内不得有氧化剂、自燃物品、强碱等残留物。

5.1.4.2 钢桶盛装的易燃液体,不得从高处翻滚卸车。卸车时从车上溜放或滚动操作时,应采取防止火星的措施,周围需有人接应,严防钢桶撞击致损。

5.1.4.3 钢制包装件多层装载时,层间必须采取合适衬垫,并应捆扎牢固。

5.1.4.4 对低沸点或易聚合的易燃液体,如发现其包装容器内装物膨胀(鼓桶)现象时,由发货人调换包装后,方可继续装车。

5.1.5 易燃固体,自燃物品和遇湿易燃物品装卸要求

5.1.5.1 对容易升华、挥发出易燃、有害或刺激性气体的货物，装卸时，应注意现场通风良好，防止中毒和燃烧爆炸。

5.1.5.2 装运需用水(如黄磷)、煤油、石腊(如金属钠、金属钾)或其它稳定剂进行防[illegible]的包装件，庆认真检查包装有无渗漏现象及封口是否严密，发现问题应立即通知发货人调换包装后，方可继续装车。

5.1.5.3 装卸碳化钙(电石时)，应问清包装内有无充填保护气体，如未充填的，在装卸前应侧身轻轻地拧开通气孔放气，防止爆炸、冲击伤人。

5.1.5.4 雨雪天装卸遇湿易燃物品时，不具备防雨雪的条件，不准进行装卸作业

5.1.6 氧化剂和有机过氧化物装卸要求

5.1.6.1 装车前，车厢、机械、工具设备及操作场所，不得沾有酸料、煤碳、砂糙、面粉、油脂、磷、硫或其它松软、粉状等可燃物质。

5.1.6.2 如货物外包装为金属容器，装车时应单层摆放，需多层装载时，应采用合适的衬垫。

5.1.6.3 对添加稳定剂和需控制温度的烈性氧化剂和有机过氧经物，作业时应认真检查包装，密切注意包装有无渗漏及变形(如鼓桶)情况，发现异常拒绝装运。

5.1.6.4 装卸时发生包装破损，撒漏物不得装入原包装内，必须另行处理。操作时，不得踩踏、辗压撒漏物。

5.1.7 毒害品装卸要求

5.1.7.1 对刚开启的库门、集装箱、封闭式车厢要先通风，装卸时应站立上风处。必要时戴好防毒面具，护目镜。

5.1.7.2 装卸时要防止包装破漏，沾染人体或污染其它货物。工作服沾染易经皮肤吸收的毒害品应及时更换。不得在毒害品包装上坐卧休息。

5.1.7.3 作业人员皮肤破伤者不能装卸毒害品。工间或工后，手、脸未经清洗干净，不得饮水、吸烟、进食。

5.1.7.4 对刺激性较强和散发异臭的毒害品，装卸人员应采取轮班作业。在夏季高温期，尽量安排在早晚气温较低时作业。

5.1.7.5 忌水的毒害品(如磷化铝、磷化锌等)，应防止受潮。

5.1.7.6 毒害品严禁与食用、药用及生活用品等同车拼装。

装运后的车辆及工属具要严格清洗消毒，未经安全管理人员检验批准，不得装运食用、药用及生活等用品。

5.1.8 放射性物品装卸要求

放射性物品装卸作业应符合 GB11806(放射性物质安全运输规定)的有关规定。

5.1.9 腐蚀品装卸要求

5.1.9.1 装运腐蚀物品的车厢和装卸工属具不得沾有氧化剂、易燃物品。

5.1.9.2 对易碎容器的包装件，严防木质包装件底部脱落，装卸时不得肩扛、背负。没有封盖的包装，不准堆码。

5.2 散装固体装卸作业要求

5.2.1 易散漏、飞扬的散装粉状危险货物，装车时应用苫布下垫上盖，必须时需洒水润湿后方可装运。

5.2.2 散装煤焦沥青在高温季节应在早晚进行装卸作业。

5.3 集装箱危险货物装卸要求

5.3.1 装箱前应检查集装箱内有无与待装危险货物性质相抵触的残留物。发现问题，应及时通知发货人进行处理。

5.3.2 装箱前对待装的包装件应进行检查。破损、撒漏、水湿及沾污其它污染物的包装件不得装箱。

5.3.3 不准将性质相抵触、灭火方法不同或易污染的危险货物装在同一集装箱内。如符合配装规定而与其它货物混装时，危险货物应装在箱门附近。包装件在集装箱内应有足够的支撑和固定。

5.3.4 货物的装箱、掏箱操作应符合 5.1.1 条的有关规定。

5.4 罐(槽)车装卸要求

5.4.1 罐(槽)车散装液体装卸要求

5.4.1.1 装卸前应对罐(槽)进行检查，必须符合下列要求：

a. 罐(槽)体无渗漏现象；

b. 罐(槽)内应无与待装货物相抵触的残留物；

c. 阀门必须关紧；

d. 罐(槽)体与车身必须紧固，罐(槽)盖必须严密；

e. 卸料导管必须良好；

f. 装运易燃易爆的货物，导除静电装置必须良好；

g. 罐(槽)体改装其它液体，必须经过清洗和安全处理，经检验合格后方可使用。其污水应按指定地点排放。

5.4.1.2 装卸时操作人员应站在上风处，密切注视进料情况。防止货物溢出。

5.4.1.3 认真核对货物品名后，按车辆核定吨位装载，并留有规定的膨胀余位。装货后关紧罐(槽)进料口盖，严禁超载。

5.4.1.4 卸货时，贮罐(槽)所标货名应与所卸货物相符，卸料导管应支撑固定，坚固卸料导管与阀门的联接处，阀门要逐渐开启。

5.4.1.5 装卸货物时操作人员不得擅离操作岗位。卸货时罐(槽)内货物必须卸净，然后关紧阀门，收好卸料导管和支撑架。

5.4.2 罐(槽)车液化气体装卸要求

5.4.2.1 罐装前，必须对罐(槽)体阀门和附件(安全阀、压力计、液位计、温度计)以及冷却、喷淋设施的灵敏度，可靠性进行检查，并确认罐(槽)体内有规定的余压，如无余压者经化验含氧不超过 2% 时方可充罐。

5.4.2.2 车辆进入贮罐区前，须停车提起导除静电装置，进入充罐车位时再接好导除静电装置。

5.4.2.3 严格控制罐装规定定量，做好罐装量复核、记录，严禁超量、超温、超压，其装卸作业顺序如下：

a. 到指定地点开启排放阀，找开 30% ~50% 左右，放掉残留气体，保持罐(槽)内压力低于罐(槽)车压力 1~1.5kPa；

b. 开球部的快换接头盖，并关闭排放阀；

c.接通罐(槽)车与装卸液料管线之间的装卸软管；

d.慢慢开启罐(槽)车的紧急切断阀；

e.观察各部零件和仪表压力、温度、液位指示均正常时，再慢慢地按顺时针方向开启气相阀和液相阀，并注意压力表、温度计、液位计变化情况；

f.要认真检查设置运转是否正常，并按时加润滑油，发现异常应立即停泵；

g.装卸作业完毕，先关闭球阀，再关闭紧急切断阀；

h.打开排气阀，排出残留气体，拆下装卸软管，盖上接头盖，关闭排空阀。

5.4.2.4 发生下列异常情况时，一律不准罐装，操作人员应立即采取紧急措施，并及时报告有关部门；

a.容器工作压力、介质温度或壁温超过许可值，采取各种措施仍不能使之下降；

b.容器的主要受压元件发生裂缝、鼓包、变形、泄漏等缺陷危及安全；

c.安全附件失效，接管端断裂、紧固件损坏难以保证安全运输的；

d.雷击、暴风雨天气或附近发生火灾。

5.4.2.5 禁止采用蒸汽直接注入罐(槽)体内升压或直接加热罐(槽)体的方法卸液，卸液后，罐(槽)内必须留有规定的余压。操作人员不得离开岗位。

5.4.2.6 运输途中应严密注视车内压力表的工作情况，发现异常，应立即停车检查，排除故障后，继续运行。

附加说明

本标准由中华人民共和国交通部运输管理司提出，由交通部标准计量研究所归口。

本标准由上海市交通运输局、交通部标准计量研究所、全国汽车危险货物运输联合会、大连运输公司负责起草。

本标准主要起草人：朱志良、张学通、张龙德、徐亚华、谭尚林。

中华人民共和国固体废物污染环境防治法

（1995年10月30日第八届全国人民代表大会
常务委员会第十六次会议通过，同日公布）

第一章 总 则

第一条 为了防治固体废物污染环境，保障人体健康，促进社会主义现代化建设的发展，制定本法。

第二条 本法适用于中华人民共和国境内固体废物污染环境的防治。

固体废物污染海洋环境的防治和放射性固体废物污染环境的防治不适用本法。

第三条 国家对固体废物污染环境的防治，实行减少固体废物的产生、充分合理利用固体废物和无害化处置固体废物的原则。

第四条 国家鼓励、支持开展清洁生产，减少固体废物的产生量。

国家鼓励、支持综合利用资源，对固体废物实行充分回收和合理利用，并采取有利于固体废物综合利用活动的经济、技术政策和措施。

第五条 国家鼓励、支持有利于保护环境的集中处置固体废物的措施。

第六条 县级以上人民政府应当将固体废物污染环境防治工作纳入环境保护规划，并采取有利于固体废物污染环境防治的经济、技术政策和措施。

第七条 国家鼓励、支持固体废物污染环境防治的科学研究、技术开发、推广先进的防治技术和普及固体废物污染环境防治的科学知识。

第八条 各级人民政府对在固体废物污染环境防治工作以及相关的综合利用活动中作出显著成绩的单位和个人给予奖励。

第九条 任何单位和个人都有保护环境的义务，并有权对造成固体废物污染环境的单位和个人进行检举和控告。

第十条 国务院环境保护行政主管部门对全国固体废物污染环境的防治工作实施统一监督管理。国务院有关部门在各自的职责范围内负责固体废物污染环境防治的监督管理工作。

县级以上地方人民政府环境保护行政主管部门对本行政区域内固体废物污染环境的防治工作实施统一监督管理。县级以上地方人民政府有关部门在各自的职责范围内负责固体废物污染环境防治的监督管理工作。

国务院建设行政主管部门和县级以上地方人民政府环境卫生行政主管部门负责城市生活垃圾清扫、收集、贮存、运输和处置的监督管理工作。

天津市排放污染物申报登记实施办法

第一条 为加强对排放污染物的监督管理，根据《中华人民共和国环境保护法》、国家环境保护局《排放污染物申报登记管理规定》、《天津市环境保护条例》及有关法律、法规、规章制定本办法。

第二条 凡是在天津市辖区内，直接或间接向环境排放废水、废气、粉尘、恶臭、噪声以及产生固体废物的市、区、县属企业事业单位，中央、部队和各地驻津企业事业单位，机关、学校、“三资企业”、饮食、娱乐、服务企业、乡镇企业及个体经营者（以下简称排污单位），都应按本实施办法进行申报登记。

第三条 天津市环境保护局统一组织实施全市的排放污染物申报登记（以下简称排污申报登记）工作，按照国家环境保护局的规定统一印制《排放污染物申报登记表》和《排放污染物申报登记注册证》。

区、县环境保护行政主管部门对本辖区排污申报登记实施监督管理。

排污单位的行业主管部门负责所属单位排污申报登记表的审核。

第四条 排污单位必须按环境保护行政主管部门指定的时间填报《排放污染申报登记表》，按要求提供必要的资料，并对申报的内容承担法律责任。

新建、改建、扩建项目的排污申报登记，应在项目的污染防治设施验收合格后的一个月内办理。

第五条 排污单位要按照《排放污染物申报登记表》和有关要求填报。申报登记的数据，由排污单位负责，按照国家统一规定的监测技术规范进行监测、统计。如本单位没有监测能力，可委托具有市环境保护行政主管部门监测资格认证的单位监测。无法监测或没有统一监测方法的污染项目，申报的数据可根据统计手册规定的方法推算或物料衡算计算。

第六条 排放污染物超过国家或地方规定的污染物排放标准或总量控制规定限值的排污单位，在申报登记时，应当写明超过污染物排放标准的原因和治理措施。

第七条 排污单位填报《排放污染物申报登记表》，经行业主管部门审核后，向所在区、具环境保护行政主管部门登记注册，领取《排放污染物申报登记注册证》。无主管部门的单位或中央和各地驻津单位可直接由所在区、县环境保护行政主管部门审核、登记注册，发放《排放污染物申报登记注册证》。

排污单位终止排污，应当在终止排污后一周内经行业主管部门审核、备案后，向原注册单位办理注销登记，并交回《排放污染物申报登记注册证》。

第八条 根据排污单位排放污染物的种类和数量等，排污申报登记表分为详表、简表和专项表。重点污染源填详表。其他排污单位填简表，机关，学校和建筑施工单位填专项表。

第九条 排污单位的废水排放口、废气排放口、噪声排放源和固体废物储存，处置场所的设置应符合采伴。监测、计量等工作的要求，排污单位应按所在地环境保护行政主管部门的要求设立标志。

第十条 环境保护行政主管部门依法对排污单位进行现场检查，被检查单位必须如实反映情况，提供必要的资料。

进行环场检查的环境保护行政主管部门应为被检查单位保守技术及业务秘密。

第十一条 排污单位申报登记后，排放污染物的种类、数量、浓度、排放去向、排放地点、排放方式、噪声源种类、数量和噪声强度、固体废物的储存，利用或处置场所以及各种污染治理设施等需作变更的，应在变更前十五日，经行业主管部门审核后，向所在地环境保护行政主管部门填报《排放污染物变更申报登记表》；发生紧急重大改变的，必须在改变后三日内向所在地环境保护行政主管部门提交《排放污染物变更申报登记表》。发生改变而不履行变更手续的，视为拒报。

第十二条 拆除或闲置污染物处理设施的，必须提前向所在地环境保护行政主管部门申报。环境呆护行政主管部门接到申报后，应当在一个月内予以批复，逾期不批复的，视为同意。

未向环境保护行政主管部门申报，擅自拆除或闲置污染物处理设施的，视为拒报。

第十三条 排污单位在环境保护行政主管部门指定时间内不办理申报登记或在申报登记中应报不报视为拒报；登记事项填报不真实视为谎报。

第十四条 排污单位拒报或谎报排污申报登记事项的，环境保护行政主管部门可依照国家环境保护局《排放污染物申报登记管理规定》处以三百元以上至三千元以下罚款，并限期补办排污申报登记手续。

第十五条 当事人对行政处罚决定不服的，可以在收到通知之日起十五日内，向人民法院起诉；期满不起诉又不履行的，由作出处罚决定的机关申请人民法院强制执行。

第十六条 本办法自公布之日起实施。

基本情况表填报说明

（一）：

封面

（申报年度）为申报登记的当年。

（申报登记号）由区、县环境保护行政主管部门编写。编号为企业申报登记的永久性代码，码由七位数字组成，前三位为行政区划代码（见《天津市排放污染物申报登记工作手册》以下简称《手册》），后四位为本区、县的申报单位序列代码。如：和平区的天津市×××厂为1010001。

（单位代码）由申报单位按天津市技术监督局统一颁发的单位代码证书自行填写。

（网格号）由区、县环境保护行政主管部门填写。

（申报单位名称）应以申报年度的单位名称为准，按照单位公章所示单位全称详细填写，不得使用简称。

（单位地址）填写单位所在市、区（县）、乡、村及街道门牌号，如果一个单位有几个出入口的，只填写主要出入口的地址。

（二）：

（行业分类）按《手册》中《国民经济行业分类和代码》（ＧＢ４７５４—８４）中的国民经济行业分类所属的工业大类。

（行业分类代码）由两位数字构成，其代码采用《国民经济行业分类和代码》（ＧＢ４７５４—８４）的代码。

（经济类型及代码）参照《手册》中国家统计局和国家工商行政管理局１９９２年制定的《关于经济类型划分的暂行规定》填写。

（企业规模及代码）按企业大、中、小型分类。根据国家经委发布的经企（１９８８）２４０号文规定划分标准填写。代码表示：大-Ｄ，中—Ｚ，小—Ｘ，不明—Ｎ。如是医院，请填报床位数。

（主管部门名称）填写单位的局级主管机关名称，无主管上级的请注明无。

（全年总产值）指按９０年不变价格计算的企业在报告期内生产的以货币表现的产品总价值。

（年末固定资产原值）指购买建造各种固定资产当时所实际支付的金额以及改建、扩建所追加的投资金额合计。

（年末职工人数）指企、事业直接组织安排生产或工作，并由其支付劳动报酬的全部人员。

（本单位环保机构名称）指企、事业负责环境保护工作的科室。

（本单位环保监测机构的名称）指企、事业单位负责环境保护监测工作的机构。

（三）：

（年缴纳排污费）指企、事业单位因排污超过有关标准而缴纳的排污费金额。废水、废气、噪声、固体废物分别填人每栏的合计中，并将具体的污染物名称填人空格内。如废水年排污费是１万元填人合计栏中，其中ＣＯＤ：０．８万元，ＳＳ：

0．2万元分别填人废水栏空格中。

（造成污染的赔款和罚款）指企、事业单位由于污染事故或违反环境管理法规受到经济制裁而被罚的金额数与排放废物对人体、农作物、林木、牲畜等造成危害，向对方所作的经济赔偿的金额数之和。

（四）：

（主要产品）在总产值和总利润中占比重较大的产品；生产过程中废物排放量大或排放污染物毒性大的产品。如主要产品较多，可加页续填。

（原辅材料名称）主要产品的原辅材料。生产过程中排出有毒有害的物质的原辅材料。原辅材料超过5种时，只要求列出最主要的5种。

（实耗）单位产品实际消耗的原辅材料量。

（定额）国家或地方主管部门为企业制定的单耗指标。

（说明）要求将本企业原材料消耗量与国内同行业平均水平进行比较，以便从技术、管理方面寻求原料消耗和污染物产生的不合理因素，另外对产品季节性或间歇性生产状况也应进行说明。

（五）：

（污染处理设施名称及规格型号）指处理设施的具体名称及产品铭牌注明的规格、型号。

（处理设施生产厂家）要求注明生产厂家的全称。

（处理方法）水处理方法按照《手册》中《废水处理工艺流程代码》中的废水处理工艺名称填写。有毒有害气体处理方法，指废气净化的原理，如活性炭吸附，催化燃烧等。

（处理效果）栏内各项指标均为设施正常运行时的测定值。

（处理效率）处理前后浓度之差与处理前浓度的百分比。

（治理资金）资金来源除环保补助资金分别填外，无论资金来源如何，一律填在其他栏内。

（设施运行情况）分为：①连续正常运行，②正常间断运行，③不正常运行，④停运，⑤报废等，并在备注栏内说明原因。

（运行费）申报前一年维持所有治理设施正常运行所发生的费用。包括能耗、水耗、设备折旧、药剂、设备维修、工资等费用。

（综合利用情况）指回收利用“三废”作为主要原料生产的产品自用或出售后所得利润额。

（设施建成日期）指设施建成并试运行的年、月。

（设施开始运行日期）指治理设施首次开始正式投入运行时间。

（设施累计运行时间）指治理设施从正式投入运行至申报时的累计运行时间。

固体废物申报登记表填报说明

（一）固体废物产生及其主要去向概况表

本表所称的固体废物，是申报单位在生产、经营活动和其他活动中所产生的所有固态的、半固态的和除废水以外的液态废物。

单位内的生活垃圾和建筑垃圾（建筑弃料）均不要申报。

〈类别编号〉指固体废物按不同性质、种类编制的类别编号，为了使申报单位能够准确选择固体废物类别编号，可按《手册》中“固体废物名称和类别编号（代码）对应表”进行检索对照，选择适当类别编号填报。

〈固体废物名称〉为了便于申报单位填报时能够准确选择合适的废物名称，在《手册》中列出了“固体废物名称和类别编号（代码）对应表”，供填报时检索选择。其中对“类别编号”为６６#、７７#、７８#、７９#、８０#、８３#６类固体废物暂不要求进行申报登记。

如果一种废物中含有多种污染物，成份比较复杂，可按如下原则来适当选择废物名称和对应的类别编号：

（１）按“固体废物名称和类别编号（代码）对应表”中所列出的来源或内容含义的含有污染物质的先后顺序选择适当的名称和对应的编号。

（２）根据废物中含有的主要污染物成份选择适当的名称和对应编号。

〈形态〉按废物的固态、半固态和液态的三种形态之一填报，其中：固态是指含水量小于等于８５％的废物；半固态是指含水量大子８５％小于９９．５％的废物；液态是指含固量小于等于５‰的废物。污泥经脱水，其含水量小于８５％时，按固态填写，但在后面“含水量”一栏内要填写含水量。

