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I. EXECUTIVE SUMMARY

1.1 Introduction

In the May of 2002, the City of Chełm, Poland ("Chełm" or the "City of Chełm"), the United States Trade and Development Agency ("TDA") and PCI Energy International, Inc. ("PCI"), agreed that PCI would perform a study (the "Study") to determine the feasibility of using the City of Chełm's municipal solid waste ("MSW") in as yet to be defined waste-to energy project ("Project") to be located in the City of Chełm. On May 24, 2002 an agreement was signed between PCI and the City of Chełm for the Study. On May 29, 2002, a Grant Agreement was signed by the TDA whereby 50 per cent of the Study would be funded as grant from the TDA and the other 50 per cent would be funded by PCI.

The City of Chełm, in response to a need to expand its existing landfill, extend the useful life of the landfill and desirous of finding an environmentally responsible way of addressing the region's waste utilization options sought the assistance of PCI. PCI is a firm with experience in dealing with municipal waste issues including the design, implementation, financing, construction and development of projects that produce energy from waste fuels.

The Study was formulated to investigate and develop the following areas associated with a Project ("Project") that would use MSW as fuel:

- Evaluation of existing MSW system.
- Assessment of the Municipal Energy Heating Company ("MEHC") Main Heating Plant ("Main Heating Plant") as a user of MSW fuel.
- Evaluation of technology alternatives for waste utilization.
- Preparation of a conceptual design and cost estimate for the Project.
- Assessment of environmental impact of proposed waste utilization.
- Preparation of a financial analysis complete with sensitivity analysis.
- Development of a financing plan.
- Evaluation of regulatory, social and political issues associated with the Project.

The Study was conducted over a fifteen (15) month period of time. During this time extensive inspections were made of the City of Chełm's existing MSW collection and disposal system operated by the Municipal Enterprise for Communal Economy, Ltd. ("MPGK") and the Main Heating Plant of MEHC. Both MPGK and MEHC are City of Chełm owned and operated companies.

Documentation was obtained from MPGK, the waste disposal company, which addressed both the current waste collection and disposal practices in the City of Chełm and the surrounding region. It provided forecasts of future trends in waste generation and population variations.

The use of MSW fuel was reviewed with the City of Chełm's heating plant and a local cement manufacturing plant.

The Main Heating Plant was inspected both during the summer maintenance period and early winter operations. Several meetings were held with the local cement plant management who expressed an interest in obtaining an alternate fuel to displace a portion of the coal currently being burned.

The information obtained from the MPGK, MEHC and the cement plant was analyzed and then used to develop several technical concepts for the utilization of the City of Chełm's and region's MSW. The technical alternatives were reviewed with City of Chełm management. One concept was selected for design development and cost estimation. The design was prepared to meet the established environmental requirements for the proposed Project. In addition, all regulatory, social and political issues identified as having a potential impact on the Project were addressed.

The final phase of the Study was the development of a financial analysis and a financing plan for the Project. The financial analysis, including a pro forma, was developed based on manufacturer's quotations, PCI engineering estimates, pricing for recyclable sales, estimates of refuse derived fuel ("RDF") values and historical information for operating and maintenance costs. A second pro forma was developed based on the City of Chełm's concern that less MSW may be available than the quantity reflected in the first base case analysis.

A financing plan was developed around the City of Chełm's ownership preferences and PCI's knowledge of funding sources for projects with the desired ownership structure and capital cost. The result of the Study is a proposed Project that will meet the City of Chełm's requirements of providing an environmentally friendly process for utilizing MSW, minimize landfill usage and can be financed with a desirable ownership structure.

1.2 Evaluation of Existing MSW System

The City of Chełm has joined with other cities and towns in the local geographic area to form the Commune Union of Chełm Region to address MSW utilization issues. The Commune Union of Chełm Region consists of the towns of Chełm and Rejowowiec Fabryczny and the following communes: Bialopole, Chełm, Dubienka, Kamien, Lesniowice, Rejowiec, Rejowiec Fabryczny, Ruta Huta, Sawin, Siedliszcze, Wierzbica, Wojslawice and Zmudz. The communes that belong to the Union are located in eastern Poland in a region between the Bug River and the Wieprz River near the Ukraine border. The town of Chelm is the population center with 70,724 inhabitants. The total population of the area is 148, 175 with 51% living in town.