〈废物来源〉指废物产生于何种过程。如铬渣是“铬矿经高温焙烧浸取铬酸盐后的残渣”，生化污泥是“有机废水经生化处理后的剩余污泥”等。

〈年产生量〉按申报的前一年实际产生的固体废物数量，如１９９５年进行申报，其产生量是指１９９４年，全年产生量。

〈含水量〉指半固态废物中的含水量（以百分含水率表示，即％），测定方法按在１０５℃烘干至恒重的称量法。半固态（污泥）以外的废物，可采取估算方法

确定，但需在说明栏内注明。

〈废物有害特性〉指有如下有害特性的，在其格子内画一“√”；

• 急性毒性：是指一次投给实验动物较大剂理的毒性物质，在短时间内所表现出的毒性。在国家没有公布“有害废物名录”之前，可以不要填。

• 易燃性：如果液体其闪点＜６０℃；如非液体废物，经过发热、吸湿、自发的化学变化具有着火倾向。

• 腐蚀性：指ＰＨ≥１２．５或ＰＨ≤２的废物。

• 反应性：指具有如下特性之一：

（１）不稳定，在无爆震时容易发生剧烈变化；

（２）和水剧烈反应；

（３）能和水形成爆炸性混合物；

（４）和水混合会产生毒性气体、蒸汽或烟雾；

（５）在有引发源或加热时能爆震或爆炸；

（６）在常温、常压下易发生爆炸或爆炸反应；

（７）有其他反应性特性。

• 浸出毒性：指按《有色金属工业固体废物浸出毒性试验方法标准（ＧＢ５０８６—８５）》和《有色金属工业固体废物污染控制标准（ＧＢ５０８５８５）》确定。

以上有害废物特性，如目前尚无条件鉴别时，暂时可以不填报。

〈含有主要成份〉是指这种废物中含有何种主要成份。如有成份分析的按成份分析数据填报，没有数据的，按物料平衡的方法推算出主要组成成份。

〈主要有害成份含量〉它与上面的“含有主要成份”不同，这里是指废物中含有污染物的含量，如铬渣，主要污染物成份是Cr^{+6}，含量是２０００mg/Kg。废物的单位重量均以干量计量。对重金属化合物及有分析测试方法的有机化合物，采取实样测试来确定，样品采集要有代表性；有的可以从物料平衡来估算（要注明估算）；对无法采取测试或物料平衡来确定其含量（如有些有机化合物，分子结构复杂，难以测试其成份及含量），可填写有害成份大约的百分含量，这时将单位“毫克／千克”改为“％”。

〈年处理量〉这里的“处理”，主要是指采用物理、化学、生物、热解、固化

等方法对有害废物进行无害化或稳定化处理的过程，是处置前的预处理过程。处理数量，可作单独一项来填写，包括本单位处理量和外单位处理量。不要与后面的“废物主要去向的数量”联系起来。

〈废物主要去向的数量〉此处所举四种去向，除综合利用往年量外，其数量之和应与“年产生量”相等。四种去向是指：

1. 综合利用：指通过回收、加工、循环利用等方式，从固体废物中提取或者使其转化为可以利用的资源、能源和其它原材料的活动，综合利用量包括当年利用往年的工业固体废物堆存量。

2. 处置：指将固体废物消纳或放置在符合环境保护要求的场所并不再回收的活动（焚烧算处置）。

①围隔堆存，即有防止废物流失或飞扬措施的永久性处置；

②填埋，即有防止废物流失或飞扬措施的永久性处置；

③海洋处置，即经海洋管理部门同意的投海处置；

④焚化，即焚烧或高温裂解处理；

⑤其它处置方式，指不包括以上处置方式，但有防止环境污染措施的永久性贮存或堆存。

处置方式，如深层灌注、废矿井永久性堆存处置作业。

3. 贮存（堆存）：指为综合利用、处理、处置而暂时性保存、堆放固体废物的活动。包括一般废物（钢渣、粉煤灰、煤矸石、尾矿等）以作坝形式的临时性堆存方式，并有一定的防止流失和飞扬措施。

4. 排放，即除上述三种方式以外的排放方式，如：

①向水体排放废油类、废酸、废碱及其它液态废物；

②在江河、湖泊、运河、渠道、海洋的滩场和岸坡倾倒、堆放和存贮废物；

③利用渗井、渗坑、渗裂隙和溶洞倾倒废物；

④向路边、荒地、荒滩倾倒废物；

⑤未经环保部门同意作填坑、填河浜和土地填埋固体废物；

⑥混人生活垃圾内，进行堆置和处置的废物；

⑦未经海洋管理部门批准同意，向海洋倾倒废物；

⑧其他去向不明的废物。

凡废物作上述八种方式之一处置作业的废物均按“排放”填报。

〈排放量〉指固体废物产生量减去综合利用量减去处置量减去贮存量。

〈说明〉如果“废物主要去向的数量”之和，不等于“年产生量”时，应说明其原因。对“处理”之后的去向也应作一简要说明。

（二）、主要产品、原辅材料消耗和单位产品的废物产生量表

此表要求将固体废物的产生数量与主要产品以及原辅材料的消耗联系起来，并由此计算出“单位产品的废物产生量”。填表时注意前后的对应关系。

〈主要严品〉指生产产品过程中产生固体废物的主要产品。有的固体废物不一定是企业中的产品生产过程中产生的，如煤渣是生产蒸汽时产生的，这时也可以把主要产品按“生产蒸汽”来填写。后一项的“原辅材料及消耗”，则只要填写“燃煤”即可。

〈原辅材料及其消耗〉应注意这里的”原辅材料”既要与主要产品对应，同时还要与所产生的固体废物种类相对应，因此，填此内容，应特别注意前后之间的对应关系。一种产品的原辅材料超过5种时，只要求列出主要的5种。

〈固体废物产生量〉应与表（一）中的“类别编号”，“固体废物名称”和“固体废物年产量”相一致。

〈单位产品的废物产生量〉这里的“单位产品”没有注明单位，应与“主要产品”中的“单位”相一致。“单位产品的废物产主量”是依据主要产品的年产量和”固体废物年产生量”进行计算的结果。

如电力行业，可按“每万度发电量”产生的粉煤灰吨数来填写。同样，造纸行业可接“每吨纸浆”，钢铁工业可按“每吨钢（铁）”来计算出废物的产主数。

无法按上述方法统计，如生产机床有大有小，就不能按生产一吨机床产多少吨固体废物来统计，那就可按万元产值生产多少吨固体废物来统计。

（三）、本单位自行综合利用固体废物情况表

〈建成综合利用项目（或设施）名称〉项目如果有多项时，可填人表（八）“固体废物的处理、综合利用、处置和贮存设备（设施）情况表”内。

〈建成日期〉指项目建成并试生产的年、月。

〈建设投资〉包括土建、征地，和其他配套工程项目的总投资。

〈利用废物生产的主要产品〉指利用废物作原料、辅料所生产的产品名称。

〈综合利用年产值〉〈综合利用年利润〉以申报单位计划部门上报的统计数据为准。

〈类别编号〉〈固体废物名称〉〈年产生量〉按表五（一）填报说明填写，其中〈年产生量〉应与表五（一）的〈年产生量〉相一致。

〈年综合利用数量〉应与表五（一）的〈综合利用〉相一致。

〈综合利用率〉指该废物的年利用数量（包括利用往年堆存的固体废物量），占废物年产生量与综合利用往年堆存量之和的百分比。

〈综合利用主要工艺方法〉简要说明从废物到产品的主要工艺方法。

〈利用废物生产的主要产品〉将主要产品的名称列出。如有多种产品时，可只填写 3 种。

〈废物利用后残渣数量〉指废物经回收利用以后所产生的残渣数量。

〈残渣最终处置方法或出路〉说明这些残渣的最后出路。

（四）、本单位自行处理、处置及贮存固体废物表

〈类别编号〉〈废物名称〉按表五（一）填报说明填写。

〈处理〉指采用物理和化学方法对固体废物进行处理的过程。包括对有害废物所进行的无害化和稳定化处理（如固化技术），也包括脱水、干燥、压缩、粉碎（水淬）以及生化处理等工艺过程。在填写时应将如何处理的方法填写出来，同时注明经处理后的去向。

〈处置〉应按表五（一）“处置”的说明来填写。“处置方法”可参照表五（一）中的说明。如果超出表五（一）中“处置”的 5 种方法，应另附纸作比较详细的说明。

〈年处置数量〉本单位自行处置数量与外单位处置数量之和与表五（一）的〈处置数量〉相等。

〈防止二次污染的主要措施〉如采取焚烧处置时，应说明有无尾气净化处理、除尘处理的情况，焚烧后残渣的最终出路等。如采取填埋等处置，应说明如何防止对地下水、土壤、大气的污染问题的主要措施。本栏如不够填写，可另附纸说明。

〈贮存数量〉应将年贮存数量和历年已贮存量分别填报。

〈贮存地点〉包括当年和历年的贮存地点。如果历年贮存地方有多处时，应另纸详细说明其地点（地名和方位），如不易写清楚时，应绘制地点的方位图。如果是贮存在厂区以外的地方，要写明详细地址和方位。例如："ＸＸ省ＸＸ县ＸＸ乡ＸＸ自然村ＸＸ河以东２００ｍ"。

〈防止流失或控制污染的主要措施〉）扼要说明采取何种防止废物流失或控制污染（水、气）的工程和非工程（管理方面）的主要措施。本栏填写不下时，可附另纸详加说明。

（五）、固体废物提供外单位进行综合利用情况表

〈类别编号〉〈固体废物名称〉见表五（一）中填报说明。

〈提供数量〉应与表五（三）中"自行综合利用数量"之和，等于表五（一）中"综合利用数量"。如果不相等，应加以说明。

〈接纳废物的单位名称〉应填写其全称。

〈接纳单位地址〉应填写其详细地址。如果是乡镇工厂，要写明省（市）、乡（镇）、村。

〈可收取费用〉指本单位向废物接纳单位收取的费用。

〈需付出费用〉指本单位向接纳单位支付的费用。

〈有否接纳单位所在地环保部门同意证明〉是指本单位向接纳单位提供废物类别编号中的０１—６７号的废物时，有没有接纳单位所在地县以上人民政府环境保护行政主管部门的书面证明（下同）。

（六）、委托外单位代为处理、处置和贮存固体废物情况表

〈类别编号〉〈废物名称〉见表五（一）中的填报说明。

〈处理〉〈处置〉〈贮存〉见表五（一）中的填报说明。

〈处理方法〉见表五（四）中"处理"的说明。

〈处置方法〉〈贮存方式〉，见表五（一）中的填报说明。

〈接纳单位名称〉需填写其全称及地址。

〈需付费用〉指委托单位向接纳单位付出的处理、处置、贮存的费用（包括运

输费）并折算成元／吨。

〈有否接纳单位所在地环保部门同意证明〉见表五（五）中的填报说明。

（七）、固体废物排放情况表

〈类别编号〉〈废物名称〉见表五（一）中的填报说明。

〈数量〉应与表五（一）中“排放数量”相一致。

〈排放方式〉指表五（一）中“排放”含义中所说的8种方式之一，如超出这8种方式的，需作详细说明。

〈排放地点〉要写出详细地点或地方的方位。如难以文字说明时，应附简图进行说明。

〈是否发生污染事故，并说明罚款、赔款情况〉应说明污染事故的情况、污染的范围，如何处理，以及罚款和赔款的金额。、

〈今后减少排放的措施或计划〉针对污染的情况，提出减少排放的措施或计划。

（八）、固体废物的处理、综合利用、处置和贮存设备（设施、装置）情况表

本表主要是填报有关固体废物方面的设备（包括设施、装置）。其中：

1． 处理设备：指蒸发、浓缩、脱水、干燥、生化处理、固化处理、压缩、粉碎、筛分、包装等处理作业中的设备、设施和装置。

2． 处置设备（设施、装置）：指焚烧、热解、填埋、围隔等的设施，并包括运输、装卸工具和装备等配套设施。

3． 综合利用：综合利用的情况比较复杂，申报单位可根据本单位实际情况进行填报。

〈治理（利用、贮存）废物名称〉应与表五（一）中的固体废物名称相一致。

〈总投资〉设备、装置按其原值（以固定资产值为准）填报。

如焚烧处置的设施，应包括各项配套的投资总额。如是填埋场、堆灰场、尾矿坝等一类的设施，还包括征地、搬迁、道路、河道开拓疏浚等配套工程的费用。

〈运行费用〉指维持处理设施正常运行所发生的费用，包括运输等费用，并折

算成元／吨。

（九）、固体废物产生源的主要流程和物料平衡图

填绘要求：

1． 用方框图标明从原（辅）材料到产生废物的简要工艺流程，并注明它们之间的物料平衡关系。

2． 从废水和废气治理中产生的固体废物，要求在流程图中标明进出口的污染物浓度，废水、废气数量（以日计），治理的装置名称和治理工艺过程和每天产生固体废物的数量。

3． 有多种固体废物，要求分别填绘，如本页不够时，可按本页式样加页绘制。

固体废物申报登记表（简表）填报说明

（固体废物名称）指生产和经营活动中产生的所有固态、半固态和除废水以外的液体废物，包括废水处理后的污泥。（生活垃圾、建筑垃圾、放射性垃圾不包括在内。）固体废物名称根据废物中的主要成分和来源，参照《手册》中“废物名称和类别编号对应表”填写。

〈代码〉按《手册》中“废物名称和类别编号对应表”填写类别编号。

〈年产生量〉按申报前一年正常产生的固体废物实际数量，如生产不正常，应按正常年份的废物产生量填报，并在数量的后面注明年份。

〈含主要成份〉是指这种废物中含有何种主要成份。如有成份分析的按成份分析的数据填写；没有数据的接物料平衡的方法推算出主要组成成份。

〈含有毒有害成份〉与上面的“含主要成份”不同，指废物中含有污染物的成份。如铬渣主要污染物成份为Cr^{+6}，含量为２０００毫克／千克，废物的主要单位重量均以干量计算。

〈年处理量〉这里的“处理”主要是指用物理、化学方法对有害废物进行无害化或稳定化处理的过程，并作为处置以前的预处理。

〈综合利用〉指以固体废物作为一种资源进行回收或利用，如能源利用、用作建筑材料、回收废物中有价值的成份等。综合利用量应包括当年利用往年的工业固体废物堆存量。

〈主要产品〉指利用废物作原料、辅料所生产的产品。

〈主要用途〉指废物的最后出路。

〈接纳单位名称〉填写其全称及地址。

〈年贮存量〉“贮存”指废物以综合利用或处置为目的的暂时性贮存方式，包括一般废物（钢渣、粉煤灰、煤矸石、尾矿等）以作坝形式的临时性堆存方式，并有一定的防止流失和飞扬措施。

〈年处置量〉“处置”指固体废物进行如下的处置作业：①围隔堆存，即有防止废物流失或飞扬措施的永久性处置；②填埋，即有防止水污染、大气污染和土壤污染的最终处置方式；③海洋处置，即经海洋管理部门同意的投海处置；①焚化，即焚烧或高温裂解处理；⑤其他处置方式，指不包括以上处置方式，但有防止环境污染措施的永久性贮存或堆存。

〈年排放量〉即除上述三种方式：综合利用、贮存、处置以外的排放方式，如①向水体排放废油类、废酸碱及其他液态废物；②在江河、湖泊、运河、渠道、海洋的滩场和岸坡倾倒、堆放和存贮废物；③利用渗井、渗坑、渗裂隙和溶洞倾倒废物；④向路边、荒地、荒滩倾倒废物；⑤未经环保部门同意作填坑、填河浜和土地填埋废物；⑥混入生活垃圾内，进行堆置和处置的废物；⑦未经海洋管理部门批准同意，向海洋倾倒废物；⑧其他去向不明的废物，凡废物作上述八种处置方式之一处置作业的废物均按“排放”填报。

年综合利用量、年处置量、年贮存量、年排放量之和应与年产生量相等。

排放污染物变更申报表填报说明

①本表用于排放污染物申报登记指标发生变更时填报。
②申报登记号系指已申报登记注册的申报登记号。
③填报要求参照排放污染物申报登记表填报说明。
④变更项目较多时可加页续填。
⑤不属于正常变更的事故性排放不填此表。
⑥“申报表编号”是指需变更的项目位于哪个表中，如：原料变更则“申报表编号”格内填“表一、(三)”，即“一 排放污染物申报登记单位基本情况表”中的“(三)主要产品及原辅材料表”。
⑦变更内容是指排污申报登记表中的内容发生变更，要写明原申报登记表中的数据和变更后数据。并附变更后的相应申报登记表格。
⑧变更生效日期是指申报登记表中需变更项目变更的起始时间。

有关排污申报登记的若干问题说明

1、排污申报登记制度及法律依据

排放污染物申报登记制度是排污单位依法向有关环境保护行政主管部门申报登记其向环境排放水污染物、大气污染物、噪声或产生固体废弃物等污染物的一项法定的行政管理制度。排污申报登记工作是环境保护行政主管部门进一步强化环境管理，使污染源的监督管理逐步实现规范化、定量化的基础工作。

排污申报登记制度的依据是《中华人民共和国环境保护法》第二十七条规定："排放污染物的企业事业单位，必须依据国务院环境保护行政主管部门的规定申报登记。"

国家环境保护局发布的《排放污染物申报登记管理规定》进一步对排污申报登记作了具体的规定。

此外，《中华人民共和国水污染防治法》、《中华人民共和国大气污染防治法》、《中华人民共和国环境噪声污染防治条例》等对此也作了相应的规定。

2、排污申报登记的范围

一切排放污染物的单位都必须进行申报登记。也就是：在天津市管辖区域内，所有直接或间接向大气、水体、土壤排放废水、废气、粉尘、恶臭、噪声以及产生固体废物等污染物的单位，如：中央、部队驻津企业事业单位，市属、区县属企业事业单位；三资、饮食、娱乐、服务企业、乡镇企业；排放污染物的个体经营者；有锅炉房、大灶的机关、学校及环境保护行政主管部门认为有污染物排放的单位都必需依照规定进行申报登记。

如果排污申报单位的分厂或车间在同一区（县）的不同地方，则由法人单位统一到所在地区（县）环保局申报，如果申报单位和其分厂或车间分布在两个或两个以上区（县），则应单独填报后交其各自所在地的环保局（办）。

租用他人房屋、场地从事经营生产的企业事业单位、个体经营者，由承租者办理申报登记手续。

3、排污单位进行申报登记的工作程序

天津市的排污申报登记工作是在市环保局统一组织实施下在全市范围内进行的。各排污单位应当按照规定的日期，到所在地的区、县环保局（办）领取《排污申报登记表》，并按表中的内容和有关要求如实认真填报，经上级主管部门审核后送所在地的区、县环保局（办），办理登记注册手续，无上级单位可直送区、具环保局（办）。对审查合格者由区县环保局（办）发给"排放污染物申报登记注册证"。

4、排污申报登记表的种类及适用范围

根据全市污染源的情况，排污申报登记表共分１０种，表一：排放污染物申报登记单位基本情况表，表二：排放水污染物申报登记表，表三：锅炉、炉窑、茶炉、大灶排放污染物申报登记表，表四：排放有毒有害气体、恶臭气体、生产性粉尘申

报登记表，表五：固体废物申报登记表，表六：噪声污染源申报登记表，表七：排放污染物申报登记表（简表），表八：机关、学校、团体排放污染物申报登记表，表九：建筑施工场地噪声申报登记表，表十：排放污染物变更申报表。

表一至表六为详表，表七为简表，表八、表九为专项表，表十为变更表。重点污染源单位填详表，一般污染源单位填表一、表六和表七，机关、学校、幼儿园、社会团体、商业等填表八，建筑施工单位填表九，排污申报登记单位登记表中的内容发生变更的须填表十。

5、重点污染源单位和一般污染源单位的界定

凡具备下列条件之一的即为重点污染源单位：

（1）年废水排放量≥８万吨（或日排放废水≥３００吨）；

（2）排放废水含有国家ＧＢ８９７８—８８《污水综合排放标准》中规定的第一类污染物汞、镉、铬、砷、铅、镍、苯并比筹；第二类污染物中挥发酚、氰化物、苯氨类、硝基苯类等；

（3）排放高浓度有机废水或废水中含有难降解有机物的；

（4）年燃煤量≥４０００吨（或单台或多台锅炉合计的蒸发量≥１０吨的）；

（5）生产过程中产生有毒有害气体、恶臭气体和工业粉尘的；

（6）生产、经营活动中产生固体废物，且其在《天津市排放污染物申报登记工作手册》中《固体废物名称和类别编号（代码）对应表》中产生量如下之一的：

编号０７、１０、２４、２９、３３、３７、３８、３９、４１、４３、４４、４５的任何产生量的固体废物；

编号０１—４５号中除以上１２种以外，其产生量≥０．０１吨／年；

编号７１—８０号产生量≥１００吨／年（单纯锅炉渣除外）；

其余编号产生量≥１吨／年；

（7）《国务院关于加强乡镇街道企业环境管理的规定》中规定的已经从事１２种污染严重的工业项目生产的乡镇街道企业；

（8）市环境保护局根据历年资料认定的重点污染源单位。

一般污染源，上述条件之外的企事业单位、机关、学校和餐饮、娱乐服务业及固体废物为单纯排放锅炉渣又不具备上述其他条件的单位为一般污染源。

6、排污申报登记单位要对申报的内容负责

排污申报登记是排污单位必须履行的一项法律义务，排污单位要对申报登记的内容承担法律责任，所有申报的内容、数据和提供的其他技术资料真实、可靠、准确、完整，不允许虚报瞒报。污染物排放浓度为实测值，废水、烟尘的监测数据以申报当年为准，采暖期计算不跨年度，按当年年初和年底合计为一个采暖期。无监测能力的单位应委托具有市环境保护行政主管部门监测资格认证的单位进行，有些数据需要计算的，应以《手册》中明确的方法为准，并注明为“计算”，如采用其他方法计算，应注明计算的依据。