The Union consists of 15 towns and communes who are currently responsible for collect and disposal of MSW in their individual areas. Twelve (12) landfills are being utilized for the disposal of MSW, most of which do not meet modern construction and environmental standards

and are approaching closure due to capacity limits. Seven municipally owned companies are responsible for the collection and disposal of MSW in the Union. The largest operation is that of MPGK of Chełm which collects from the town of Chełm and in the area of Chełm, Kamien, Ruta Huta and Zmudz communes. The City of Chełm operates a landfill in the village of Serebyszcze which has just constructed a new landfill cell that meets all of the current standards for landfill design and operation.

Waste is collected from single family and multifamily dwellings on a six day per week basis. The quantity of waste collected is fairly consistent throughout the year. The waste stream from the Commune Union of Chełm Region is estimated to be approximately 125 tonnes per day (2200 lb per tonne).

Five (5) major component of collected waste can be identified; paper and, cardboard, plastic, household organic wastes, recyclables and non-combustibles. Sorting of the waste will substantially reduce the amount of materials flowing directly to the landfill.

1.3 Assessment of the MEHC Main Heating Plant

In order to help determine which MSW technologies are the most appropriate for the City of Chełm to optimally utilize its MSW in the production of energy, PCI undertook an evaluation of the existing heat generating assets of MEHC, the City of Chełm heat company. The Chełm district heating system consists of MEHC's two heating plants, Centralna Cieplownia (the "Main Heating Plant") and Cieplownia Szczytowa (the "Peaking Plant") and an extensive underground hot water distribution system.

An inspection of the Main Heating Plant was made to determine the general condition of the existing equipment and facilities. The Main Heating Plant is located on a large site of approximately 39 acres. It consists of three buildings; a water treatment building and two-boiler buildings that are joined together. In addition, an administration building and a maintenance building are provided on the site.

A visual inspection of the equipment and interviews with operating personnel determined that the plant is maintained in good condition. An inspection showed the interior of the boiler(s) to be in good condition. The coal feed systems occupy the full space in front of the boilers and do not allow sufficient space for an alternate fuel feed system which would be required to burn MSW fuel. Conversation of the existing boilers to co-fire an alternate MSW fuel or conversion of a boiler to an alternate fuel is not practical.

The Main Heating Plant has sufficient space for the installation of new fuel handling and combustion equipment to fire an alternate fuel. The site could support a mass burn facility, and RDF combustion facility or a gasifier. The installation of a large combustor that would burn RDF and several grades of coal would also be practical. A large unit could be a steam generator that would also produce electricity. The utility infrastructure will support any of these options.

1.4 Evaluation of Technology Alternatives for Waste Utilization

Using the base of information gathered from its evaluation of the City of Chełm's MSW system and MEHC, PCI next undertook an evaluation of alternative waste-to-energy technologies available in order to select the most appropriate technology for the Chełm Project.

There are three general types of combustion technologies that PCI evaluated in the Study for the Waste-to-Energy Project for the City of Chełm, these include.

- Mass burn technology.
- Preparation and combustion of RDF.
- Gasification technology.

Mass burn is the simplest of the technologies in that minimum fuel preparation is required. This technology would only work at the MEHC Main Heating Plant. A mass burn facility must receive the untreated MSW, remove the components that too large for the fuel feed system and combust the balance of the MW. This technology provides a substantial reduction in the volume of material to be landfille, however, does not meet the current European objective of providing the maximum utilization of the components of the waste stream.

The preparation of a RDF from MSW provides the maximum utilization of the components of MSW. Design of the sorting and fuel preparation facility allows for the recovery of recyclables, selection of components for fuel, selection of components for composting and minimizing the portion of the MSW that is landfilled. This technology can be implemented on the same site as the combustion process or at a separate site.

The gasification process produces a gaseous fuel by heating the solid waste fuel in an oxygen starved condition. The product gas can be used to fuel a combustion process such as a boiler or spark ignition engines.

Based on a review of the technologies and the sites available, RDF preparation technology was selected for further development and design. The RDF facility will be sited at the existing City of Chełmlandfill facility. This provides the opportunity to sell RDF to either the MEHC or the cement plant. The City of Chełm confirmed it favored this approach.

PCI investigated the available sites for a new waste-to-energy facility in Chełm, the logistics of waste handling, the available waste reduction/separation technologies and a range of waste combustion and utilization technologies.