市、区、县环境保护局（办）应当对管辖区域内的排污单位进行现场检查、核实。如发现谎报、拒报等情况，要根据情节轻重依法追究其责任并给予处罚。

7、排污单位需要申报的污染物

排污单位需要申报的污染物有：

（一）水污染物：（１）以《污水综合排放标准》（ＧＢ８９７８－８８）和《天津市水污染物排放标准》（试行）中规定的水污染物为申报重点，其中ＣＯＤ、ＳＳ、挥发酚为必报项目：（２）尚未包括在上述标准中，但对环境已造成较大危害或潜在影响的水污染物也应申报。

（二）大气污染物：以《锅炉大气污染物排放标准》（ＧＢ１３２７１－９１）、《恶臭污染物排放标准》（ＧＢ１４７６１.１－９３）及《天津市有毒有害气体排放标准》（ＤＢ１２／－０３２－９３），《天津市恶臭排放标准》（ＤＢ１２／－０３３－９３）（试行）中规定的烟尘，生产性粉尘和工艺废气为申报重点。

（三）固体废物：以有毒有害废物为申报重点，《天津市排放污染申报登记工作手册》中“固体废物名称和类别编号（代码）对应表”所列出的废物名称，可对照申报。

（四）环境噪声：以固定声源产生的噪声为主，具体按《噪声污染源申报登记表填报说明》执行。

（五） 建筑施工噪声：按《中华人民共和国环境噪声污染防治条例》第二十二条的规定执行。建筑施工场地噪声分施工阶段填报。已完成的施工阶段可以不再填写。

８、医院排放污水的申报登记

医院污水排放除执行《污水综合排放标准》（ＧＢ８９７８－８８）和《天津市水污染物排放标准》（试行）外，还须符合ＧＢＪ４８－８３《医院污水排放标准》（试行）规定的要求填报。

医院污水量如没有实测值，则根据医院污水设计规程，每张床位按认０．８吨水量计算。

９、排放污染物申报登记注册证

《排放污染物申报登记管理规定》中规定的排污申报登记后领取的《排放污染物申报登记注册证》是已经办理排污申报登记手续的证明。应当指出的是：“注册”不等于“许可”。注册仅表明申报单位已遵照法律规定在当地环境保护行政主管部门履行了登记手续，纳入其管理范围。其排污行为是否超过国家有关标准或排污许可证的规定，还需要按有关法律和法规进行管理。

１０、变更登记及手续

排放污染物申报登记表中内容发生变更时，如：变更产品、产量、工艺、设备等因素造成的排污行为变化，使污染物质排放种类、数量、浓度、排放去向、排放地点、排放方式，噪声源种类、数量、噪声强度，固体废物的贮存、利用、处置场所以及各种污染治理设施等发生变化时填此表。排污量减少时也必须变更申报。

申报登记内容发生变化前１５日在所在地的区、县环境保护局（办）办理变更申报手续。如发生紧急重大改变时，变更后３日内必须办理变更申报手续。

１１、排污申报登记与排污许可证的关系

排污申报登记是排污许可证的一个必备阶段，它是发放排污许可证的基础。二者有一定的内在联系，同时，排污申报登记本身又是一项有法律依据的独立的环境管理制度。

１２、锅炉、茶炉炉渣问题

炉渣排放无实测值，可按用煤量的２５—３０％估算值填报，企、事业单位的茶、浴炉炉渣应按固体废物申报，不应算生活垃圾。

１３、　一个单位内有几个合资企业如何申报？

一个单位内现有几个合资企业，这个单位本身应按程序进行申报登记，设在该单位内的合资企业应按注册的独立的法人单位申报登记。排放废水、烟尘、废气等污染物设施共用部分，由牵头单位负责申报登记并在“备注”栏中说明。

１４、　在开发区注册，异地办厂如何申报？

企业在经济技术开发区注册，工厂座落在天津市辖区内的某个区或县，该企业应到所在地的环境保护行政主管部门履行申报登记手续。

天津市环境保护条例

（1994年11月30日天津市第十二届人民代表大会常务委员会第十二次会议通过）

第一章 总 则

第一条 为保护和改善本市的生活环境与生态环境，防治污染和其他公害，保障人民群众身体健康，促进社会主义现代化建设，根据《中华人民共和国环境保护法》和其他法律、法规，结合本市实行情况，制定本条例。

第二条 本条例适用于本市管辖的行政区域和海域。

第三条 环境保护必须坚持预防为主、防治结合、综合防治的方针以及谁污染谁治理和污染者付费的原则。

第四条 市和区、县人民政府应当把环境保护规划纳入国民经济和社会发展计划与城市规划，制定和实施有利于环境保护的经济、技术政策和措施，使环境保护与经济建设、社会发展相协调。

第五条 市和区、县人民政府及有关部门应当推进环境保护科学技术的研究、开发及应用。

第六条 市和区、县人民政府应当扶持、发展环境保护产业和环境标志产品，对资源及工业废弃物的综合利用和防治污染的技术改造项目实行优惠政策。

第七条 市和区、县人民政府应当对本行政区的环境质量负责，实行环境保护目标责任制；定期向同级人民代表大会及其常务委员会和上级人民政府报告环境保护工作和环境质量状况。

第八条 市和区、县人民政府和有关部门、单位，对国家规定用于环境保护的资金，应当予以落实并合理安排使用，不得截留或者挪作他用；积极开辟新的资金渠道，逐步增加对环境保护的投入，提高环境保护投资额在国民生产总值中的比例；逐步建立环境污染治理基金。

第九条 市和区、县人民政府应当组织协调各方面的力量，开展以防治工业污染和加强环境基础设施建设为主要内容的环境综合整治，并实行环境综合整治定量考核制度，每年将定量考核结果向社会公布。

第十条 各街道办事处和乡、镇人民政府负责本行政区的环境保护监督工作。

第十一条 各级人民政府和各部门、各单位应当加强环境保护基本国策的宣传教育，普及环境保护科学知识，提高全体公民的环境意识和环保法制观念。

第十二条 一切单位和个人都有保护环境的义务，并有权对污染和破坏环境的单位和个人进行检举、控告。

第十三条 各级人民政府对保护和改善环境作出显著成绩的单位和个人，应当给予奖励。

第二章 管理职责

第十四条 市和区、县环境保护行政主管部门对本行政区的环境保护工作，实施统一监督管理，其职责是：

（一）贯彻并监督执行环境保护法律、法规、规章和标准；

（二）拟定并监督实施本行政区的环境保护规划和计划，参与制定经济发展中长期规划、城市总体规划、分区规划、国土规划和区域开发计划；

（三）监督管理和协调本行政区的环境污染防治、环境综合整治和生态环境保护工作，对建立自然保护区提出审批意见；

（四）组织开展环境监测和环境管理，定期发布环境质量状况公报；

（五）依法查处违反环境保护法律、法规、规章的行为，处理环境污染事故，调解环境污染纠纷；

（六）组织开展环境保护科学研究与环境保护宣传教育，推广环境保护先进经验和技术，开展国际间环境保护的合作和交流；

（七）受理对污染和破坏环境行为的检举和控告；

（八）市环境保护行政主管部门组织开展环境保护法规、政策的调查研究；草拟本市环境保护法规、规章草案和标准；依法受理环境保护行政复议案件；

（九）环境保护法律、法规、规章规定的其他职责。

第十五条 各级城建、规划、公安、工商行政、卫生、土地、矿产、农业、林业、渔业、水利、交通、铁道、民航及海洋、港务监督、渔政渔港监督管理部门和军队环境保护部门，应当依照有关法律、法规的规定，对环境污染防治和资源保护实施监督管理。

第十六条 市和区、县计划部门负责国民经济和社会发展计划中环境保护方面的综合平衡工作。

第十七条 市和区、县财政部门应当把城市环境基础设施和大型生态保护工程等建设费用纳入各级财政预算，并予以落实。

第十八条 市和区、县经济综合部门和行业主管部门，应当把环境保护工作纳入行业管理规划和计划，与经济发展统筹安排，同步实施；对所属企业按照国家关于环境保护的技术、经济政策，从产业、产品结构调整和开发、技术改造、综合利用、污染防治等方面进行管理、治理和考核，并保证环境保护资金的落实。

第三章 环境监督管理

第十九条 市环境保护行政主管部门统一规划、组织和协调全市的环境保护监测工作，组织实施国家和地方的环境质量标准、污染物排放标准和监测技术规范，组织和协调全市各级环境监测网络，向本市各级环境监测单位下达环境监测任务，收集汇总监资料，对本市环境状况进行调查和评价。

市和区、县环境保护行政主管部门的监测机构，负责本行政区的环境质量监测和污染、流动污染源监测。

市环境保护监测机构负责环境监测数据争议的裁定。

第二十条 造成环境严重污染的排污单位必须限期治理。

市和区、县人民政府可以作出限期治理的决定，或者授权环境保护行政主管部门作出决定。

被责令限期治理的排污单位，应当定期向环境保护行政主管部门报告治理进度。环境保护主管部门应当检查排污单位的治理情况，对完成限期治理的项目进行验收，并向同级人民政府报告验收结果。

严重扰民又缺乏有效治理措施的排污单位，应当停业、转产、关闭或者有计划地搬迁。

第二十一条 排污单位必须按照国家和本市的规定向环境保护行政主管部门缴纳排污费或者超标准排污费，并应当承担消除污染、排除危害和赔偿损失的责任。

征收的排污费，必须用于污染防治，不得挪作他用。

第二十二条 排污单位必须向环境保护行政主管部门办理排污申报登记手续。申报登记后，排放污染物的种类、数量、浓度有重大改变时，应当在改变的十五日前，重新申报登记。发生突发性重大改变的，必须在改变之日起三日内，重新申报登记。

第二十三条 实行排污总量控制和排污许可证制度。环境保护行政主管部门对不超过排污总量控制指标的排污单位，发给排污许可证；对超过排污总量控制指标的排污单位，限期削减污染物排放量，并根据情况发给临时许可证。排污单位必须按照排污许可证的规定排放污染物，禁止无证排放。

第二十四条 市环境保护行政主管部门会同市技术监督行政管理部门，拟定地方环境质量标准和污染物排放标准。地方环境质量标准和污染物排放标准，报市人民政府批准后施行。

第二十五条 市环境保护行政主管部门协同市技术监督行政管理部门，制定环境保护产品地方质量标准，对环境保护产品质量进行监督管理，并定期发布优先发展的环境保护产品名录。

第二十六条 环境保护行政主管部门和其他依照法律规定行使环境监督管理职权的部门，有权对管辖范围内的排污单位进行现场检查。被检查的单位应当如实反映情况，提供必要的资料。

进行现场检查的监督管理人员，应当出示由国家或者本市颁发的行政执法证件，并为被检查单位保守技术和业务秘密。

第四章 建设项目环境管理

第二十七条 建设项目必须按照先评价后建设的原则，执行环境影响报告书(表)的审批制度。防治污染的设施必须与主体工程同时设计、同时施工、同时投产使用。

利用外资项目和从境外引进技术、设备，必须遵守国家和本市的环境保护管理规定。在签定的合同中，必须有环境保护篇章。

第二十八条 环境保护行政主管部门根据建设项目对环境的影响程度划分类别，按照审批权限，实行分级管理。

第二十九条 建成投入生产的污染防治设施，必须正常运转，未经所在地环境保护行政主管部门同意，不得擅自拆除或者闲置。防治污染的设施非正常停用，必须立即向所在地环境保护行政主管部门报告并采取有效措施，防止污染环境。

第三十条 承担建设项目环境影响评价的单位，必须持有《建设项目环境影响评价证书》，按照证书中规定的范围进行环境影响评价工作，并对评价结论承担责任。

第五章 保护和改善环境

第三十一条 城市建设的集中供热、供气、供水、排水、园林绿化、污水集中处理、固体废弃物和生活垃圾的处理与综合利用，必须统一规划，配套建设。

实施污染物集中控制和处理时，有关排污单位应当承担相应的治理资金。

第三十二条 一切单位和个人在开发和利用资源时，应当严格遵守国家有关资源管理和环境保护的法律、法规，坚持开发利用与保护增殖并重的方针。

第三十三条 各级人民政府应当加强资源管理和生态环境建设，做好自然保护工作，对本行政区内具有代表性的自然生态系统区域，珍稀濒危的野生动植物自然分布区域，重要水源涵养和重要渔业保护区域，具有重大科学、文化价值的地质构造、古树名木、人文遗迹，应当采取措施进行保护。

第三十四条 在生活居住区、自然保护区、风景名胜区、文物保护区和其他需要特别保护的区域，不得新建、扩建污染和破坏环境的建设项目。已建成的设施，其污染物排放超过排放标准的，必须限期治理。建设旅游、娱乐以及其他对环境有影响的设施，其污染物排放不得超过规定的排放标准。

第三十五条 各级人民政府应当加强对农业环境的保护，发展和扶持生态农业和绿色食品，防治土壤污染、植被破坏、水土流失、水源枯竭、种源灭绝以及其他生态失调现象的发生、发展，推广植物病虫害的综合防治，合理使用化肥、农药、植物生长激素、农膜和农用化学材料。禁止利用超过水产养殖标准和农业灌溉标准的污水进行养殖与灌溉，禁止使用有害污泥施肥。

第三十六条 严格保护饮用水源和饮用水备用水源，建立饮用水源及其备用水源保护区。直接危害饮用水源的单位必须转产、搬迁或者关闭。污水处理实行集中处理与分散治理相结合，逐步实现污水资源化。加强地下水源管理，防止地下水水质质恶化。

第三十七条 采取措施防治大气污染。严格控制粉尘排放，建立烟尘控制区，发展集中供热和燃气事业，推广成型煤的生产和使用。加强对恶臭和工艺废气污染源的监督管理。严格限制有毒有害气体和恶臭的排放。实施对机动车尾气排放的监督管理和控制。

禁止在人口稠密区焚烧产生有毒有害烟尘和恶臭气体的物质。

第三十八条 市和区、县人民政府按照国家对噪声的限值规定，划定城市区域环境噪声标准适用区，并实施监督管理。

第三十九条 市和沿海区人民政府应当加强对近岸海域的环境保护，划定海洋环境

区。

禁止在海上自然保护区、海滨风景游览区、海水浴场、水产养殖区、盐场保护区和其他需要保护的区域内，建设污染环境、破坏景观的海岸工程建设项目。禁止排放可能造成水质恶化、有碍海生生物生长、影响人体健康的废水。禁止擅自在近海岸滩堆放、弃置和处理固体废弃物。

禁止在有航运价值的天然港湾，重要苗种基地和养殖场所，以及水面、滩涂中鱼、虾、蟹、贝、藻类的自然产卵场、繁殖场、索饵场，海生动物的重要回激通道，有重要观赏和考察价值的自然遗迹区域围海造地。

第六章　防止环境污染和其他公害

第四十条　产生环境污染和其他公害的单位，都必须把环境保护纳入工作计划，推行清洁生产，把消除污染、改善环境、节约资源和综合利用作为技术改造和经营管理的重要内容，建立环境保护责任制度和考核制度。

第四十一条　乡镇企业、街道企业、校办企业、私营企业和个体工商户，应当因地制宜地发展符合国家和本市环境保护管理规定的行业和产品，并按照以下规定执行：

（一）禁止生产和经营汞制品、砷制品、铅制品、放射性制品、联苯胺、多氯联苯、六六六、滴滴涕等产品；

（二）生产土硫磺、石棉制品、染料、土磷肥等产品的，以及电镀、制革、造纸制浆、土炼焦、炼油、土法生产沥青、有色金属冶炼等项目，应当具备有效污染治理条件，并严格执行环境影响评价和“三同时”制度。

第四十二条　新建、改建、扩建或者转产的乡镇企业、街道企业、校办企业、私营企业和个体工商户，应当到当地环境保护行政主管部门办理有关环境影响审批手续。未经环境保护行政主管部门审批的，工商行政管理部门不得发给营业执照。

第四十三条　禁止将产生严重污染的技术、设备、产品转移给没有防治能力的单位和个人使用。

第四十四条　禁止引进或者进口不符合国家和本市环境保护管理规定的建设项目技术、设备、产品以及废弃物。严禁将有毒有害物和垃圾转移到本市。

第四十五条　生产、储存、运输、销售、使用有毒化学品和含有放射性物质物品，应当采取防护措施，严格登记和管理，防止造成环境污染。放射性废物和废放射源，必须按照本市有关规定存入天津市放射性废物库，任何单位和个人不得自行处理和处置。

产生固体废弃物的单位，应当根据固体废弃物的不同特性合理贮存、处理、处置和运输，并进行综合利用。

第四十六条　因发生事故或者其他突发性事件，造成或者可能造成污染事故的单位，必须立即采取应急措施，同时报告所在地环境保护行政主管部门和其他有关部门，通报可能受到污染危害的单位和个人，并在事故发生的四十八小时内提出关于事故发生的时间、地点、类型、排放污染物数量、经济损失、人员受害等情况的初步报告。事故查清后，提出关于事故发生的原因、过程、采取的应急措施等情况的报告。事故处理完毕后，提出关于事故的处理结果，遗留问题和今后防范措施的报告。

环境保护行政主管部门在接到发生污染事故的报告后，应当立即向同级人民政府和上级环境保护行政主管部门报告，并会同有关部门对事故进行调查处理，监督造成或者可能造成污染事故的单位采取措施消除或者减轻污染。

第七章　法律责任

第四十七条　违反本条例规定，有下列行为之一的单位或者个人，环境保护行政主管部门或者其他依照法律规定行使环境监督管理职权的部门，可以根据情节给予警告或者处以罚款：

(一)拒绝现场检查或者被检查时弄虚作假的；

(二)不按照规定缴纳排污费或者超标准排污费的；

(三)拒报、谎报污染物排放申报事项的；

(四)将产生严重污染的生产设备转给没有污染防治能力的单位和个人使用的；

(五)引进不符合国家和本市环境保护管理规定的技术设备和有毒有害物的；

(六)不按照排污许可证制度的规定排放污染物的；

(七)发生污染事故不及时通知、报告或者不采取有效应急处理措施的；

(八)环境影响评价错误并造成损失的；

(九)擅自收集、运输、处理、处置、排放有毒有害废物、放射性废物以及放射源的；

(十)本条例禁止的其他行为。

第四十八条　在建设项目中不执行环境影响评价制度和“三同时”制度的，由批准该建设项目环境影响报告书(表)的环境保护行政主管部门责令停止建设、生产或者使用，并可处以罚款。对造成环境危害后果时，应当追究有关人员的行政责任。

第四十九条　逾期未完成限期治理任务的单位，除依照国家规定加收超标准排污费外，可以根据所造成的危害后果处以罚款，或者责令停业、关闭、转产、搬迁。

罚款由环境保护行政主管部门决定。责令停业、关闭、转产、搬迁，由市和区、县人民政府决定。

第五十条　擅自拆除或者闲置防治污染设施的，由环境保护行政主管部门责令重新安装使用，限期达到标准，并按照国家有关规定处以罚款。

第五十一条　违反本条例第四十一条规定的，由所在地环境保护行政主管部门责令其关闭或者停产。

第五十二条　实施罚款处罚时，区、县环境保护行政主管部门可处以五万元以下的罚款，超过五万元的罚款应当报市环境保护行政主管部门批准；市环境保护行政主管部门可处以二十万元以下的罚款。罚款的具体数额，按照国家和本市的有关规执行。

第五十三条　当事人对行政处罚决定不服的，可以在接到外罚通知之日起十五日内，向作出处罚决定机关的上一级机关申请复议；坚复议决定不服的，可以在接到复议决定书之日起十五日内，向人民法院起拆。当事人也可以在接到处罚通知之日起十五日之内，直接向人民法院起拆，当事人逾期不申请复议也不向人民法院起诉又不履行处罚决定的，由作出处罚决定的机关申请人民法院强制执行。

第五十四条　造成环境污染危害的单位或者个人，应当承担恢复环境功能和排除污

染危害的责任，并赔偿受到直接损害的单位或者个人的损失。

赔偿责任和赔偿金额的纠纷，可以根据当事人的请求，由环境保护行政主管部门或者其他依照法规规定行使环境保护监督管理职权的部门处理；当事人处理决定不服的，可以向人民法院起诉。当事人也可以直接向人民法院起诉。

完全由于不可抗拒的自然灾害，并经及时采取合理措施仍然不能避免造成环境污染损害的，免予承担责任。

第五十五条 违反本条例规定，造成土地、森林、水、矿产、海洋、渔业、野生动植物等资源破坏的，依照有关法律、法规的规定承担法律责任。

第五十六条 造成重大环境污染事故，导致公私财产重大损失或者人身伤亡的严重危害后果，构成犯罪的，依法追究有关责任人员的刑事责任。

第五十七条 环境保护监督管理人员玩忽职守、滥用职权、徇私舞弊、索贿受贿，构成犯罪的，依法追究刑事责任；不构成犯罪的，依据国家有关规定给予行政处分。

第八章 附 则

第五十八条 本条例自公布之日起施行。

天津市人民政府令

第36号

《天津市道路危险货物运输管理办法》，已于一九九一年七月二十三日经市人民政府批准，现予发布，自一九九一年九月一日起施行。

市　长　聂璧初

一九九一年七月二十三日

天津市道路危险货物运输管理办法

第一章　总　则

第一条　为加强道路危险货物运输管理，保障人民生命财产安全，根据国家有关规定，结合本市具体情况，制定本办法。

第二条　凡具有爆炸、易燃、毒害、腐蚀、放射性等性质，在运输、装卸、搬倒、打包、联运服务（以下简称危险货物运输）及在运输过程中临时存放，容易造成人身伤亡和财产损毁而需特别防护的货物，均属危险货物运输管理的范围。

道路运输危险化物的品名，以交通部《关于发布＜汽车运输危险货物品名表＞的通知》（[91]交运字163号）为准。

第三条　本办法适用于本市所辖行政区域内，从事道路危险货物运输的单位和在生产、销售、储存危险货物过程中，需经道路运输的单位。

从事危险货物运输的司机、装卸、打包、保管、押运、管理等作业人员均应遵守本办法。

第四条　市交通局是道路危险货物运输的行政主管部门，具体工作由其所属的道路运输管理机关负责。

第二章　运输资格审查登记程序

第五条　从事营业性危险货物运输的单位，需具备定车、定人、定任务、定防护用品及其清洗点、定车辆清洗消毒点等专业化运输条件，分别经公安、交通、环保部门审查批准后，由市道路运输管理机关发给道路危险货物运输经营许可证，方可承运。

停办危险货物运输的，应在三十天前向市道路运输管理机关提出书面报告，注销原领取的道路危险货物运输经营许可证。

第六条　企事业单位自备车辆，从事提取、运送本单位危险货物的，需持本单位申请

书和上级安全技术部门书面证明，向市道路运输管理机关申请，经公安、交通、环保部门[illegible]后，由市道路运输管理机关发给道路危险货物非营业运输许可证，方可运输。

第七条 设置供货危险货物运输过程中，临时存放危险品专用停车场地的，应向市道路运输管理机关提出书面申请，经公安、交通、环保部门审核批准，发给开业证明，再向工商行政管理部门申请领取营业执照，根据营业执照和开业证明，由市道路运输管理机关核发道路危险货物运输中转许可证后，方可开业。

停办危险货物临时存放业务的，应在三十天前向市道路运输管理机关提出书面报告，注销原领取的道路危险货物运输中转许可证。

第三章 托运

第八条 危险货物托运人应向具有道路危险货物运输经营许可证的单位或到市道路运输管理机关指定的危险货物运输业务受理站，办理托运危险货物运输的手续。

第九条 托运下列危险货物，应持有关证件：

(一)爆炸物品，应有市公安机关签发的爆炸物品运输证；

(二)一级毒害品(即剧毒品、烈性毒品)，应有市公安机关签发的剧毒物品运输证；

(三)放射性物品，应在市环保、公安、卫生等部门共同审查同意后，持有公安机关签发的放射性物品运输许可证和卫生部门签发的放射性物品剂量检查证明书或放射性同位素、空容器检查证明书；

(四)感染性物品，应分别有市卫生防疫或兽医卫生检疫部门签发的卫生检疫证明和消毒证明；

(五)麻醉药品、精神药品，托运人应在托运单的发货人记事栏内，分别加盖卫生部门的麻醉药品专用章或精神药品专用章；

(六)使用集装箱装运危险货物时，除持有上述证明外，还需要有商品检验部门签发的集装箱危险货物装箱证明书和港务监督部门的证明。

两种以上危险货物的性能有抵触的，必须分别托运。

第十条 托运未列入汽车运输危险货物品名表的其他危险货物，需持交通部统一印发的危险货物鉴定表，由上级主管部门审核签章，经市道路运输管理机关批准后，方可办理运输手续。

第十一条 托运爆炸品、一级毒害品、放射性物品和需要特殊防护的危险货物，托运人应指派懂得危险货物性能，有应急经验，熟悉业务的押运人员，负责运输的安全指导；危险货物运输作业人员，应服从押运人员的安全指导和应急安排。

运输作业人员和车辆需要的急救用品和特殊防护用品，由托运人提供。

第十二条 危险货物的包装、容器，应符合交通部《公路、水路危险货物包装基本要求和性能试验》规定，具有适合道路运输的规定强度和膨涨余量，且须坚固、完整，严密不漏，表面清洁。

对与国家标准不同的进口原包装危险货物，如包装完整无损，符合安全运输要求，应注明“进口原包装”字样，可按照包装运输。

未经清洗消毒处理的危险货物空容器，必须按原装危险货物办理托运；危险货物的空容器清洗消毒后，应经卫生、环保部门检测，并开具检疫、消毒合格的证明，方可按普通

货物运输。

包件外表面或集装箱的明显部位，应贴有与内装危险货物性质、分类一致的危险货物标志。

第四章　承运与交接

第十三条　承运人受理危险货物托运，须核对托运单所填写内容和要求及所提供的证件，及时勘察作业现场，检查包装情况，对包装破损或不符合包装要求的，不准承运。

第十四条　承运人起运前，应检查核实危险货物与托运单所列品名、数量是否相符，包装是否符合要求，并在运单上签章，证明托运单所列货物接收无误，同时签注装车时间。

货物送达目的，承运人应通知收货人验收。收货人经查验包装无破损，品名、数量与运单相符合，应在运单上签章，证明货物收到无误，并签注收货时间。

第十五条　承运人不得将危险货物转运给其他单位运输。

第十六条　抵达收货地点出现所运货物数量缺少或包装破损时，交接双方应做好记录。并由承运人签章确认属实。一式两份，双方各持一份记录。其余危险货物，收货人不得拒收。

因危险货物包装破损无法收货的，应由承运人指派配备必要防护用品的专人进行看管；对丢失的危险货物由承运人负责查找，并及时与当地有关部门联系处理。

在此期间因包装破损发生事故的，由承运方负责。

第五章　车辆与设备

第十七条　从事道路危险货物运输的车辆、设备和工属具，必须符合《汽车危险货物运输规则》(JT3130－88)的有关规定；营业性车辆应在道路运输营运证上加盖道路危险货物运输许可章；非营业性车辆须持有市道路运输管理机关核发的非营业性道路危险货物车辆运输证。

第十八条　从事危险货物运输的车辆，白天行车应在车辆的左前方悬挂危险品信号旗；夜晚行车应在车顶装置危险品标志灯。信号旗和标志灯由市道路运输管理机关会同公安机关发放，按有关规定安装。

第十九条　运输危险货物的车辆，须携带与危险货物性能相关的消防器材；装运爆炸品、易燃物品、有机过氧化物的车辆，其排气管须有隔热和熄灭火星装置；装运易燃液体的罐(槽)车，须有导除静电设施。

第二十条　各种车辆的驾驶室及各类客车(含公共电、汽车)，不准装运危险货物。

全挂货物列车、三轮机动车、摩托车、拖拉机、人力车、畜力车和其他特种车辆，不准装运爆炸品、一级氧化剂、有机过氧化物等危险货物。

自卸汽车只准装运散装二级非易燃的固体危险货物。

第六章　运输与装卸

第二十一条　从事危险货物运输的作业人员，应参加市交通、公安、劳动部门组织的危险货物运输知识、技术、业务知识和应急处理知识的联合培训。经考试合格后，由交

通、公安、劳动部门共同核发道路危险货物运输操作证，方能上岗作业。对从事易燃易爆化学物品作业的有关人员，还须进行消防知识的专业培训，经有关主管部门考试合格后，方可定岗位从事操作、管理。

第二十二条 危险货物作业区内，不准使用明火照明；不准吸烟、进食；装卸作业时必须轻装轻卸，防止翻滚、震动；作业人员应服从作业区安全管理人员的指挥、监督。

第二十三条 作业人员必须执行运输计划和配装规定，危险货物性能互相抵触或其消防、防护方法不同的，不能同车装运。

第二十四条 被毒害品、腐蚀品等危险货物污染的车辆、设备、工属具和场地，必须及时清洗消毒并经检验合格后，方可装运其他物资。在车厢内清扫出的残留物，应按环保部门指定地点妥善处理。

装运危险货物的专用车辆，严禁装运食用物品（含饲料）。

第二十五条 作业人员发现危险货物有下列情况之一，不准装车：

（一）所运的危险货物与托运单所列品名不符的；

（二）包装破损或不符合包装规定的；

（三）遇湿易燃物品已有水渍、雨淋痕迹的；

（四）不符合配装规定的；

（五）危险货物包装标志不清或无标志的。

第二十六条 运输危险货物的车辆，除作业人员外，严禁搭乘其他人员；作业人员在运输过程中，不准与危险货物处于同一车厢内。

第二十七条 装运由公安机关签证的危险货物的车辆，应按公安机关指定的路线、时间和车速行驶。每年六月十五日至八月三十一日为夏季作业期，在夏季作业期间每日十时至十八时停止装运易爆易燃物品和气体。

装运不燃气体和民用石装化油气，具有通风、防晒装置的，不受时间限制。

第二十八条 危险货物运输过程中，押运人员应经常检查危险货物的包装、捆扎情况、数量和车辆运转状况。发现货物丢失，应立即向当地公安、交通、环保、卫生部门报告并及时查找。

第二十九条 危险货物运输过程中发生的包装、容器破损，由承运部门整修，整修费用由责任方负担；因货物变质或包装损坏无法整修而影响运输时，应立即报请当地道路运输管理机关及有关部门妥善处理。

第三十条 运输危险货物过程中发生事故，作业人员必须及时组织抢救、维护事故现场，并立即向所在单位及当地交通、公安、劳动、环保、卫生部门报告。

第三十一条 运输危险货物的车辆发生故障时，如维修时间及程度危及货物安全的，应将危险货物转移到安全场地，并由专人看管，方可进行车辆维修。

第三十二条 运输危险货物的车辆在运输过程中停车或过夜，应到指定的危险货物专用停车场地停放。

第三十三条 本市承运危险货物的车辆需跨省、市运输的，应到所在区、县道路运输管理机关开具道路危险货物跨省、市运输行车路单，路单应在规定时期内使用。

外地危险货物运输车辆来津，应持车籍所在地县以上运输管理部门核发的道路危险货物跨省、市运输行车路单，到本市公安交通检查站验证登记后，取得本市公安机关签发

的危险货物通行证，方可在我市行政区域内通行；途径本市的，不准进入市区。

第七章　票据与统计

第三十四条　从事营业性危险货物运输的单位，应使用统一的托运单、行车路单等单证和危险货物专用结算凭证。

非营业性危险货物运输，应使用统一行车路单，并作为危险货物运输统计的依据。

第三十五条　从事危险货物运输的单位，应做好危险货物运输统计的原始记录，按期填写有关报表，经主管部门审核后，按时报送所在区、县道路运输管理机关。

市道路运输管理机关负责全市危险货物运输的统计汇总工作。

第八章　安全与防护

第三十六条　从事危险货物运输的单位，应负责运输作业人员的安全教育，建立健全岗位责任制和操作规程等规章制度，及时处理事故，并按期向市交通、公安、劳动、环保、卫生部门报送事故、案例报表。

第三十七条　生产和使用危险货物的单位，在新建、扩建厂房的设计中，应考虑为危险货物运输提供安全条件。

第三十八条　从事危险货物运输的单位，须配备必要的劳动防护用品和急救用品。

作业人员要穿戴相应的劳动防护用品，携带必需的急救用品上岗作业。

第三十九条　劳动防护用品使用后，要集中清洗，受一般毒害品和放射性物品污染的防护用品，要分别清洗消毒。

第四十条　从事危险货物运输的单位，要有专职医务人员负责对有关作业人员进行定期保健检查；并负责急救知识培训工作。

第九章　监督与处罚

第四十一条　道路运输管理机关的工作人员（简称运管人员），在执行检查危险货物运输、勘察事故现场、处罚违章等公务时，均应佩带运管人员标志，并出示《中华人民共和国交通部公路运输管理证》。

运管人员不得扣留装载爆炸品、易燃物品、一级氧化剂、有机过氧化物、一级毒害品和放射性物品等危险货物的车辆。

第四十二条　对违反本办法的单位，由道路运输管理机关进行批评教育，并可视情节予以处罚。

第四十三条　对无道路危险货物运输经营许可证、道路危险货物非营业运输许可证或道路危险货物运输中转许可证而从事危险货物运输及临时存放业务的单位，处三千元以上六千元以下（含六千元）罚款，并责令停止营业，没收全部非法收入；

对伪造、涂改、转让、出卖、借用道路危险货物运输经营许可证、道路危险货物非营业运输许可证或道路危险货物运输中转许可证的单位，处三千元以上六千元以下罚款，并收缴有关证件，没收全部非法收入；

对隐瞒事故不报告的单位，处三千元以上六千元以下罚款，并责令停业整顿。

第四十四条　对有下列违章行为之一的单位，处一千元以上三千元以下（含三千元）

款：

（一）营业性运输车辆的道路运输营运证未加盖道路危险货物运输许可章，非营业车辆无非营业性道路危险货物车辆运输证，从事危险货物运输的；

（二）运输或临时存放危险货物发生事故不立即报告、破坏现场的；

（三）各种车辆驾驶室及各类客车（含公共电、汽车），装运危险货物的；

（四）全挂货运列车、三轮机动车、摩托车、拖拉机、人力车、畜力车、自卸汽车和其他特种车辆，违反规定擅自装载危险货物的；

（五）运输毒害品、腐蚀品和放射性物品的车辆及其设备、工属具，未经清洗消毒、排除污染，装运其他物资的；

（六）危险货物的包装、容器，不符合《公路、水路危险货物包装基本要求和性能试验》规定，承运人受理运输的。

第四十五条 有下列违章行为之一的单位，处三百元以上五百元以下（含五百元）罚款：

（一）无有效证件或伪造、借用证件的，托运或承运需凭证件运输的危险货物的；

（二）托运未列入《汽车运输危险货物品名表》的危险货物，不履行《危险货物鉴定表》规定手续，或假报品名、隐瞒危险性的；

（三）应派人员随车押运，未派或委派不懂业务知识和急救处理知识的人员押运的；

（四）危险货物运输车辆无规定的消防器材、熄灭火星装置、导除静电设施的；

（五）从事危险货物运输的单位，不配备必要的劳动防护用品和急救用品，或对使用的劳动防护用品不进行清洗消毒的；

（六）从事危险货物运输的单位，对作业人员不按期进行保健检查的；

（七）不认真总结事故教训，连续两次发生同类型事故的。

第四十六条 对有下列违章行为之一的单位，处三百元以下（含三百元）罚款：

（一）承运人不按规定查验有关证件的；

（二）收货人发现危险货物数量缺少、包装破损不做记录或拒收其余危险货物的；

（三）运输危险货物的车辆，无危险品信号旗或标志灯的；

（四）委派无道路危险货物运输操作证的人员，从事危险货物作业的；

（五）不使用危险货物运输专用的托运单、行车路单等票据的。

第四十七条 违反本办法从事危险货物运输或违章作业的个人（含危险货物运输单位的主要负责人），道路运输管理机关可视情节处一百元以下（含一百元）罚款或扣留、吊销道路危险货物运输操作证。

第四十八条 对违反本办法的行为，由区、县道路运输管理机关做出处罚。

罚款金额在五十元以下，被处罚者没有异议的，可当场执行。

罚没收入一律按规定上缴财政，不得截留挪用。

第四十九条 运管人员必须依照本办法秉公执法。对超标罚款、越权处罚、索贿受贿的，由道路运输管理机关给予行政处分或提请司法机关依法处理。

第五十条 被处罚的单位或个人，对处罚不服的，可在十五日内向上级主管部门申请复议，也可按《中华人民共和国行政诉讼法》的规定，向人民法院起诉。逾期不起诉，又不履行处罚决定的，主管部门可向人民法院申请强制执行。

第十章　附则

第五十一条　本办法公布前，已经从事危险货物运输的单位，应自本办法颁布之日起三个月内，到市道路运输管理机关补办登记手续。

第五十二条　本办法由天津市交通局负责解释。

第五十三条　本办法自一九九一年九月一日起实行。

市人民政府关于发布《天津市剧毒物品安全管理办法》的通知

津政发[1984]197号　一九八四年十一月二十二日

各区、县人民政府，各委、局，各直属单位：

现将《天津市剧毒物品安全管理办法》予以发布，望遵照执行。

加强剧毒物品的管理，对保障人民生命安全至关重要。各地区、各部门应经常对生产、经销、储存、运输、使用剧毒物品的单位和个人，进行关于剧毒物品安全管理重要性的教育和科学知识的宣传，在公安部门的指导下，切实做好剧毒物品的安全管理工作。

天津市剧毒物品安全管理办法

第一章　总则

第一条　为加强对剧毒物品的管理，防止中毒、投毒事故的发生，保障人民生命的安全，维护安全治安，根据国务院批准的关于化工产品安全管理等有关规定，特制定本办法。

第二条　凡在天津市区域内生产、经销、购买、运输、储存、使用剧毒品的单位和个人，除法律另有规定的外，均应遵守本办法。

第三条　本办法所指剧毒品包括附表所列各项物品和经市公安局核定的其它剧毒物品。

第四条　公安机关是剧毒物品安全管理的主管部门。对生产、经销、购买、运输、储存、使用剧毒物品的单位和个人进行监督检查。

生产、经销、购买、运输、储存、使用剧毒物品的单位及其上级业务主管部门的保卫、安技组织，应在公安机关指导下，做好剧毒物品安全管理工作。

第二章　管理

第五条　生产、经销、购买、运输、储存、使用剧毒物品的单位和个人，须经上一级业务主管部门审核，向所在地公安分局、县公安局提出申请，由市公安局批准，分别发给《剧毒物品生产许可证》、《剧毒物品经销许可证》、《剧毒物品购买使用许可证》、《剧毒物品运输证》、《剧毒物品储存许可证》。

任何单位和个人未经许可不准生产、买卖、赠送、转让、持有和使用剧毒物品。

第六条　生产、经销、购买、运输、储存使用剧毒物品，必须执行岗位责任制、安全操作规程和安全管理制度，防止发生意外或丢失、被盗等事故。

第七条　生产、经销、购买、储存、使用剧毒物品的单位，变更单位名称，调换采购、保

管剧毒物品人员，应填写《变更申请表》，由所在地公安分局、县公安局核准，予以变更。增减剧毒物品种类数量时，须经上一级业务主管审核，向所在地公安分局、县公安局提出申请，由市公安局批准。

第八条 新建、改建、扩建生产、使用、储存剧毒物品的厂房、车间、仓库，必须符合《建筑设计防火规范》及有关规定，经公安、环保部门审核后方准动工。竣工后，须经公安、环保部门验收合格，方准投产使用。

不准在居民区新建、扩建剧毒物品工厂、车间、仓库；已设在居民区的，危害较大，污染严重的，要进行调整、改革、治理；治理不了的，应当限期迁出或责令停产。

第九条 剧毒物品必须包装牢固，注明"剧毒品"标志。生产剧毒物品的，必须随生产随入库，入库前，要对品种、数量、规格等逐项登记，储存时要分类存放。

生产剧毒物品的单位，未经公安机关许可，不准直接销售剧毒物品。

第十条 本市单位临时购买剧毒物品的，须持单位证明信，经所在地公安分局、县公安局审查批准，发给《剧毒物品临时购买证》，方准购买。

外地来津购买剧毒物品的，凭当地县以上公安机关开具的证明，到经销部门所在地公安分局、县公安局换取《剧毒物品临时购买证》，到经销部门购买。

第十一条 经销部门出售剧毒物品，必须凭购买单位或个人所持的《剧毒品购买使用许可证》或《剧毒物品临时购买证》，并应填写销售登记表。对持临时购买证购买的，应将临时购买证留存备查。

第十二条 国家计划调拨的剧毒物品，调出、调入单位凭调出、调入证件，向所在地公安分局、县公安局备案。

第十三条 运输剧毒物品，必须包装坚固，专人押运。运输工具应挂有标志，中途停车须有专人看守。

运输剧毒物品出、入天津区域时，须持《剧毒物品运输证》。

不准私自携带剧毒物品。不准在托运、邮寄的包裹内夹带剧毒物品。

铁路、水上、航空运输剧毒物品，依照铁道、交通、航空部门的规定办理。

第十四条 储存、领取、使用剧毒品，应严格执行登记制度，专人负责，随用随领，不准超量。

剧毒物品应设专库或专柜存放。性质相抵触的剧毒物品应分库、分室存放。剧毒物品仓库、储存室必须坚固、干燥、通风，符合防火、防毒、防盗等要求。

使用剧毒农药，要严格执行《农药安全使用规定》，应统一购买、统一保管、统一配制，集中或分户使用。

第十五条 失效的或者搁置不用的剧毒物品，不得私自处理，每年由公安机关协同环保部门监督销毁或由经销部门收购。

包装剧毒物品的容器，由物资回收部门定点收购，并须经彻底清洗消毒处理检测合格后，方能改作它用。

第十六条 剧毒物品必须由政治可靠，责任心强，并有一定专业知识的人管理。

发现剧毒物品丢失、被盗或发生投毒、中毒事故，须立即报告当地公安机关。

第三章 奖 惩

第十七条 对于认真执行本办法，并取得显著成绩的单位和个人，应予表彰和奖励。

第十八条 对违反本办法的单位主管人员和直接责任者，由公安机关依据《中华人民共和国治安管理处罚条例》予以处罚，并限期整改。逾期不改的，责令停止生产，停止使用，停止经销，进行整顿；拒不改进的，吊销许可证。对违反本规定构成犯罪的，依法追究刑事责任。