PCI identified three (3) sites in the Chełm region at which a potential waste-to-energy facility could be located. The sites were evaluated separately and in combination to establish the optimal configuration.

The existing landfill is located in an undeveloped industrial/rural area with sufficient space for additional material handling operations. MSW separation, sorting, recovery of recyclables, preparation of RDFs and composting could be accomplished at this site. This site is too remote for the installation of combustion equipment and interconnection with the district heating system.

The MEHC Main Heating Plant site has the greatest adaptability for the implementation of a waste-to-energy technology. Land is available for the construction of waste/fuel receiving and storage, fuel preparation, installation of combustion equipment and air cleaning equipment. The site provides an interconnection point with the district heating system. The site is located in an industrial area with a road system that would support the traffic that would be generated by the new facilities.

The third site evaluated is the local cement manufacturing plant. It is limited in scope to being a combustion source only since the management is interested in receiving RDF as an alternate fuel for use in the existing cement calciner, but not in hosting a RDF preparation operation. The RDF preparation would be accomplished on one of the other sites.

1.5 Preparation of a Conceptual Design and Cost Estimate for the Project

The limited land availability in Europe has placed a premium on land available for landfill use. To minimize the amount of materials going into landfills, programs are being established through out Europe to recover reusable materials primarily glass, plastics and metals from MSW streams. In addition, the combustible components of MSW are being utilized in combustion processes or gasification processes as alternate fuels replacing more expensive fuels.

Midway through the Study a new City of Chełm Mayor was elected in the municipal elections of November 2002 and a new Vice Mayor was appointed. At this time, the Study focus shifted from primarily evaluating different waste handling and treatment technologies and combustion options which could be sited at the MEHC. The new focus was to explore those options that would produce RDF as part of a waste handling and recycling system. The expectation of the City and of Cementownia – Chełm, the local cement manufacturing plant, was that the RDF produced by an RDF facility could be combusted in the calciner of the local cement plant.

The conceptual design for the Study is based on the preparation of an RDF that will be acceptable for combustion in the local cement plant calciner. An acceptable alternate fuel for the calciner must have a minimum heating value of 14,000 KJ/kg. In addition, the fuel must have a maximum chloride content of 1 per cent and complete combustion must be accomplished in the 3 second residence time. To achieve these conditions from MSW, all of the non-combustible components must be removed from the prepared RDF fuel stream. In addition, moisture content which is normally high in MSW ,must be reduced either in the processing steps required to produce the RDF or by drying. The cement plant management specified that household organic waste not be present in the RDF. The City of Chełm expressed a desire to have a composting operation as part of the Waste-to Energy process. The basis for the conceptual design is to site a facility adjacent to the City of Chełm's landfill that will recover and separate recyclables, separate combustible components and prepare RDF, compost organic materials not suitable for use in RDF and transfer the unusable balance of the MSW stream to the landfill. The RDF

produced will have an estimated heating value of 26.5 GJ/tonne. This is comparable to the heating value of the coal currently being used by the cement plant.

The proposed RDF Project will consist of two major components, an enclosed building to receive and process the MSW and a covered compost area. The processing of the MSW will be accomplished in a large, ventilated building. Waste will be received in on a tipping floor that can hold 1 ½ days delivery. The area for receiving MSW and shipping RDF will be isolated from the balance of the processing operations by a masonry wall. Oversize and hazardous components will be removed from the delivered MSW on the tipping floor by manual sorting. The sorting and separation operations will be accomplished by a series of conveyors, mechanical separators and hand sorting stations. The initial separation will be accomplished by a sizing screen which will separate the 10 inches and over materials from the under 10 inches components of the MSW. The over 10 inches materials will be primarily paper and plastic which will be utilized in the preparation of RDF. A manual picking station will be used to separate any non-combustible materials in the over 10 inches stream.

The under 10 inches materials will be conveyed to a series of manual sorting stations for the removal of recyclables and paper and plastic combustibles. Metals will be removed from the waste stream by a magnetic separator and eddy current separator. The materials that remain will be the household organic wastes and the non-combustibles. These will be separated by an inerts separator that will remove the inorganic materials from the organics. The organic materials will be processed through a shredder to size them for composting. The inerts will be transported to the landfill.

The separated combustible materials, primarily papers and plastics, will be processed through a high speed shredder to obtain a uniform particle size for combustion in the cement calciner. The final product will be transported by truck to the cement plant.