第四章 附则

第十九条 本办法由天津市公安局负责解释。

第二十条 本办法自一九八五年一月一日起施行。自施行之日起，一九六五年发布的《天津市剧毒物品管理办法(试行草案)》即行废止。

附：剧毒物品名称表(略)

剧毒物品名称表

一、氰化物类

品名	别名	品名	别名
氰化钾	氰酸钾里	氰化钙	
	山奶钾	氰氢酸	普鲁士兰
氰化钠	氰酸曹达		青配甲腈
	山奶钠	氰铜盐	氰化铜钠
氰化汞	二氰化汞		氰铜矾
	氰化高汞	氰熔体	氰盐熔合物
氰化铝		粹火盐	
氰化铜		溴化氰	
氰化钡		氰化汞钾	银氰化钾
氰化银钾		氰化铈	
氰化亚铜		硫氰酸乙酯	
氰化银		硫氰酸甲酯	
氰化钴		乙醇腈	
氰化锌		丙铜氰醇	
氰化碘	碘化氰	甲肼	异氰基甲烷
氰化亚金钾	亚金氰化钾	氯化氰	
氰化镉			

二、砷化物类

品名	别名	品名	别名
三氧化二砷	亚砷酸酐、信、信石	亚砷酸铅	
	信精、白砒	亚砷酸锌	
	红矾	砷酸铵	
	亚砒酸	砷酸钠	砒酸钠
	信华	焦砷酸	
五氧化二砷	五氧化砷	砷酸锌	
	砷酸	砷酸氢二钠	
	砷酸酐	砷酸钡	
三氯化砷	氯化砷	亚砷酸钡	
亚砷酸钠	亚砒酸钠	砷酸	正砷酸
亚砷酸钙	亚砒酸钙	亚神醋酸铜	巴黎绿
砷酸钙	砒酸钙	三氟化砷	
亚砷酸铜		五氟化砷	
砷酸铅	砒酸铅	三碘化砷	
五氧化二砷		三硒化二砷	

三、汞化物类

品名	别名	品名	别名
氯化汞	二氯化汞		碘化高汞
	升汞	氧化汞	红升汞
	氯化高汞		三仙丹
硝酸汞		乙酸汞	醋酸汞
砷酸汞		乙酸苯汞	醋酸苯汞
硫酸汞	硫酸高汞	氧氰化汞	
溴化汞	二溴化汞	氯化乙基汞	
	溴化高汞	二甲基汞	
碘化汞	二碘化汞	二乙基汞	

四、农药类

品名	别名	品名	别名
一六〇五	对硫磷		台锡斯通
福利多		苏化 203	硫特普
一〇五九	内吸磷		治螟灵
	地密通	久效磷	
三九一一	甲拌磷	谷硫磷	保棉磷
	西美托		谷赛昂
	赛美特	速灭磷	磷君
四〇四九	马拉硫磷	灭蚜净	
马拉松	马拉赛昂	磷胺	
敌死通	乙拌磷	治线磷	
丰索磷		一六〇〇	E600
益棉磷	乙基谷硫磷		对氧磷
保棉丰		八甲磷	施来顺
甲氟磷			(八甲基焦
威菌磷			磷酸酰胺)
特普	四乙基焦	吡唑磷	
	磷酸酯	塔崩	
胺吸磷		碳氯磷	碳氯特灵
硫环磷	棉胺磷	异狄氏剂	
	棉环磷	呋喃丹	碳呋喃
三硫磷			

五、生物硷类(只限纯品或原粉)

品名	别名	品名	别名
马钱子硷	白路新	毒芹硷	可尼因
乌头硷	附子精	毒偏豆硷	依邑林
士的宁	番木鳖硷	海洛因	二乙酰吗啡
钩吻硷		奎宁	
吗啡		箭毒	
可待因	甲基吗啡	秋水仙硷	
阿托品	颠茄硷	绿卢黎硷	赛丸丁
莨菪硷		盐酸可卡因	古柯硷
烟硷	尼古丁	吐根硷	

六、其它

品名	别名	品名	别名
氯化苦	硝基二氯甲烷	氯化铊	
		醋酸铊	
锇酸	四氧化锇	毒毛旋花素	毒毛旋花子
四乙基铅			
硫酸二甲脂		磷化锌	（零售鼠药除外）
		硒酸钠	
敌鼠	二苯基乙酰基	亚硒酸钠	
		斑蝥素	（只限粉）
氯化钡		氟乙酰胺	
硝酸钡		三氯化锑	
硫酸铊		氟化钠	
碳酸铊			

天津市交通局
天津市公安局文件

(1992)津交管字第10号

关于印发《天津市危险货物运输车辆装置、使用危险品标志灯、牌管理规定》的通知

五县交通局、各区、县公路(交通)运输管理处(所),市公安局有关处、各区、县公安交通警察支、大队:

根据天津市人民政府第36号政府令颁布的《天津市道路危险货物运输管理办法》有关规定,现将市交通局、公安局制订的《天津市危险货物运输车辆装置、使用危险品标志灯、牌管理规定》印发给你们,望遵照执行。

附:购置危险品标志灯、牌单格式

天津市交通局
天津市公安局
一九九二年七月七日

天津市危险货物运输车辆装置、使用危险品标志灯、眚管理规定

第一条 为加强我市道路危险货物运输管理,保障运输安全,根据《天津市道路危险货物运输管理办法》制定本规定。

第二条 凡在本市范围内,经市道路运输管理机关审查批准从事道路危险货物运输的车辆,均应装置《危险品》标志灯、牌。

第三条 危险品标灯,装置在车辆驾驶室外顶部中央处。夜间行车时,必须开启危险品标志灯(以路灯启闭时间为准)。

危险品标志牌,应悬挂在车辆尾部的右方,与车辆牌照相对应。

第四条 危险品标志灯、牌的制造要求、型号选用,应符合GB13392-92标准规定。

危险品标志灯壳为黄色塑料制成,边为黑色,字为黑体黑色。

危险品标志牌为黄色金属板材制造,字为黑体黑字。

第五条 装置、使用危险品标志灯、牌的运输车辆,不属于特种车辆。

第六条 经审查核准的危险货物运输车辆，持市道路运输管理机关、公安交通管理机关开具的危险品标志灯、牌购置单及有关证件（营业性车辆凭营运证，非营业性车辆凭车辆运输证）到市道路运输管理机关、公安交通管理机关指定的单位购置危险品标志灯、牌。任何单位和个人，均不得擅自生产或经营。

第七条 受市道路运输管理机关、公安交通管理机关共同委托销售危险品标志灯、牌的单位，应加强销售管理，严格执行销售规定，搞好登记注册、注销等工作。每月向市道路运输管理机关、公安交通管理机关报送销售登记报表。

第八条 危险品标志灯、牌不准转借、转让、挪用、倒卖、仿制和修改。破损或失效时，凭旧标志灯、牌到原购置单位维修或更新。丢失的，到市道路运输管理机关、公安交通管理机关备案。凭开具的购置单，重新办理购置手续。

第九条 从事道路危险货物运输的单位暂停运输期间，应及时交回运输证件，同时将危险标志灯、牌交回道路运输管理机关，办理停运手续。

第十条 道路运输管理机关、公安交通管理机关共同负责对装置、使用危险品标志灯、牌的车辆，进行监督检查。

第十一条 凡装置危险品标志灯、牌的车辆，必须按公安交通管理机关指定的时间、路线、时速行驶。装运爆炸、剧镇、放射性物品，还必须有公安交通管理机关核发的有关危险品通行证件。

第十二条 凡违反本规定中第八、九条的单位和个人，由道路运输管理机关依据《天津市道路危险货物运输管理办法》和有关运输管理规定予以处罚。

凡违反本规定中第十一条的单位和个人，由公安交通管理机关依据道路交通管理法规的有关规定予以处罚。

第十三条 本规定由天津市交通局、天津市公安局负责解释。

第十四条 本规定自公布之日起执行。

天津市危险废物转移联单实施细则

（天津市环境保护局2001年7月16日颁布）

第一条 为加强对危险废物转移的有效监督，根据《中华人民共和国固体废物污染环境防治法》、《天津市危险废物污染防治管理办法》、《危险废物转移联单管理办法》（国家环境保护总局第5号令）的有关规定，结合本市实际，制定本实施细则。

第二条 本细则适用于在本市辖区内从事危险废物转移活动的单位。将危险废物移入或移出本市的，按照国家有关规定执行。

第三条 天津市环境保护局对本市危险废物转移联单（以下简称联单）实施监督管理。天津市工业废物交换中心具体负责联单实施过程中的技术性、事务性工作。

第四条 危险废物产生单位应当在每年11月15日之前向所在地区、县环境保护局提交下一年度危险废物转移申请书（一式三份），区、县环境保护局接到申请书之日起10日内对其进行审核，签署意见后报天津市环境保护局，天津市环境保护局在每年年底前作出审批决定。

天津市环境保护局的审批决定以书面形式通知申请单位并抄送申请单位所在地区、县环境保护局。

危险废物转移申请书由天津市环境保护局统一制订。

第五条 危险废物产生单位不得擅自转移未经天津市环境保护局批准转移的危险废物。

第六条 联单的运做程序：

（一） 危险废物产生单位持批准的危险废物转移申请书到天津市环境保护局办理领取联单手续。

（二） 危险废物产生单位在每次转移危险废物时，应如实填写联单一式五份，逐联加盖企业公章，其中第5联自留，其余四联交给危险废物运输单位（以下简称"运输单位"），随危险废物转移运行。

（三） 运输单位在运输危险废物时，应按照危险废物产生单位所填联单内容逐项核实所运输的危险废物，核实后按照要求如实填写联单一式四份，并负责将联单随同危险废物交付接受单位。

联单填写内容与实际运输的危险废物不符的，运输单位有权拒绝运输。

（四） 危险废物接受单位（以下简称"接受单位"），在危险废物运到时，应按照联单填写内容逐项进行核实，核实后按照要求如实填写联单一式四份，逐联加盖企业公章。自留第4联，并负责将第1联交危险废物产生单位存档；第2联交运输单位存档；第3联交天津市环境保护局存档。

联单填写内容与实际运到的危险废物不符的，接受单位有权拒收。

第七条 联单由天津市环境保护局统一印制。

第八条 违反本办法有关规定的，由天津市环境保护局依据有关环境保护法律、法规、规章的规定予以处罚。

第九条 本办法由天津市环境保护局负责解释。

第十条 本办法自发布之日起施行。

天津市危险废物污染环境防治办法

(1999年12月15日天津市人民政府令第17号发布)

第一条 为加强危险废物的管理，防止危险废物的污染，保护和改善环境，保障人民身体健康，根据有关法律、法规，结合我市实际情况，制定本办法。

第二条 在本市行政区域内从事危险废物产生、收集、运输、贮存、利用和处置活动的，必须遵守本办法。

第三条 按照本办法管理的危险废物是指列入《国家危险废物名录》或者根据国家规定的危险废物鉴别标准和鉴别方法认定的具有危险特性的废物。

第四条 危险废物污染环境的防治，实行减少危险废物的产生、充分合理利用危险废物和无害化处理危险废物的原则。本市鼓励、支持综合利用资源，对危险废物进行充分回收与合理利用。建立危险废物交换机构和交换网络。

第五条 市环境保护行政主管部门负责全市危险废物污染环境防治工作的统一监督管理。各区、县环境保护行政主管部门负责本辖区内危险废物污染环境防治工作的监督管理。天津经济技术开发区、天津港保税区和天津新技术产业园区的危险废物污染环境防治工作，分别由本区管理委员会按照本办法组织实施。市和区、县人民政府有关部门依照各自职责对危险废物污染环境的防治实施监督管理。第六条 产生危险废物的单位，必须按照国家和本市污染源申报登记的有关规定到所在区、县环境保护行政主管部门进行申报登记。当所产生的危险废物的种类、数量、去向变化时，必须及时向原申报登记的环境保护行政主管部门办理变更申报登记手续。产生危险废物的新建项目应在投入试生产之日起一个月内进行申报登记。

第七条 产生、贮存、利用、处置危险废物的建设项目，必须遵守国家和本市建项目环境保护管理的有关规定，执行环境保护影响评价制度和防治危险废物污染的设施与主体工程同时设计、同时施工、同时投产使用的制度。对于所产生的危险废物无法处置的建设项目，不得批准建设。

第八条 市环境保护行政主管部门应当对全市危险废物集中处置设施、场

所进行统一规划和环境监督管理。危险废物集中处置设施、场所的建设，应当纳入我市城市基础设施的建设规划。产生危险废物的单位或个人将危险废物送入集中设施、场所进行处置的，应当缴纳处置费用并遵守有关管理规定。

第九条 从事收集、贮存、利用、处置危险废物经营活动的单位(含跨省、市从事危险物经营活动的单位)，应当向市环境保护行政主管部门申领危险废物经营许可证。

申领危险废物经营许可证必须提交下列材料：

(一)企业法人营业执照副本；

(二)危险废物经营许可证申请表；

(三)贮存、利用、处置设施的环境保护“三同时”竣工验收材料；

(四)收集、贮存、利用、处置危险废物能力的评价报告表。

市环境保护行政主管部门应当自受理之日起45日内，对申请材料进行审查，签署审查意见，并通知申请单位。

第十条 从事危险废物收集、贮存、利用、处置的单位，应具备与其经营活动相适应的技术、场地、设备和污染防治能力，并持有环境保护行政主管部门颁发的危险废物经营许可证。禁止无经营许可证或者不按照经营许可证的规定从事收集、贮存、利用、处置危险废物的经营活动。

第十一条 持危险废物经营许可证的单位所从事的经营活动与危险废物经营许可证规

定的范围和内容发生变化，应于3个月内向发证机关办理变更手续并领取申请表。危险废物经营许可证有效期为3年。在期满前停业或期满后不再从事该经营活动的，应向发证机关办理注销手续。有效期满后继续从事该经营活动的，应当在期满前60日提出延续申请。

第十二条 将危险废物从产生地运至利用、贮存和处置地点，产生、运输和接受危险废物的单位必须按照国家有关规定填写危险废物转移联单(以下简称联单)。

第十三条 接受危险废物的单位在验收危险废物时，若发现危险废物的名称、数量、特性、形态、包装方式与联单填写的内容不符，有权拒绝接收废物，并及时向市环境保护行政主管部门报告。

第十四条 产生、运输和接受危险废物的单位必须对自留存档的联单保存3年。市环境保护行政主管部门对某些联单提出延长保存年限的，产生、运输和接受危险废物的单位应当按照要求延期保存。

第十五条 禁止任何单位和个人从境外向本市进口、走私危险废物。

第十六条 将危险废物移入我市利用和处置的，必须经市环境保护行政主管部门许可后，持许可证明向移出地省级环境保护行政主管部门报告，经批准后，方可移入。将危险废物移出我市利用和处置的，必须经接受地省级环境保护行政主管部门许可后，持许可证明向市环境保护行政主管部门报告，经批准后，方可移出。

第十七条 危险废物必须按照国家规定进行处置，不按规定处置危险废物的单位，由所在区、县环境保护行政主管部门责令其限期改正。逾期不处置或者处置不符合国家有关规定的，由环境保护行政主管部门指定的具有处置能力和资格的单位代为处置，处置费用由产生危险废物的单位承担。

第十八条 直接从事收集、贮存、运输、利用和处置危险废物的人员，由市环境保护行政主管部门组织进行专业培训，经培训合格后，持合格证书方可从事该项工作。

第十九条 环境保护行政主管部门有权对管辖范围内危险废物的产生、收集、贮存、利用和处置活动进行现场检查、索取资料、采集样品。被检查单位必须如实反映情况，提供必要的资料和样品。检查部门和人员有义务为被检查单位保守技术秘密和业务秘密。

第二十条 在收集、运输、贮存、利用和处置危险废物过程中，发生污染事故或其他突发性污染事件时，有关单位和个人必须立即采取措施，消除或减轻污染危害，及时通知可能受到危害的单位和居民，并应于24小时内向所在区、县环境保护行政主管部门和有关部门报告，接受调查处理。

第二十一条 禁止向危险废物处置场所以外的区域倾倒、堆放、填埋或者排放危险废物。禁止利用渗坑、裂隙、溶洞或稀释等方法处理危险废物。禁止将危险废物与一般固体废物、城市生活垃圾及其他废物混合排放。

第二十二条 采取焚烧方式处理危险废物时，焚烧炉的设计及其污染物排放必须符合国家制定的规范和标准，防止对大气造成污染。采取填埋方式处置危险废物时，填埋场的建设必须符合国家制定的规范和标准，必须采取防止污染大气、水体和土壤等措施。

第二十三条 收集、贮存、利用和处置危险废物的设施和场所，必须按市环境保护行政主管部门的规定设置统一的危险废识别标志。

危险废物运输识别标志的申领和放置，按照危险货物和化学危险品运输管理的有关规定执行。

第二十四条 收集、运输、贮存危险废物，必须按危险废物特性进行分类包装。

危险废物产生者应当根据危险废物的性质、形态，选择安全的包装材料和包装方式。包装容器的外面必须有表示废物形态、性质的明显标志，并向运输者和接受者提供安全保护要求的文字说明。

第二十五条 运输危险废物时，委托、运输和装卸的单位或个人应当按照国家和本市有

关危险货物和化学危险品的管理规定执行。运输过程中应有防泄漏、防散落、防破损的措施。禁止使用载客的交通工具装运危险废物或者客货混装。

第二十六条 危险废物的贮存设施必须符合国家标准和有关规定，有防渗漏、防雨淋、防流失措施，并必须设置识别危险废物的明显标志。

第二十七条 收集、贮存、运输、利用、处置危险废物的场所、设施、设备和容器、包装物或其他物品转作他用时，必须经过消除污染的处理，并经环境保护监测部门监测，达到无害化标准，未达标准的严禁转作他用。

第二十八条 危险废物处置场所必须严格管理和维护，保证正常运行，防止环境污染事故的发生。对停止使用或决定关闭的危险废物贮存、利用、处置设施和场所，必须经环境监测部门监测，按照有关技术规范采取防止污染的措施，并经市环境保护行政主管部门批准后，方可停止使用或关闭。禁止任何单位或个人侵占、损坏危险废物贮存、利用、处置场所和设施。对堆放、填埋过危险废物的土地，必须采取植被覆盖等封闭措施，不能进行其他用途的开发利用。

第二十九条 违反本办法第十五条规定的，由市环境保护行政主管部门提出处理意见，按照《中华人民共和国固体废物污染环境防治法》的有关规定执行。

第三十条 违反本办法第二十一条第一、二款规定的，对经营性活动并有违法所得的处3万元以下罚款，无违法所得的处1万元以下罚款；对非经营性活动的，处1000元以下罚款。

第三十一条 违反本办法规定，有下列行为之一的，由市或区、县环境保护行政主管部门责令其限期改正，并处以1万元以下罚款：

(一)不按规定向环境保护行政主管部门申报登记危险废物，或者在申报登记时弄虚作假的；

(二)拒绝环境保护行政主管部门现场检查，或者在被检查时弄虚作假的。

第三十二条 违反本办法规定，有下列行为之一的，由市或区、县环境保护行政主管部门责令停止违法行为，限期改正，排除危害，并可以根据危害程度处以5万元以下罚款：

(一)将危险废物混入城市生活垃圾及其他非危险废物内的；

(二)将危险废物提供或者委托给无经营许可证的单位收集、贮存、利用、处置的；

(三)转移危险废物，不按照有关规定填写危险废物转移联单的；

(四)使用载客的交通工具装运危险废物或将危险废物与旅客在同一运输工具上混载的；

(五)危险废物产生者不处置其产生的危险废物或者不承担依法应当承担的处置费用的；

(六)将收集、贮存、运输、利用、处置危险废物的场所、设施、设备、容器包装物及其他物品未经消除污染处理转作他用的；

(七)收集、贮存、利用、处置危险废物的设施或者场所不设置危险废物识别标志的；

(八)擅自关闭、闲置或拆除危险废物污染环境防治场所、设施的。

第三十三条 无经营许可证或者不按照经营许可证规定从事收集、贮存、

利用、处置危险废物经营活动的，由市环境保护行政主管部门责令停止违法行为、没收违法所得，并可处违法所得一倍以下罚款。不按照经营许可证规定范围从事前款活动的，还可由发证机关吊销其经营许可证。

第三十四条 建设项目中需要配套建设的危险废物防治设施，未建成或未

经验收合格即投入生产或使用的，由审核该建设项目环境影响报告书的环境保护行政主管部门责令其停止生产或使用，可并处10万元以下罚款。

第三十五条 违反本办法第二十一条第一、二款以及第三十一条、第三十二条规定的行

为之一，造成危险废物污染环境事故的，由市环境保护行政主管部门处以 10 万元以下罚款。造成重大经济损失的，按照直接损失的 30%处以罚款，但最多不得超过 50 万元。对项目直接责任的主管人员和其他直接责任人员，由所在单位或者上级主管部门给予行政处分；构成犯罪的，依法追究刑事责任。

第三十六条 造成危险废物污染环境事故的单位和个人，有责任排除危害，并对遭受损害的单位或个人赔偿损失。

第三十七条 对监督管理部门的工作人员玩忽职守、滥用职权、徇私舞弊的，由所在单位或上级机关给予行政处分；构成犯罪的，依法追究刑事责任。

第三十八条 当事人对行政处罚决定不服的，可以依法申请行政复议或向人民法院提起诉讼。逾期不申请行政复议，也不向人民法院起诉，又不履行处罚决定的，由作出处罚决定的机关申请人民法院强制执行。

第三十九条 排入水体中的废水和排入大气中的废气污染防治以及放射性废物污染防治不适用本办法。

第四十条 本办法自发布之日起施行。

申报登记代码：

□□□□□□□□□□□□

天津市危险废物申报登记表

登记或变更年度：□□□□

申报单位详细名称：_____（盖章）

申报单位法人代码：□□□□□□□□-□

法人（或负责人）：_____；开业年份（N4）：_____年；

申报单位地址：

_____（区、县）_____乡、镇及街（道、路）_____号

邮政编码：□□□□□□　　电话号码：_____

传真号码：_____　　地区代码：□□□□□□

单位类别代码：□　　隶属关系码：□　　行业代码：□□□□

企业注册类型代码：□□□　　企业规模码：□

填表人：_____，单位环保负责人：_____，审核人：_____

填表日期：_____年_____月_____日

天津市环境保护局制

二〇〇一年九月

一、单位基本情况表

年总产值（N7.2）：_____万元，按1990年不变价年总产值：_____万元

利税金额：_____万元，年末生产经营用固定资产原值（N9.2）：_____万元

其中环保设施：_____万元，交纳排污费总额（N6.2）：_____万元

年末职工总数（N5）：_____人，其中专职环保人员（N2）_____人

年正常生产天数（N3）_____天，单位占地面积（N5.3）：_____万平米。

1. 主要产品年产量及与产生危险废物相关的原辅材料耗量(最多填三种)

产品名称（C10）：_____单位（C7）：_____年产量（N8.5）：_____

产品名称（C10）：_____单位（C7）：_____年产量（N8.5）：_____

产品名称（C10）：_____单位（C7）：_____年产量（N8.5）：_____

原辅材料名称（C10）：_____单位（C7）：_____年耗量（N8.5）：_____

原辅材料名称（C10）：_____单位（C7）：_____年耗量（N8.5）：_____

原辅材料名称（C10）：_____单位（C7）：_____年耗量（N8.5）：_____

2. 危险废物综合利用及处置、贮存情况申报:(本单位内)

综合利用设备名称 _____

处理能力（吨/台.天）_____ 设备数量 _____年运行天数 _____

综合利用危险废物名称[1]_____ 类别[2]_____ 数量 _____

危险废物综合利用产品产值：_____，危险废物综合利用产品利润：_____

处置、贮存设施名称 _____

处理能力（吨/台.天）_____ 设施数量 _____年运行天数_____

处置、贮存危险废物的名称_____ 类别_____ 数量 _____

3. 运输条件： ☐ 水路 ☐ 铁路 ☐ 公路

二、危险废物种类申报（如有多种废物可复印填写）

类别[2]：_____ 危险废物名称[1]：_____

废物来源：_____

含有危害组分名称	分析浓度（范围）
1）_____	_____
2）_____	_____
3）_____	_____
4）_____	_____

产生数量：每_____日_____公斤　　年产生量：_____公斤

物理状态：☐无分层：☐固体 ☐淤泥状 ☐液体

☐有分层：分层状况及比例 [3]（_____）

颜色：_____ 气味：_____ 酸碱度（pH）：_____

危害性：☐ 易燃性 ☐ 腐蚀性 ☐ 反应性 ☐ 易爆性 ☐ 其他____

现在的包装及贮存情况

_____

_____

现废物去向：（本企业内）

☐ 综合利用 ☐ 处理 ☐ 处置 ☐ 储存

现废物去向：（外单位）

☐ 综合利用 ☐ 处理 ☐ 处置 ☐ 储存 ☐排放

数量：_____单位名称_____

详情：_____

_____

三．危险废物产生工艺方框图：

四. 危险废物申报登记审核意见

主管部门审核意见：
主管部门（盖章） 负 责 人（盖章） 审核日期：　　年　月　日

区县环保局审核意见：
区县环保主管部门：（盖章） 负　　责　　人：（盖章） 审核日期：　　年　月　日

市环保局审核意见：
天津市环境保护局（盖章） 审核日期：　　年　月　日

申报登记代码：□□□□□□□□□□□□

单位坐标　：东经：□□□°□□′□□″

北纬：□□°□□′□□″

天津市固体废物调查表

调查年度：2002 年

单位详细名称：_____（盖章）

法人（或负责人）：_____开业年份（N4）：_____年

单位地址：

_____（区、县）_____乡、镇及街（道、路）_____号

邮政编码：□□□□□□　　电话号码：_____

传真号码：_____

单位类别代码：□　　隶属关系码：□　　行业代码：□□□□

企业注册类型代码：□□□　　企业规模码：□

填表人：_____单位环保负责人：_____审核人：_____

填表日期：_____年_____月_____日

天津市环境保护局制

二〇〇三年三月

一、 单位基本情况表

年总产值(N7.2)：_____万元，按1990年不变价年总产值：_____万元

利税金额：_____万元，年末生产经营用固定资产原值(N9.2)：_____万元

其中环保设施：_____万元，交纳排污费总额(N6.2)：_____万元

年末职工总数(N5)：_____人，其中专职环保人员(N2)_____人

年正常生产天数(N3)_____天，单位占地面积(N5.3)：_____万平米。

1. 主要产品年产量及与产生固体废物相关的原辅材料耗量(最多填三种)

产品名称(C10)：_____单位(C7)：_____年产量(N8.5)：_____

产品名称(C10)：_____单位(C7)：_____年产量(N8.5)：_____

产品名称(C10)：_____单位(C7)：_____年产量(N8.5)：_____

原辅材料名称(C10)：_____单位(C7)：_____年耗量(N8.5)：_____

原辅材料名称(C10)：_____单位(C7)：_____年耗量(N8.5)：_____

原辅材料名称(C10)：_____单位(C7)：_____年耗量(N8.5)：_____

2. 固体废物综合利用及处置、贮存情况：(本单位内)

综合利用设备名称 _____

处理能力(吨/台.天) _____设备数量 _____年运行天数 _____

综合利用固体废物名称[1]_____类别[2]_____数量 _____

固体废物综合利用产品产值：_____固体废物综合利用产品利润：_____

处置、贮存设施名称 _____

处理能力(吨/台.天) _____设施数量 _____年运行天数_____

处置、贮存固体废物的名称_____类别_____数量 _____

3. 运输条件： ☐ 水路 ☐ 铁路 ☐ 公路

二、 固体废物种类调查(如有多种废物可复印填写) 废物编号：

类别[2]：_____固体废物名称[1]：_____

废物来源：_____

含有危害组分名称	分析浓度(范围)
1) _____	_____
2) _____	_____
3) _____	_____
4) _____	_____

产生数量:每_____日_____公斤　　年产生量:_____吨

物理状态: ☐ 固态 ☐ 淤泥状 ☐ 液态

☐ 有分层状态及比例[3]:(_____

_____)

颜色: _____ 气味: _____ 酸碱度(pH): _____

危害性: ☐ 易燃性 ☐ 腐蚀性 ☐ 反应性 ☐ 易爆性 ☐ 其他 _____

现在的包装及贮存情况:

_____

_____

现废物去向:(本企业内)

☐ 综合利用 ☐ 处理 ☐ 处置 ☐ 储存

现废物去向:(外单位)

☐ 综合利用 ☐ 处理 ☐ 处置 ☐ 储存 ☐ 排放

数量: _____单位名称 _____

详情: _____

_____

可利用固体废物情况：

一、类别[2]：_____固体废物名称[1]_____

利用数量：每_____日_____公斤　年利用量：_____吨

可利用成分_____含量要求[4]：_____需严格控制的杂质[5]：_____

可利用废物状态：□ 固态 □ 液态 □ 淤泥状

可利用废物所含杂质要求：_____

有无运输能力：有□ 无□ 车辆要求：_____

有无贮存条件：有□ 无□ 贮存设备名称：_____

最大贮存能力：_____吨(个)有无标识：　有□　无□

目前是否利用其他公司废物：　是□　否□

所利用废物情况：_____

二、类别[2]：_____固体废物名称[1]_____

利用数量：每_____日_____公斤　年利用量：_____吨

可利用成分_____含量要求[4]：_____需严格控制的杂质[5]：_____

可利用废物状态：□ 固态 □ 液态 □ 淤泥状

可利用废物所含杂质要求：_____

有无运输能力：有□ 无□ 车辆要求：_____

有无贮存条件：有□ 无□ 贮存设备名称：_____

最大贮存能力：_____吨(个)有无标识：　有□　无□

目前是否利用其他公司废物：　是□　否□

所利用废物情况：_____

危险废物转移申请书

申请单位名称：_____（盖章）

申请单位地址：_____

联系电话：_____邮政编码：_____

联 系 人：_____负 责 人：_____

申请日期：_____联单有效期：_____

天津市环境保护局制

一、申请单位产生危险废物情况：

危险废物名称	类别	数量（公斤/年）	形态	有害成分含量	运输包装方式容量

二、拟送危险废物接收单位情况：

拟送危险废物接收单位名称：_____

拟送危险废物类别、名称：_____

提交接收单位危险废物经营许可证复印件，做为申请附件。

拟送危险废物接收单位名称：_____

拟送危险废物类别、名称：_____

提交接收单位危险废物经营许可证复印件，做为申请附件。

拟送危险废物接收单位名称：_____

拟送危险废物类别、名称：_____

提交接收单位危险废物经营许可证复印件，做为申请附件。

三、市、区（县）环保局审核意见：

1. 区、县环保局审核意见：

（盖　章） 年　月　日

2. 天津市环境保护局审批意见：

（盖　章） 年　月　日

注：1. 本申请书一式三份，认真填写；

2. 危险废物名称、类别须按《国家危险废物名录》填写；

3. 危险废物形态为：固态、液态、半固态；

天津市危险废物经营许可证管理办法

（天津市环保局2001年7月16日颁布）

第一条 为了加强对我市危险废物的收集、贮存、利用、处置活动的管理，防止危险废物污染环境，根据《中华人民共和国固体废物污染环境防治法》和《天津市危险废物污染环境防治办法》的有关规定，结合本市实际，制定本办法。

第二条 在本市行政区域内从事收集、贮存、利用、处置危险废物经营活动的单位，必须遵守本办法。

第三条 天津市环境保护局对本市危险废物经营许可证（以下简称许可证）实施统一监督管理。

第四条 从事收集、贮存、利用、处置本市行政区域内的危险废物经营活动的单位，必须到天津市环境保护局申请许可证。

第五条 申请许可证的单位，应当是依法成立具有法人资格的企业，并具备与其申请经营项目相适应的下列条件：

（一） 收集、贮存、利用、处置危险废物的资金、场所、技术、设施；

（二） 专业技术人员；

（三） 污染防治能力；

（四） 预防和处理经营活动中发生的污染事故和其他突发性事件的能力。

第六条 申请许可证的程序：

（一）、申请许可证的单位应当向天津市环境保护局领取并填报许可证申请表（一式二份），并提交下列材料（一式二份）：

1、 企业法人营业执照副本（复印件）；

2、 贮存、利用、处置设施的建设项目环境保护验收材料。

3、 申请单位委托具有环境风险评估资质的单位出具的收集、贮存、利用、处置危险废物活动环境风险评估报告书（表）。

（二）、天津市环境保护局在收到申请材料之日起45日内做出审批决定，对合格的单位颁发许可证。

许可证的有效期为3年。

天津市环境保护局将对持有许可证单位进行年度审核。

第七条 持有许可证的单位经营危险废物的类别和数量发生变更的，应于3个月内向天津市环境保护局办理变更手续。

天津市环境保护局接到持证单位变更申请之日起45日内对变更申请做出审批决定；变更申请被批准的，由天津市环境保护局收回原许可证，颁发变更后的许可证。
变更后的许可证有效期不超过原许可证的截止日期。

持有许可证的单位改变经营方式、经营场所的，应当按本办法第六条的规定申请领取新的许可证。

第八条 持有许可证的单位关闭、停产、停业、转产、合并的，应当在停止经营活动6个月之前向天津市环境保护局提交终止经营报告，终止经营报告应当包括防止危险废物流失、防止对经营设施所在地环境造成污染、防止无关人员进入经营设施的计划、措施和资金安排及终止经营活动的时间。并在停止经营活动之日起7日内，将许可证交回天津市环境保护局。

第九条 持有许可证的单位必须建立危险废物经营情况记录，载明每日收集、贮存、利用、处置危险废物的类别、数量、危险废物的最终去向、有无事故或其他异常情况等。

第十条 持有许可证的单位必须在每年三月前向天津市环境保护局提交上一年度危险废物经营活动年度报表，同时抄报经营设施所在地区、县环境保护局。

第十一条 持有许可证的单位在许可证有效期满后继续从事危险废物经营活动的，必须在许可证有效期满60日前，按照本办法第六条规定申请领取新的许可证。

第十二条 从事收集、贮存、利用、处置危险废物的人员，由天津市环境保护局组织专业培训，持合格证书方可从事该项工作。

第十三条 市、区、县环境保护局有权对管辖范围内危险废物经营单位进行现场检查。被检查单位必须如实反映情况，并提供必要的资料和样品。检查部门和人员有义务为被检查单位保守技术秘密和业务秘密。

第十四条 禁止伪造、转让、出租、出售、出借、质押许可证。

第十五条 违反本办法，有下列行为之一的，由天津市环境保护局责令停止违法行为，限期改正，并按有关规定没收违法所得、处以罚款、吊销许可证：

（一） 无经营许可证从事收集、贮存、利用、处置危险废物经营活动的；

（二） 在申请经营许可证过程中弄虚作假的；

（三） 从事与经营许可证内容不符的经营活动的；

（四） 违反本办法第七条的规定，变更危险废物经营类别和数量，未提出申请的，或改变经营方式、经营场所未按本办法领取新的许可证的；

（五） 违反本办法第八条的规定，从事收集、贮存、利用、处置活动的单位停止经营活动而未按规定的时间事先报告的，或未在规定时间内交回许可证的；

（六） 违反本办法第九条规定，未具备危险废物经营情况记录或未按要求载明规定事项的；

（七） 违反本办法第十条规定，未在规定的时间内提交危险废物经营活动年度报表的；

（八） 违反本办法第十一条规定，在许可证有效期满后未领取新的许可证，仍从事经营活动的；

（九） 违反本办法第十三条规定，拒绝接受市、区(县)环境保护局现场检查，或者在被检查时弄虚作假的。

（十） 违反本办法第十四条规定，伪造、转让、出租、出借、出售、质押许可证的；

第十六条 本办法中下列用语含义：

（一）收集：是指把分散产生的危险废物从产生地集中到贮存、处置或利用场所的全过程或某一阶段的活动。

（二）贮存：在危险废物 被处置或利用前，将其放置在符合环境保护规定要求的场所或设施中的活动。

（三）利用：是指把危险废物直接或经过加工，部分或全部转化为原料、产品的活动。包括以向社会提供能源为主要目的，并且以危险废物为燃料的经营活动。

（四）处置：是指将固体废物焚烧和其它改变固体废物的物理、化学、生物特性的方法，达到减少已产生的固体废物数量、缩小固体废物体积、减少或者消除其危险成分的活动，或者将固体废物最终置于符合环境保护规定要求的场所或者设施并不在回取的活动。

第十七条 本办法由天津市环境保护局负责解释。

第十八条 本办法自颁布之日起施行。

危险废物经营许可证
申请表

申请单位：

申请日期：　　年　　月　　日

申请单位情况：

单位名称（中文）：_____

单位名称（英文）：_____盖章：_____

地址：_____

_____

公司类型：□外资 □合资 □国有 □乡镇 □集体 □私营

注册资金：_____

资金组成：_____

_____

_____

固定资产投资：_____

企业法人：_____电话：_____

邮政编码：_____传真：_____

员工状况：

领导人员（人）	高级工程师（人）	工程师（人）	技术人员（人）	操作工（人）

地表水及地下水功能及监测本底：

厂房面积：

总面积（m^2）	仓库（m^2）	填埋场（m^2）	焚烧厂（m^2）	预处理厂（m^2）	综合利用厂（m^2）	车库（m^2）

厂区平面图（标明功能区划分）：

周围居民状况及周边土地使用状况：

申请表内容

（一）申请经营的危险废物的特性分析：

废物名称	类别	物理性质	成分比例	化学性质	危险特性	鉴别方法	鉴别标准

（二）危险废物包装、运输计划：

申请许可证单位应提供危险废物标签及危险废物运输车辆证明。

运输车辆	废物名称	类别	废物形态	危险特性	包装方式	预计批次
运输车辆	废物名称	类别	废物形态	危险特性	包装方式	预计批次

（三）危险废物利用工艺流程，利用后残余物的处理方法：

废物名称	类别	废物形态	成分比例

危险废物利用工艺流程：

利用后残余物

成分比例	形态	危险特性	收集方式	处理方法

（四）危险废物贮存仓库的评估

许可证申请单位应提供贮存仓库（除环保局外）的其他管理部门的审批报告

仓库名称	仓库面积	仓库标准
仓库所存废物种类		
废物名称	类别	危险特性
配套设施		

（五）危险废物预处理工艺

预处理所能处理废物。

预处理工艺流程：
所能处理废物名称、类别、废物形态、危险特性：

（六）危险废物处置工艺

处置设施所能处理废物

处置工艺流程：
所能处置废物名称、类别、废物形态、危险特性：

（七）污染防治设施：

（八）防止经营活动中发生突发性事件的方案及必备的设备和材料：

APPENDIX C

APPLICATIONS, MANUFACTURING INFORMATION, AND TECHNICAL SPECIFICATION FOR FIELD MONITORING EQUIPMENT

Ambient Air Monitoring Equipments

Parameter	Manufacturer	Model	Technical Specifications																			Instrument Feature Availability
			Analytical Method	Measurement Range	Detection Limit	Zero Drift	Span Drift	Precision	Accuracy	Response Time	Sample Flow Rate	Analog Output	Serial Output	Power	Computer Requirements	Environmental Temperature	Datalogging	Dimensions	Weight	Note	Accessories	Auto Aero/Span Check or Adjustment
Ambient Air Monitoring																						
NO/NO2/ NOX	**API**	200A	Chemiluminescences	0 to 50 ppb, 0 to 20,000 ppb	0.4 ppb	<0.5 ppb of reading/ 24 hours, < 1ppb reading/ 7 days	<0.5% of reading/ 24 hours, < 1% reading/ 7 days	0.5% of reading	-	-	-	10V, 5V, 1V, 100mV, selectable	RS-232 port	115V	-	-	-	177.8 mm x 431.8 mm x 596.9 mm (7" x 17" x 23.5")	20.9 kg (46 lbs)	Independent parameter ranges	-	Continuous auto-zero and automantic compensation for temperature, pressure, and flow rate.
SO2	**API**	100A	Flourescence	1 to 50 ppb, 0 to 20,000 ppb	0.4 ppb	<0.5 ppb of reading/ 24 hours, < 1ppb reading/ 7 days	<0.5% of reading/ 24 hours, < 1% reading/ 7 days	0.5% of reading	-	-	-	Bipolar, 10V, 5V, 1V, 100mV, selectable	RS-232 port	115V	-	-	Up to 8,000 records, date and time stamped	177.8 mm x 431.8 mm x 596.9 mm (7" x 17" x 23.5")	20.4 kg (45 lbs)	A hydrocarbon "kicker" and advanced optical design prevent inaccuracies due to interferents	-	-
Ozone	**API**	400A	UV Absorption	0 to 100 ppb, 0 to 10 ppm	<0.6 ppb	<0.5 ppb of reading/ 24 hours, < 1ppb reading/ 7 days	< 1% reading/ 7 days	0.5% of reading above 50 ppb	-	-	-	10V, 5V, 1V, 100mV, selectable	RS-232 port	115V	-	-	Up to 8,000 records, date and time stamped	177.8 mm x 431.8 mm x 596.9 mm (7" x 17" x 23.5")	16.8 kg (37 lbs)	Microprocessor control produces unbaised true ozone measurement	-	IZS ozone generator eliminates time-consuming external calibration for many applications
articulate	**Thermo Andersen**	DataRam (2000)	-	0.1 to 999.99 μg/m3 (0.1 μg/m3 resolution), 1 to 39.99 mg/m3 (0.01 mg/m3 resolution), 40 to 399.99 mg/m3 (0.1 mg/m3 resolution)	0.1 to 10 μm particle size range of maximum response	-	-	-	±5% of reading ± precision	-	1.7 to 2.3 l/m	Sealed lead-acid battery, 24 hour operation, or AC operation with adapter	RS-232 port	-	-	-	Up to 10,000 records, with average, minimum, and maximum concentrations for each point	5.28" x 7.25" x 13.63"	5.3 kg (11.7 lbs)	For airborne dust, smoke, mists, haze and fumes	Respirable Cyclone Precollector, Isokinetic Sampling Probe, Temperature Conditioning Heater, Omnidirectional Sampling Inlet, PM-10 Inlet Head (PM-10 or PM-2.5)	-
Particulate	**Thermo Andersen**	DataRam 4 (4000)	Spectral nephelometry	0.0001 to 400 mg/m3	0.08 to 10 μm particle size range of maximum response	-	-	±1% of reading or ± 0.001 mg/m3, whichever is greater (1-second averaging), ±0.3% of reading or ± 0.0003 mg/m3, whichever is greater (10-second averaging)	±2% of reading ± precision	1 measurement per second	1 to 3 l/m (accuracy: 0.05 l/min, adjustability: 0.1 l/min)	0 to 5V and 4 to 20mA, with selectable full scale ranges between 0.1 and 400 mg/m3	RS-232/RS port	Internal sealed lead-acid rechargeable battery (24 hr), AC line 100-250V, 50-60 Hz, optional solar power system (Model DR-SOL)	IBM compatible PC, Windows 95 or higher, 8 MB memory or more	14°F to 122°F (-10°C to 50°C), 10 to 95% relative humidity, noncondensing	Up to 50,000 data points in up to 99 data groups	134.1 mm x 184.1 mm x 346.2 mm (5.28" x 7.25" x 13.63")	5.3 kg (11.7 lbs)	For real-time concentration and median partical size of airborne dust, smoke, mist, and fumes. Air tempurature (5°F to 140°F [-15°C to 60°C]; accuracy: 0.05°C) and relative humidity (0 to 100% [accuracy 2%, noncondensing]) are also displayed	Respirable Cyclone Precollector, Isokinetic Sampling Probe, Temperature Conditioning Heater, Omnidirectional Sampling Inlet	Programmable zeroing periods (1 to 168 hrs)