The second operation at the RDF facility will be the composting of the household organic materials separated from the MSW stream. The compost area will be located adjacent to the RDF processing building. The facility will occupy approximately 3 acres. It will consist of a hard impervious surface covered by an open sided roofed structure. The organic waste will be arranged in windrows. The temperature and moisture content of the windrows will be monitored to maintain optimal composting conditions. The composting process will take from 2 to 6 months depending on how well conditions are maintained in the windrows. The windrows will have to be turned and mixed several times during the composting process to assure complete reaction of the waste.

The City of Chełm indicated that the desired business structure for the new RDF facility would be a stand alone company or corporation. This could be accomplished with a staff of 15 to 17 operating personnel and three managers; a president, vice president and an accountant.

A cost estimate was prepared for the new facility based on manufacturer's quotations and engineering estimates. It was assumed that the land currently owned by the City of Chełm would be provided to the Project at no cost. The capital cost for the Project is estimated at $6,425,000. In addition to the cost for design and construction, the Project will be subject to development

costs including: permitting costs, permitting fees, special technology consultants, legal, other financial consultants and a contingency. This cost will be approximately $1,025,000.

1.6 Environmental Impact Assessment

PCI subcontracted with WS Atkins Polska Sp. z.o.o., an experienced environmental consultant, to provide environmental consulting services for the Waste-To-Energy Study for the City of Chelm. PCI requested Atkins identify the applicable regulations for the proposed Project, identify the permits that are required, define the emission limits, the permitting procedure(s) and estimate the time required to obtain all necessary permits and approvals. Environmental regulations in Poland are currently undergoing change to bring them into compliance with the EU environmental requirements. It is possible to identify the objectives to be achieved by the regulations that are currently being enacted but some changes may occur in the finalized regulations.

As part of the Study, PCI identified four (4) waste utilization technologies to reduce the amount of MSW that is being sent to the landfill. These options consisted of:

- Mass burning incineration.
- RDF preparation and combustion.
- Gasification of MSW to provide a fuel gas.
- Composting.

An understanding of the environmental requirements for each of the above listed processes was developed during this Study. The Study's primary interest was in the requirement for the preparation of RDF and composting since these were the processes directly included in the conceptual design. An understanding of the requirements for combustion processes was necessary to assure that the companies that are consumers of the RDF are properly permitted.

Poland move toward adapting the EU environmental standards clarifies what the long term standards will be in Poland. The permitting process has incorporated the requirement for an integrated permit for large combustion projects and the application of "Best Available Techniques". Existing facilities like the cement plant and MEHC are in the process of obtaining integrated permits. The cement plant's application includes the combustion of RDF. MEHC would not be able to include RDF until the combustion technology is defined. Permitting of the RDF and composting facility is expected to take 6 to 8 months. Permitting of this RDF preparation and composting facility is anticipated to be straight foreword since it is an extension of the existing landfill operations.

1.7 Financial Analysis Complete With Sensitivity Analysis

PCI has developed a conceptual design for a waste handling and preparation plant. This Project included a composting area, a recycling capability and the production of RDF. This Project

represents the alternative that best utilizes the waste stream, minimizes the waste that will flow into the existing landfill and is most acceptable to the management of the City of Chełm. Based on this design, PCI prepared a cost estimate for the Project based on manufacturer's quotations and internal engineering estimates. This cost estimate to design and construct the Project coupled with a list of other critical construction, operating and financial assumptions are the basis for the baseline financial analysis for the Study.

This baseline financial analysis ("Baseline Financial Model" or "Baseline Financial Analysis") has been refined to include inputs and comments from the City of Chełm, refined cost estimates provided by a Polish engineering firm that reviewed the PCI conceptual design, and comments from several financial advisors that reviewed PCI's financial assumptions. This refined analysis incorporates the optimal capital structure that the Study is proposing for the Project and examines a number of variations of the Baseline Financial Analysis to give the Study a clear profile of the different ways that the City of Chełm might structure the Project to meet its particular criteria.

The Base Case No. 1 Financial Model assumed that the City of Chełm creates a separate company ("NewCo") that would own the facility. NewCo would be separate from any existing City of Chełm corporation and would be staffed and managed as a separate business venture. Projected staffing levels include a president, vice president, two administrative staff and 15 operators/maintenance personnel. It is assumed that the facility would operate 6 days a week, 8 hours per day and receive waste deliveries 6 days per week.