Confined Space Entry Equipments

Parameter	Manufacturer	Model	Technical Specifications																
			Analytical Method	Measurement Range	Detection Limit	Accuracy	Response Time	Sample Flow Rate	Analog Output	Power	Computer Requirements	Environmental Temperature	Datalogging	Dimensions	Weight	Note	Accessories	Warranty	Resolution
Confined Space Entry																			
O2, CO, H2S, and hydrocarbons	Thermo Gastech	GT201 (hydrocarbons and O2) and GT402 (all four gases)	-	Hydrocarbons - 0 to 100% LEL in 1% increments, 0 to 10,000 ppm in 20 ppm increments; O2 - 0 to 30% vol in 0.1% increments; CO - 0 to 300 ppm in 1 ppm increments; H2S - 0 to 200 ppm in 1 ppm increments	-	LEL - ±5% of reading; O2 - ±0.5% vol; CO, H2S - ±10% of full scale	90% in 30 seconds	-	-	4 NICd batteries, 10 hours operation	-	-4°F to 113°F (-20°C to 45°C)	Built-in datalogging that is downloadable to PC or printer	152.4 mm x 127mm x 254 mm (6" x 5" x 10")	2.3 kg (5 lbs)	Internal pump meets federal regulations for pre-testing confined spaces and other remote areas. Contains two-level alarm system with both audio and visual signals.	-	-	-
O2, CO, H2S,and combustible gases	Industrial Scientific TMX412	TMX 412	-	Combustible gases - 0 to 100% LEL in 1% increments, O2 - 0 to 30% vol in 0.1% increments; CO - 0 to 999 ppm in 1 ppm increments; H2S - 0 to 999 ppm in 1 ppm increments; -Methane – 0 to 5% of volume in 0.1% increments; Chlorine, Chlorine Dioxide, Nitrogen Dioxide, Sulfur Dioxide –0.2 to 99.9 ppm in 0.1 ppm increments	-	-	-	-	-	Rechargeable Ni-Cad Battery Pack (10 hours typical), Replaceable Cell Lithium Battery Pack (18 hours typical), Replaceable 9-volt Alkaline Battery Pack (11 hours typical)	-	(-4oF to 122oF (-20oC to 50oC))	On-board datalogging with a real-time clock calulates and records STEL and TWA readings, with a storage capacity of up to 110 hours	120.65 mm x69.85 mm x 50.8 mm (4.75" x 2.75" x 2")	26 oz	Unit also has a audio and visual alarms. It displays instaneous readings on the LCD display). RFI protected. One-button auto calibration. Combustible Gases/Methane - Catalytic Diffusion Oxygen and Toxic Gases - Electrochemical	A motorized sampling is standard with the rental unit however datalogging software and cable and a vibrating alarm	-	-
	RAE Systems QRAE	QRAE Four-gas	-	Combustible gases - 0 to 500 ppm, O2 - 0 to 30%; CO - 0 to 500 ppm; H2S - 0 to 100 ppm	-	-	15-30 seconds depending on the gas (Instantaneous values: Oxygen as % by vol, Combustible gas as % of lower explosion limit (LEL), Toxic gases as parts per million	200-300 cc /min, user selectable (QRAE) Plus), 150 cc/min (QRAE)	-	Lithium -Ion battery pack, 20 hours operation	-	(-4° to 113°F)	16,000 points (64 hours, 5 channels at one minute intervals) down load to PC with serial number of unit, user ID, site number, calibration date (1-3,600 seconds, programmable)	45.72 mm x 76.2 mm x 114.3 mm (1.8" x 3.0" x 4.5")	15 oz	Units are rugged, easy to use, small, lightweight and highly water resistant.1 2 line, 16 digit LCD with LED back light automatically in dim light or alarm condition. High and low values for all gases. STEL & TWA values of toxic gases. Date, time, elapsed time, temperature, LEL scale. LEL scale, using correction factors	A built in sample draw pump,audible and visual alarms, belt clip. RFI protected	Instrument - 2 years /Pump - 1 year	-
O2, CO, H2S,and combustible gases	RAE Systems MultiRAE Four-gas Monitor with PID	MultiRAE	-	VOCs 0 to 2000 ppm; O2 0 to 30%; Combustible gases 0 to 100% LEL; Carbon Monoxide 0 to 500 ppm; 0 to 100 ppm	-	-	10-30 seconds, gas dependent	150 cc/min	-	-	-	-	20,000 points (64 hours, 5 channels at one minute intervals) Download to PC with unit serial number, user ID, site number, calibration date	48.26 mm x 76.2 mm x 118.11 mm (1.9" x 3.0" x 4.65")	16 oz	It combines a sensative four-gas monitor with a photoionization detector that measures volatile organic compounds in low ppm, including benzene, butadiene, trichloroethylene and vinyl chloride. VOC monitor provides continous display and alarms for exact airborne VOC levles. Alarms can be set for Short Term Exposure Levels (STEL), Time Weighted Average (TWA), Peaks and minimums	Rents with software, charger, download, cable, sample probe, spare alkaline battery pack, filter, tubing, case and operating manual	-	VOCs 0.1ppm to 200 ppm and 1ppm at 200 to 20000 ppm; O2 0.1 %; Combustible gases 1%; Carbon Monoxide 1 ppm; Hydrogen sulfide 1 ppm
O2, combustible gases	Crowcon Triple Plus +	Triple Plus	-	Combustible gases 0 to 100 % LEL (alarm at 20% LEL), O2 0 to 25% (19% and 23%), 0-50ppm hydrogen sulfide, 0-500ppm carbon monoxide	-	-	Methane (20 seconds), O2 (10 seconds), Typical toxic gases (20 seconds)	-	-	Sealed lead acid rechargeable battery	Windows software	-4°F to 122°F (-20°C to 50°C)	Adustible sample rate 100 hours @ one minute sample rate (max 6000 data points per channel. logging of events, user and site.	6.8 in.(L) x 4.65 in.(W) x 2.9 in.(H)	2.0 lbs. (900g)	3 per channel, Instantaneous alarm and/or TWA alarms (TLV and STEL)/ Its loud and clear alarms - ideal choice in harsh environment	Rents with software, accessories pouch, charger,/interface dock, probe assembly, sample line, carry strap, Interface cable, manuals and carrying case.	-	-
Combustibel gases and vapors	MSA Model 2A Explosimeter	Model 2A	-	0 to 100% of LEL	-	-	-	-	-	6 standard "D" dry carbon-zinc cells Approximately 12 hours continuous operation	-	-	-	12.25" x 8.5" x 5.25" (311.15mm x 215.9mm x 133.35mm)	4 lbs	Concentrations in the explosive range are indicated by full-scale deflection of the meter pointer, and concentrations above LEL can be diluted with air so that actual gas concentrations are easily calculated. An illuminated meter dial reads gas concentrations from zero to 100 percent	MSA Model 2A rents with an aspirator bulb (attached to unit), 5-foot sample hose, fresh batteries, shoulder strap, operating manual and carrying case	-	-
Combustible Gas, Oxygen, Carbon Monoxide, Hydrogen Sulfide	MSA ORION MULTIGAS DETECTOR	Orion Multigas Detector	Combustible Gas (Catalytic),Oxygen (Electrochemical), Carbon Monoxide (Electrochemical), Hydrogen Sulfide (Electrochemical)	Combustible Gas (0 to 100% LEL),Oxygen (0 to 25%), Carbon Monoxide (0 to 1,000 ppm), Hydrogen Sulfide (200 ppm)	-	-	Combustible Gas (30 seconds),Oxygen (30 seconds), Carbon Monoxide (30 seconds), Hydrogen Sulfide (40 seconds)	-	-	NiMH battery pack, recharges in 2 to 4 hours, 16 hours continuous operation in pump mode, 20 hours continuous operation in non-pump mode	-	0 to 40C normal, -20 to +50C extended	MSA FiveStar Link software for easy data transfer and manipulation, graphing capability lets you view all gases simultaneously or one at a time. The software also has a zoom feature that can expand any portion of a single-gas graph to focus on activity in more detail.	-	-	-	rents with a battery charger, 5-foot sampling line and Water Stop sampling probe, rubber boot, shoulder strap, operating manual and carrying case. MSA FiveStar Link software package is also available on request.	-	Combustible Gas (1%),Oxygen (0.1%), Carbon Monoxide (1 ppm), Hydrogen Sulfide (1 ppm)
Combustible Gases, Oxygen, Carbon Monoxide, Hydrogen, Sulphide	MSA	Watchman Multi-Gas Monitor	-	Combustible Gas (0 to 100% LEL),Oxygen (0 to 25%), Carbon Monoxide (0 to 1,000 ppm), Hydrogen Sulfide (50 ppm)	-	-	Combustible Gas (12 seconds),Oxygen (15 seconds), Carbon Monoxide (25 seconds), Hydrogen Sulfide (20 seconds)	-	-	Integral, rechargeable NICd battery pack 10 to 15 hrs continuous operation	-	-	The data tagging capability lets the user "tag" ten characters of information to a specific sample, for download to a PC	-	7.5 lbs	Watchman warns against the presence of combustible gases and vapors and atmospheres rich or deficient in oxygen with plenty of reliable safety features. No matter which display is showing, the alarm sounds automatically if an alarm condition is reached. An internal horn activates and two bright red warning lights flash. If combustible gas levels reach 100 percent of the lower explosive limit (LEL), MSA's exclusive Lock alarm Circuit will activate and lock the alarm on. The user must move into fresh air in order to turn off the unit and the alarm	A built-in pump draws a sample from an immediate area, or from confined spaces when used with the remote sampling line and probe. MSA Watchman Multigas Monitor rents with battery charger, water trap assembly, 5-foot sampling line, sampling probe, operating manual and carrying case. A software package consisting of MSA Link software, data docking module and manual, is available on request	-	Combustible Gas (1%),Oxygen (0.1%), Carbon Monoxide (1 ppm), Hydrogen Sulfide (1 ppm)
VOCs	RAE Systems	Mini Rae	-	0 to 999 ppm / 100 to 10,000 ppm	-	0 to 999 ppm (plus/minus or 10% of reading <2000 ppm) / 100 to 10,000 ppm (plus/minus or 20% of reading >2000 ppm. Calibrated to 100 ppm	0 to 999 ppm (3 seconds) / 100 to 10,000 ppm (3 seconds)	Internal integrated flow rate 400 cc/minute, Sample from 100' horizontally or vertically	-	Rechargeable, field changeable NiMH battery pack, 10 hours operation	-	-	15,000 points with time/date, header information Datalogging and custom software.	8.2" x 3" x 2" (50.8mm x 76.2mm x208.28mm)	19.5 oz	With built-in correction factors for more than 100 chemicals, the MiniRAE 2000 provides excellent all around sensitivity to most VOCs, down to 0.1 ppm. Selectable survey and hygiene modes permit the user to set appropriate alarm thresholds for STEL, TWA and lowhigh level peak values.Smallest handheld VOC monitor	MINIRAE 2000 PID rents with download cable, zero filter, probe tip, hydrophobic filter, charger, alkaline battery adapter, case and operating manual	-	0 to 999ppm (0.1 ppm) and 100 to 10,000 (1ppm)
Organics and inorganics species that can be ionized by the 10.2 UV lamp	Process Analyzer DL102	DL102	-	0.1 to 30,000	-	-	<1 second to 90% response	-	RS232	115V, 60 HZ for recharging battery (Nickel metal hydride)	-	5°C to 40°C, to 0 to 95% RH (non-condensing)	Includes a LCD digital display, datalogging for more than 7000 points.	8" L x 3" W x 2.25" D (203.2mm x 76.2mm x 57.5mm)	1.9 lbs (0.86 kg)	Duraclean PID, simple push-button sensitivity control). It has a built in library of sensitivities can handle more than 200 compound. Alphanumeric display for compound, sample point, mode.	The equipment is rents with one snap-on module (10.2 eV lamp), hand strap with belt clip, operator's manual, and hydride battery.	-	-
Thermo Environmental 580B	Thermo Environmental	580 B	Photoinization	Autoranging 0 to 200 ppm with resolution to 0.1 ppm, 200 to 2000 ppm with resolution to 1.0 ppm	0.1 ppm benzene in air matrix (photoionization detector)	-	-	Nominal flow 400 ml/min	-	Internally rechargeable with 8 hours operation	-	-	-	-	-	-	-	-	-

Industrial Hygiene Equipments

Parameter	Manufacturer	Model	Technical Specifications																	
			Analytical Method	Measurement Range	Linearity	Precision	Accuracy	Response Time	Sample Flow Rate	Analog Output	Serial Output	Power	Computer Requirements	Environmental Temperature	Datalogging	Dimensions	Weight	Note	Accessories	Resolution
										Industrial Hygiene										
Particulate	SKC	AirChek 52 Personal Sampling Pump	Sampling Pump	Range (5 to 3,000 ml/min, 5 to 500 ml/min with constant pressure controller) / Compensation Range (750 to 2,000 ml/min up to 25 inches, 2,500 ml/min up to 20 inches, 3,000 ml/min up to 15 inches)	-	If the flow is restricted more than 15 seconds, the pump shuts down automatically, but the timer retains the valid run time.	See sample flow rate	-	± 5% set point constant flow (Flow is compensated to 25 " of H2O back pressure and moderated with a built in pulsation dampner). As back pressure increases, the motor voltage corrects automatically for constant flow, so there is no sacrifice in accuracy, even in dusty environment	-	-	Built-in rechargeable NiCd battery pack, 8 hours operation	-	-	-	5" x 3" x 1.75" (127mm x 76.2mm x 44.45mm)	20 oz	Ideal for "on worker" short-term or full shift sampling, the AirChek 52 personal sampling pump can be used for STEL, TWA or Ceiling sampling using single sorbent tubes. Lightweight, heavy duty/ Intrinsically safe and EMI, RFI	AirChek 52 Personal Air Sampling Pump rents with the constant pressure controller and tube holder for low flow and single sorbent tube sampling, battery charger, screwdriver set, operating manual and carrying case	-
Area monitoring / clearance sampling	Dawson	1300 Air Sampling Pump	High volume air sampler	-	-	-	-	-	Adjustable flow rate	-	-	-	-	-	-	-	-	A breathing zone cassette holder sits on a tripod for testing AHERA standards. The Flow regulator adjust from three to 20 liters per minutes. Meets AHERA standards.	1300 ASP rents with tubing, tripod, one rotometer case, and operating manual	-
Dry primary standard calibrator	BIOS	DryCal® DC-Lite	–	DC-Lite Medium Flow Range ±1% accuracy: 100ml to 7 lpm. Full flow range: 10ml to 12 lpm Dc-Lite High Flow Range ±1% accuracy: 500ml to 30 lpm. Full flow range: 50ml to 30lpm	-	-	± 2% single reading, ± 1% averaged reading	-	See measurement range	-	-	Sealed lead acid battery, 6 to 8 hours operation, or AC operation with battery charger	-	-	-	5" x 5" x 2.75" (127mm x127mm x 69.85mm)	42 OZ	Convenient features include AC/DC operation, a large alphanumeric LCD for flow rate, flow average with number of readings included in the average, push-button read and auto-read volumetric flow rate, automatic shut-off, a parallel printer port that interfaces with most PC-compatible printers--and no messy soap film. The DryCal® DC-Lite is also available in a model with high-range (30 liter) flow. Dry, Volumetric accuracy based upon NIST-traceable standards of volume, time, distance and it has a simple push-button operation	Primary Standard Flow Calibrator rents with the charger, tubing, calibration certificate, operating manual and carrying case	-
Electric & Magnetic Fields	Holaday	Low Frequency EMF Survey System Model 3603, 3604, 3616	Model 3604 ELF field strenght meter evaluates electric and magnetic fields associated with 50/60 hz power lines and electrically operated equipment and appliences. Model 3603 VLF radiation survey meter measures the complex electromagnetic field emmisions from computers, video display terminals and any CRT or similar device radiating within 10 Khz to 300 KHz.	Model 3603 (E-Field- 1 to 2000 V/M and H-Field- 1 to 2000 mA/M) / Model 3603 (E-Field- 1 V/M to 200 kV/M and H-Field- 50 to 1000 Hz).	-	-	-	-	-	-	-	-	-	-	127 data points using front panel controls, waveform output	14.125" x 8.375" x 1.75" (358.775mm x 212.725mm x44.45mm)	2.5 lbs		Rental package includes the Holaday Model 3604, which is an ELF/power frequency survey meter, the Model 3603, a VLF/VDT radiation survey meter, and the Model 3616 fibre optic remote control, for situations where the surveyor must be isolated from the instrument. A dielectric tripod is also included	-
Magnetic Fields	Holaday	ELF Magnetic Field Meter Model 3627	Uses three orthogonal sensing coils combined in a vector sum to provide accurate magnetic field measurements from any ELF source, including single or polypase electrical circuits, VDTs, household wiring and appliances.	2, 20, 200 milligauss, 2, 20 gauss full scale	-	-	-	-	-	Remote sensor and analog meter makes a quik work of findings ELF distributions in any application.	Recorder Output (1/4" phone jack, 0 to 5V DC (1 mA max) proportional to meter deflection)	9.6V Ni-Cd rechargeable battery, 30 hours operation	-	-	-	4.13" x 2.68" x 1.78" (104.902mm x 68.072mm x 45.212mm)	1.44 lbs	100 dB dynamic range (0.2 milligauss to 20 gauss) / Low frequency cut off at 5 or 30 Hz	Model 3627 ELF Magnetic Field Meter rents with probe, battery charger, carrying case and operating manual	-
Electromagnetic Fields	Holaday	Holaday Broadband RF Field Strenght Meter Model HI 3012 /4012	-	Dynamic Range- E-Field Probe (102 to 106 V2/M2), H-Field Probe (.001 to 10 A2/M2)	-	-	Accuracy at Calibration Frequencies 0.5 dB	-	-	-	-	14 C-size batteries	-	-	-	8.125" x 5.125" x 4.875" (206mm x 130.17mm x 123.82mm) / Probe Length 30" (762mm) with 60" (1524) cable)	6.5 lbs	Automatic self-zeroing circuit, Accurate in any RF/microwave field environment. It is ideal for measuring electromagnetic fields generated by a wide range of equipment, including RF heat sealers, RF/microwave processing equipment, broadcast stations and medical instrumentation. Readings are displayed on an analog scale.	Broadband RF Field Strength Meter rents with probe handle, cable assembly, HCH probe, carrying case and operating manual.	-
Magnetic Field from MRIs, nuclear fusion experimental devices, metallurgical processes and superconductive magnets	Holaday	DC Magnetic Field Meter Model 3550	Three-axis isotropic sensing measures the actual field, regardless of instrument orientation.	0.1 mT to 0.3 T	-	-	0.1 mT to 0.5 mT ± 0.05 mT, 0.5 mT to 0.3 T ± 10%	This monitor provides instantaneous and time integrated field readings, measuring instantaneous fields up to 0.3 Teslas. The time integrating feature tracks 8-hour average exposures to the ACGIH TLV for static magnetic fields	-	-	-	Four AAA batteries	-	0 to 50 Celsus	-	-	5.3 oz	Instantaneous with peak hold function, Integrating (mT-hours). Instantaneous and Time Integrating. Track exposure to ACGIH TLV for static magnetic fields. Fits in a pocket or clips to belt	Model 3550 Portable Magnetic Field Monitor rents with carrying case and operating manual.	-
Microwave leaks	Holaday	Microwave Meter Model 1600	-	0 to 10 mW/cm2 at 2450 MHz / 0 to 10 and 0 to 20 mW/cm2 at 915 MHz. Three survey ranges are available	-	-	± 1 dB	1 second fast, 2.5 seconds slow, to 90% of final value for a step input	-	-	-	Two 9V batteries	-	-	-	6.25" x 3.63 x 2.63" (158.75mm x 92.2mm x 66.8mm)	2 lbs with probe	2.0 W/cm2. The Model 1600 microwave meter accurately measures microwave leakage from microwave ovens operating at 2450 MHz and 915 MHz. Measured values are indicated on an easy-to-read, front panel analog meter	Model 1600 Microwave Survey Meter rents with a beaker, carrying case and operating manual	-

Industrial Hygiene Equipments

Parameter	Manufacturer	Model	Technical Specifications																	
			Analytical Method	Measurement Range	Linearity	Precision	Accuracy	Response Time	Sample Flow Rate	Analog Output	Serial Output	Power	Computer Requirements	Environmental Temperature	Datalogging	Dimensions	Weight	Note	Accessories	Resolution
Industrial Hygiene																				
Measures heart rate / body temp	Metrosonics	Personal Heat Strain Monitor Model hs-3800	Heart rate detector- EKG type electrodes	Measures heart rate from 40 tp 220 beats/min	-	-	plus/minus 0.2 °F	-	-	Output is RS-232 port	-	Internal 9-volt battery	-	-	4000 intervals, 1 minute measurement intervals. Hs-3800 can transfer data directly to a printer, with real time, minute by minute readings of heart rate, temperature and alert status. A microprocessor-based module combines the monitoring and datalogging funtions.	3" x 1" x 5" (76.2mm x 25.4mm x 127mm)	14 oz	monitors individual body strain in hot working conditions and lets the subject know when exposure to heat stress has reached the exposure limit. Compact, hs-3800 is a sensor belt and monitor module assembly. The sensor belt is worn around the chest-measurements. The watertight, lightweight can be slipped on to a shirt pocket or clipped on a belt. There are two alerts, first one is to alert for the unsafe temp and second to stop the work.	Model hs-3800 rents with a certificate of calibration, chest belt sensor assembly, software and download cable, spare 9-volt battery, operating manual and case.	-
Measures ambient temperature	Quest	Temp 34 Area Heat Stress Monitor	dry bulb sensor	Globe, dry bulb, wet bulb, WBGTin, WBGTout, WBGT weighted average (if 3 sensor sets), relative humidity, and Heat Index / Humidex. Temperatures given in Celsius or Fahrenheit.	-	-	Temperature: +/- 0.5°C between 0°C and 100°C Relative Humidity: +/-5%	-	-	RS-232	-	9V alkaline, 7.2V NiMH rechargeable pack (charged in the unit), or AC adapter wall power cube (AC adaptor will operate the unit or recharge the NiMH battery pack). 9V alkaline: 140 hours. Rechargeable Nickel Metal Hydride: 300 hours. (Adding additional sensor bars to the QUESTemp°34 reduces battery life.) Charge Time (NiMH Battery Pack): 16 hours (charge in the unit)	-	Sensor Assembly: -5°C to +100°C, Electronics: 5°C to 50°C (0 to 100% (extended exposure to humidity > 90% can cause a reversible shift of 3%)	Records and prints all measurements at user selected interval of 1, 2, 5, 10, 15, 30, or 60 minutes. 128K bytes of data memory. Datalogging capacity (11 days at 1 min intervals). QUESTemp° 34 will print a report without the need for special software. Quest Suite software, an optional rental item, facilitates custom reports and graphs. It can also be used to perform statistical analyses and build archival files, and integrate data from other heat stress monitors, noise dosimeters, sound level meters, gas detectors and the like.	Height 9.2in (233.68); Width 7.2in (182.88mm); Depth 3.0in (76.2). Dimensions include mounted sensor assembly	2.6 lbs. (1.2 kg) with mounted sensor assembly	Sensor typr used: Temperature: 1000 ohm platinum RTD. Humidity: Integrated circuit with capacitive polymer sensor. The globe sensor can provide measurement of radiant heat due to direct light/hot objects. The unit can converts all these measurements to single-number indoor an outdoor WBGT index that can be used with guidlines from ACGIH, navy, EPRI, ISO for heat stress exposure guidelines. Unit available in English, French, Spanish, Italian, German	Heat Stress Monitor rents with a certificate of calibration, calibration verification module, wicks, wick kit, water bottle, printer cable, operating manual and storage case. There are 2 x 15pin D-sub jacks are located on the side of the unit for plugging in 1 or 2 additional sensor bars by using remote cables up to 200 feet (61m). The top sensor bar can also be remote with a cable.	-
Heat	RSS	WBGet Heat Stress Monitors	-	Calibrated to 140 °F; Sample Interval (0.5), 1, 2, 5, 6, 10, 20, 30 minutes , user selectable)	-	-	Temperature sensor accuracy +/- 0.3 °F at 32° to 199 °F Measurement accuracy +/- 0.5 °F within calibration range	<2.2 minutes to 90% of reading	-	-	-	PV rechargable NICd battery, 17 hours operatio, or AC operation with charger/adapter	-	-	Stores up to 500 records	3.75" x 6.2" x 1.75" (95.25mm x57.48mm x44.45mm)	12 oz	This instrument provides direct read of outdoor and indoor WBGT and calculates time weighted mean WBGT, metabolic rates and work to rest ratios.	-	0.1 F
	International Light Radiometer / Photometer	Model 1400A	-	Dynamic Range 10 pA to 350 mA	Dynamic Range 10 pA to 350 mA	-	-	-	-	-	-	-	Power Four AA batteries, 36 hours operation	-	-	185.42mm x 99.06mm x 43.18mm)	19.2 OZ	-	-	-
(Radiation) Alpha, Beta, Gamma, X-ray	S.E. International	Radiation Model 4EC	-	0 to 0.5, 0 to 5, 0 to 50 mR/hr ; 0 to 500, 0 to 5,000, 0 to 50,000 CPM ; 0 to 5, 0 to 50, 0 to 500 µ Svhr and mR/hr	-	(Sensitivity >80% efficiency at 3.6 MeV; Detects beta at 50 keV with 21% efficiency; Detects beta at 150 keV with 75% efficiency, Detects gamma and X-rays to 10 keV through the end window, 40 keV minimum through the case	-	-	-	-	-	9-volt battery, up to 2,000 hours operation	-	-	-	5.7" x 2.8" x 1.5" (144.78mm x 71.12mm x 38.1mm)	6.3 oz	The analogue meter is scaled in CPM (counts per minute) or mR/hr (milli-Roentgens per hour), and the XI, X10, X100 switch extends the effective measurement range. Model 4E monitor conveniently checks for contamination on countertops, clothing and equipment surfaces.	It rents with a check source, manual, certification, and a carry case	-
Gamma radiation	Ludlum	M-3 Survey Meter with 44-2 probe	-	6.5" x 8.5" x 3.5" (165.1mm x 215.9mm x 88.9mm); Recommended Energy Range Approx. 10 to 60 keV	-	Sensitivity Typically 675 cpm/microR/hr	-	Response time as fast as four seconds. A toggle switch changes response times from fast (four seconds) to slow (22 seconds) for up to 90 percent of the final reading.	-	-	-	2 "D" batteries in a sealed compartment 2000 hours operation	-	Operating Temperature Range -4 to 122F	-	HLW 6.5" x 3.5" x 8.5" (165.1mm x 88.9mm x 215.9mm)	3 lbs	Meter Dial 0 to 2 mR/hr or 0 to 5k cpm; Multipliers X0.1, X1, X10, X100; Audio Built-in unimorph speaker with On/Off switch, greater than 60 dB at 2 feet; High Voltage 200 to 1500 volts, user adjustable; Threshold 30 mV ± 10 mV; Threshold 30 mV ± 10 mV; Scintillator 1"d x 1mm sodium iodide (NaI) Tl scintillator ; Background Typically 40 cpm/microR/hr	It rents with a low energy gamma scintillator with cable, case and operating manual.	-

Industrial Hygiene Equipments

Parameter	Manufacturer	Model	Technical Specifications																	
			Analytical Method	Measurement Range	Linearity	Precision	Accuracy	Response Time	Sample Flow Rate	Analog Output	Serial Output	Power	Computer Requirements	Environmental Temperature	Datalogging	Dimensions	Weight	Note	Accessories	Resolution
Industrial Hygiene																				
Alpha, beta, gamma survey	Ludlum	2241 Digital Survey Meter with 44-9 Pancake Probe	-	Display range Auto ranging from 0.0 micro R/hr; 0.000 microSv/hr – 999 Sv/hr, 0 cpm; or 0 cps – 100k cps	Reading within plus or minus 10% of true value with detector connected	-	-	-	-	-	-	2 each "D" cell batteries (housed in sealed compartment that is externally accessible); Battery Life - Typically 200 hours with alkaline batteries (low battery indicated on display)	-	Temperature Range - - 4° F (-20° C) to 122° F (50° C). May be certified for operation from -40° F (-40° C) to 150° F (65° C)	RS-232 Data Dump	Meter dimensions: HLW 6.5" x 3.5" x 8.5" (165.1mm x 88.9mm x 215.9mm) Probe dimensions: 1.8" x 2.7" x 10.7" (45.72mm x 68.58mm x 271.78mm)	3.5 lbs (1.6kg) including batteries	Compatible detectors- G-M, proportional scintillation; Connector- Series "C" (others available on request); Audio - Built in unimorph speaker with ON/OFF switch (greater than 60 dB at 2 feet) ; Display - 4 digit LCD display with 0.5" (1.3cm) high digits, separate enunciators for display units, alert, alarm, low battery, detector overload, counting overflow, and scaler counting; Backlight-Push-button to activate ; Ratemeter - Can display in R/hr, Sv/hr, cpm, or cps when control switch is in Rate meter position; Scaler - Activated by push-button in handle (count time adjustable from 1 – 9999 seconds in 1 second intervals) ; Calibration controls - Accessible from front of instrument (protective cover provided); Discriminator Adjustable from 2 – 100 m V; Overload- Indicated by OVERLOAD on display (adjustable depending on detector selected); Reset- Push-button to zero display, acknowledge and/or reset alarm	It rents with a certificate of calibration, operating manual and carrying case	-
Dust, smoke, mists, fumes	MIE Personal Data ram Aerosol Monitor	PDR 1000 AN	-	Concentration Measurement Range 0.001 to 400 mg/m3	-	-	± 5% of reading ± precision	Particle Size Range of Max. Response 0.1 to 10 μm	-	RS-232 port	-	9V alkaline battery, 24 hours operation or AC operation with	-	-	13,000 data points, with average concentration, time/date and data point number for each, stored in 1 to 99 data sets	6.0" x 3.6" x 2.5" (152.4mm x 91.44mm x 63.5mm)	18 oz	The meter sounds an on-board audible alarm when a user-defined level is exceeded. Its ideal for monitoring personal breathing zones, plant walk through surveys, worker exposures, or indoor air quality monitoring.	The unit rents with a zero bag, aspirator, filter, extra battery, power supply, download cable, 9-25 pin adapter, software, analog cable, power cable, tool kit, carrying case and operating manual.	-
Alpha, beta, gamma survey	Victoreen- 190 Survey and Count Rate Meter	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Model 190 include error free visual indication, reduced exposure for a technician, exposure time verification and highly accurate counting	-	-
Gamma and X-ray above 60 kev	Victoreen- 190 Survey and Count Rate Meter	489-50	Type-NaI (T1) sodium iodine 1x1, Scintillator	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Applications: Nuclear medicine; Industrial hygiene; Industrial X-ray mfg; Geological surveys; Radiation safety office	-	-
Gamma and X-ray above 60 kev	Victoreen- 190 Survey and Count Rate Meter	489-120	Type-NaI (T1) sodium iodine 2x2, Scintillator	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Application: Alpha detection Uranium, Plutonium; HAZMAT; RSO	-	-
Aplha above 3.5Mev, beta above 35 keV, gamma and x-ray above 6 keV	Victoreen- 190 Survey and Count Rate Meter	489-110D	Pancake alpha, beta, gamma and x-ray with thin pancake window	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Application: All purpose alpha, beta, gamma, X-ray probe, Nuclear medicine counter tops; Leakage from diagnostic Xray machines, especially mammography, Geological surveys, Scrap metal yards, HAZMAT	-	-
Particulate, gases, vapors	Sensidyne	GilAir 5RC Air Sampling Pumps	-	Constant High Flow (750-5000 cc/min 20) / Constant Flow (low flow from 5 to 500 cc/min) / 8 hr Run Pump Flow with flow in lpm and H2O ( ). 0.75 lpm (20), 1 lpm (25), 2 lpm (26), 3 lpm (23), 4 LPM (15), 5 LPM (8)	-	-	-	-	*See Range also. Multi-flow (low flow) - 1 to 750 cc/min at 18" plus/minus 3" H2O. Flow control (plus/minus 5% of set point, user adjustable	-	-	Sealed NiCd Battery, 8 hours of operation	-	-	-	-	-	These three-in-one samplers perform filter cassette, single or multiple sorbent tube sampling with constant flow accuracy. The flow modules convert the pumps to the lower flow rates required for sorbent tube sampling. The modules has	5RC sampling pump rents with air boss, three feet of tubing , restrictor screwdriver, battery charger, carrying case, and operating manual.	0.1% of reading or 0.001 mg/m^3 whichever is greater

Indoor Air Quality Equipments

Parameter	Manufacturer	Model	Technical Specifications																	Instrument Feature Availability
			Analytical Method	Measurement Range	Detection Limit	Precision	Accuracy	Response Time	Sample Flow Rate	Analog Output	Serial Output	Power	Computer Requirements	Environmental Temperature	Datalogging	Dimensions	Weight	Note	Accessories	Auto Aero/Span Check or Adjustment
Indoor Air Quality																				
dust, smokes, fumes and mists	**TSI**	8520	Laser Photometer	0.001 to 100 mg/m^3	0.1 to 10 µm	Resolution: 1% of reading or 0.001 mg/m^3, whichever is greater	-	Adjustable from 1 to 60 seconds	Adjustable 1.4 to 2.4 lpm	-	RS-232 port	4 C-size batteries, 16 hours operation or AC operation with adapter	-	-	31,000 data points, adjustable from 1 second to 1 hour	220.98mm X 149.86 mm X 86.36mm (8.7" X 5.9" X 3.4 ")	1.23 kg (3.3 lbs)	For spot checks or long term sampling and datalogging	-	When used with Q-Trak, P-Trak, air velocity meters and other TSI instruments, furnishes a comprehensive analysis of indoor air quality.
for particles smaller than 0.1 µm	**TSI**	8525	Ultra fine Particle Counter	0.01 to 5X10^5 particles/cm^3	0.02 to greater than 1 micrometer	-	-	-	100cm^3/min	-	RS-232 port	6 AA alkaline batteries, 6 hours operation @ 70°F	-	32° to 100°F	-	273.05mm X 139.7 mm X 139.7mm (10.75" X 5.5" X 5.5 ")	1.42kg (3.8 lbs)	Gets at the source of tough IAQ problems and counts particles smaller than 0.1 micrometer.	Windows-based TrakPro™ software	-
CO_2, CO, temperature and humidity	**TSI**	8551 and 8554	CO_2 : Non-dispersive infrared (NDIR) CO: Electrochemical Temperature: Thermistor Humidity: Film capacitive	CO_2 and CO : 0 to 5000ppm Temperature: 32° to 122°F Humidity : 5 to 95% RH	-	-	CO_2 : ±3% of reading ±50 ppm CO: ±3% of reading ±3ppm, whichever is greater Temperature: ±1°F Humidity: ±3%	CO_2 : 20 seconds CO: < 60 seconds to 90% of final value Temperature: 30 seconds Humidity: 20 seconds	-	-	-	4 AA alkaline batteries, 13.5 hours operation or AC adapter	Windows® 3.x-	-	63,000 data points, adjustable from 1 second to 1 hour	273.05mm X 139.7 mm X 139.7mm (10.75" X 5.5" X 5.5 ")	0.59kg (1.3lbs)	IAQ portable monitor with CO that measures all key parameters and datalogging. Provides real time measurement and takes reading once a minute for 10 days.	Windows-based TrakPro™ software	-
CO_2, CO, temperature, relative humidity, dew point, wet bulb temperature, percent outside air	**TSI**	8762	CO_2: Dual-wavelength NDIR CO: Electrochemical Temperature: Thermistor Relative Humidity: Film capacitive	CO_2 and CO : 0 to 5000ppm Temperature: 32° to 140°F Relative Humidity : 5 to 95% RH Dew Point: 5° to 120°F Wet Bulb Temperature: 40° to 140°F Percent Outside Air: 0 to 100%	-	-	CO_2 : ±3% of reading ±50 ppm CO: ±3% of reading ±3ppm, Temperature: ±1°F Relative Humidity: ±2%	-	-	-	-	4 AA alkaline batteries, or AC adapter	Excel	-	5 seconds to 1 hour	99.06mm X 167.64 mm X 36.1mm (3.9" X 6.6" X 1.5 ")	0.43kg (1.16lbs)	Datalogging with direct download to excel. Datalogging capacity is a hefty 14,000 samples with time and date stamp and 14 user-selectable sampling intervals	software	-
bioaerosol sampling	**NIOSH**	N6	Collects airborne microorganisms on a petri dish and then send to a laboratory for analysis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Single or two stage models available that meets ACGIH specs and minimal set-up, efficient sampling	-	-
Temperature and humidity	**Vaisala**	-	Humidity sensor	Temperature: -4° to 140°F Humidity: 0 to 100% RH	-	Resolution Temperature: 0.1°F Humidity: 0.1%	Temperature: ±0.5°F Humidity: ±2% at 0 to 90% RH, ±3% at 90 to 100% RH	-	-	-	-	9V battery, 50 hours operation	-	-	-	160.02mm X 55.88 mm X 27.94mm (6.3" X 2.2" X 1.1")	0.25kg (8 oz)	Fast response with ±2% accuracy, insensitive to dust	-	The "hold" button lets the user retain an RH or temperature reading until it has been noted.
Moisture	**Tramex**	Tramex Moisture Meter	Non-destructive electrical impedance	-	-	-	-	-	-	-	RS-232 port	1 PP3 lithium manganese battery	-	-	625 readings can be stored in 25 files. Stored data can be read directly from LCD display or downloaded to a PC with Windows-compatible Software	152.4mm X 81.28mm X 6.35mm (6" X 3.2" X 0.25")	0.22kg (0.6 lbs)	Non-destructive readings	CD software	-
Moisture content in wood and wood products	**Tramex**	Pin Type	Built-in electronic probes	8% to 40% in 0.1% increments	-	-	-	-	-	-	-	1 standard 9V battery	-	-	-	160mm X 75mm X 25mm (6.25" X 3" X 1")	0.25kg (8.8 oz)	-	-	Selection of electrodes includes deep hammer type, shallow penetration and deep wall type
VOC, nerve agents, pesticide residues and isocyanates	**RAE**	7240	Photoionization	0 to 999 ppb at 1 ppb resolution, 0.01 to 9.99 ppm at 0.01 ppm resolution and 0.1 to 199.9 ppm at 0.1ppm	-	-	20 ppb or 10% of reading	< 5 sec	400 cc/minute	-	RS-232 port	NiMH battery pack, 10 hours operation	-	-	15,000 data points with time and date	208mm X 76.2mm X 50.8mm (8.2" X 3" X 2")	0.61kg (19.6 oz)	Intrinsically safe for UL and cULL Class I, Division 1, Groups A,B,C,D, Eex ia IIC T4. Can program the unit for average, STEL and peak readings	software	-
Ozone	**IN USA**	AET-030	Thin film semiconductor sensor	0.01 to 10ppmv	-	±0.03 ppmv between 0 and 0.5 ppmv, ±30% between 0.5 and 10 ppmv resolution: 0.01 ppmv from 0 to 1 ppmv, 0.5 ppmv from 1 to 10ppmv	-	~1 minute to 70% of value, ~3 minutes to 90% of value	~0.3l/min via internal micro-pump	0 to 1 VDC corresponding to 0 to 1 ppmv	-	4 AA alkaline batteries, or AC operation with adapter	-	-	-	-	0.37kg (1lb)	-	-	-
Particle counter	**Pacific Scientific**	Met One 227B	Laser diode technology	-	Channel 1: 0.3µm Channel 2: selectable from 0.5, 1.0, 3.0 or 5 µm	-	-	sample time: 1 second to 24 hours hold time: 1 second to 24 hours	0.1 cfm	-	RS-232 port	NiMH battery pack, 8 hours operation or AC operation with charger	-	-	200 records, rotating buffer and 250 locatopn labels apppear on printout	175.26mm X 101.6mm X 58.42mm (6.9" X 4" X 2.3")	0.8kg (2.13lb)	NIST-traceable calibration	-	-