It assumed that the land adjacent to the landfill is owned by the City of Chełm and that the land will be provided to the NewCo at no cost. The Project has been designed to fit on the City of Chełm owned land as PCI understands the boundaries. The detailed design of the Project may reduce the amount of land required.

The build-up of the Project's costs to be put in service is based on the cost estimates secured during the work on conceptual design and includes about $500,000 of costs necessary to be expended as development costs before the facility is constructed. These include costs of design and engineering, set-up of the NewCo, legal and permitting costs. It also incorporates costs for financing, project management, builder's risk insurance, working capital and a contingency.

On the revenue side, the economics of NewCo are based on NewCo receiving revenue from three separate business activities. It has been assumed that MPGK and the other collectors of MSW in the Chełm Commune region will deliver unsorted or sorted MSW to the facility. First, NewCo will separate all recyclable materials from this waste stream – glass, aluminum, ferrous metals, other metals, and sell all the reclaimed materials. Compost produced will also be sold.

Second, the waste collectors will pay a fee to NewCo which will approximately offset the current costs of placing the waste in the landfill, a tipping fee. In work with MPGK, its own independent analysis of MSW hauling and land fill costs in Chełm and its research on other landfill costs in Poland, the Study concluded that the cost to landfill a tonne of MSW to the Chełm landfill is in the range of $10-12.50. Finally, NewCo will sell the RDF produced by the facility as the third source of revenue to the local cement manufacturing plant at $24.50 per tonne.

The Study developed eleven (11) possible financial results of the Investment showing a range of critical variables and of estimated financial results. These eleven results are summarized in the following table.

Financial Sensitivity Table

	NPV (US)	Is Cashflow Positive?
Case 1-Tipping Fee @ $10.50 USD/tonne	4,767,917	Yes
Case 2-Tipping Fee @ $7.50 USD/tonne	3,554,131	No/Year 1
Case 3-Tipping Fee @ $12.50 USD/tonne	5,577,108	Yes
Case 4-Tipping Fee @ $15.00 USD/tonne	6,588,597	Yes
Case 5-Reduce Construction Costs 10%/Tipping Fee @ $10.50 USD /tonne	5,263,177	Yes
Case 6-Increase Capital Costs 10%/Tipping Fee @ $10.50 USD/tonne	4,272,554	Yes
Case 7-Increase RDF Revenue to 115 PLN/tonne/Tipping Fee @ $10.50 USD /tonne	5,293,275	Yes
Case 8-Reduce O&M Costs by 10%/Tipping Fee @ $10.50 USD/tonne	5,359,803	Yes
Case 9-Eliminate Management and Administration/Tipping Fee @ $10.50 USD /tonne	5,526,271	Yes
Case 10-Environmental Loan Forgiveness (40 % of Principal at 4 ½ Years	6,098,385	Yes
Case 11-Reduce Recycling Revenue fo Aluminum and Other Metals 25 %	3,752,273	Yes

The positive NPV for each of these cases means that over a 20 year term, the Investment has a positive value. In other words the discounted cash flow generated by the Investment is greater than the cost of the Investment and in seven of the nine cases there is sufficient cash flow in every year to pay required interest and principal. In cases 2, 6 and 11, a minor shortfall of cash flow exists for five to seven years; but in these cases, there is sufficient cash flow in subsequent years to pay off the loan on time and the Investment still generates additional cash flow and a positive NPV.

PCI also developed a second base case which takes into consideration the City of Chełm's concerns that the volume of MSW collected would be less than 44,000 tonnes per year. In Base Case No. 2, MSW collection was reduced from 44,000 tonnes per year to 35,000 tonnes per year. In addition, the capital costs of equipment and building were reduced 10 per cent and it was assumed that the City of Chełm would manage the facility with existing City of Chełm management. This eliminated the costs for a president, vice president and administrative staff. This Study developed ten (10) possible financial results of the Investment showing a range of critical variables and of financial outcomes. These ten results are summarized in the following table.

Financial Sensitivity Table

	NPV (US)	Is Cashflow Positive?
Case 1-Tipping Fee @ $14.00 USD/tonne	4,150,689	Yes
Case 2-Tipping Fee @ $10.50 USD/tonne	3,039,447	No/Years 1-2
Case 3-Tipping Fee @ $12.50 USD/tonne	3,674,443	Yes
Case 4-Tipping Fee @ $15.00 USD/tonne	4,468,188	Yes
Case 5-Reduce Construction Costs 10%/Tipping Fee @ $14.00 USD/tonne	4,599,261	Yes
Case 6-Increase Capital Costs 10%/Tipping Fee @ $14.00 USD/tonne	3,709,851	Yes
Case 7-Increase RDF Revenue to $28.75/tonne/Tipping Fee @ $14.00 USD /tonne	4,562,953	Yes
Case 8-Reduce O&M Costs by 10%/Tipping Fee @ $14.00 USD/tonne	4,643,927	Yes
Case 9-Environmental Loan Forgiveness (40 % of Principal at 4 ½ Years)	5,335,236	Yes
Case 10-Reduce Recycling Revenue for Al and other metals 25 %	3,353,683	Yes

The reduction in waste quantity has a significant impact on the financial viability of the Project. It requires the establishment of a higher tipping fee. In addition the capital costs must be reduced and the cost of management be covered by the utilization of existing City of Chełm management. This configuration of the Project is at higher financial risk that the base case configuration.

From a financial modeling and analysis perspective, each of these base cases and their sensitivities make reasonable assumptions about how the Investment will operate and generate positive cash flow over its entire life. Certainly, these projections are not guarantees that the Investment will perform as projected; but given the range of cases evaluated and the sizeable NPV for each of these cases, the Study shows that the Investment does have strong economics and can be justified from both a financial and environmental improvement standpoint.

1.8 Development of a Financing Plan

In order to present realistic financing options for a Waste-to-Energy Project investment in Chełm, the Study identified and evaluated three potential investment alternatives and developed a financing plan for each. These investment alternatives represent different investment risk and return profiles with financing structures and sources that are distinctly different. Each alternative, its related financing plan and its probabilities of success will require City of Chełm management to seek a balance between the City's desires to secure the required financing and its desire to surrender as little control as possible over the investment and MEHC in order to secure that financing.

The three investment options are as follows:

- The construction and operation of a waste handling and fuel preparation facility with the production of RDF to be sold to local a user(s), most likely the local cement plant. This is the lowest capital cost option.

- The construction and operation of the Project for the production of RDF to be sold to the local cement plant and MEHC. In this configuration a small RDF fueled hot water boiler capable of burning RDF will be added to the MEHC's Main Heating Plant. This option increases the capital investment substantially with a limited increase on revenue.

- The construction and operation of a large waste fuel combustion system, including the waste handling and preparation facility, which would be used for the production of heat for the MEHC and electricity for the sale to the regional electric distribution company.

The first two options anticipate the construction of the waste handling and preparation facility at the existing City of Chełm landfill. Depending upon the technology selected for option 3, this option would also include the waste handling and preparation facility, although the location of the facility could be at MEHC or the City of Chełm landfill. The City of Chełm administration expressed a strong preference for the smaller investment, the RDF and composting facility Project, which sells RDF to the cement plant.

From an investors' and lenders' viewpoint, the risk profiles, investment sizes and rates of return of these three options are is dramatically different. Therefore, PCI developed a different financing plan for each option targeted to a different group of potential financing sources. The second option, the RDF facility and small boiler installation, was determined to be the least attractive investment and dropped from the final evaluation.

The remaining two (2) options were evaluated based on six (6) risk criteria:

Risk Criteria	RDF/Compost Facility Option	Large Combustion Facility Option
Completion	Low	Low
Operations	Low	Low
Revenue	Probably Acceptable*	Acceptable
Fuel	Acceptable	Acceptable
Regulatory	Acceptable	Acceptable
Financing	Low	Acceptable

* Dependent on the cement plant remaining a customer for the RDF

The relative size of the two investments range from $8,000,000 for the RDF/Compost facility to $50,000,000 for the large combustion facility. Each option can be financed from different sources of funding under differing ownership structures.

The City of Chełm needs to pursue two distinct directions in order to secure financing for the Small Project. It is uncertain given the small size of the investment, the risk profile and the possible lower equity returns of this investment and the City of Chełm's stated preference to implement this investment without bringing in an outside equity investor that financing can be accomplished with traditional private funds. The first step is to look almost exclusively for as much financial support for the Project as possible from the non-private sector. While it is unlikely that the City of Chełm can secure EU related transitional funds, the City of Chełm can

secure funds from the national, regional and international environmental funds. Traditionally these funds require some equity commitment from the sponsor – perhaps 20% of the total capital required. By matching several programs together and the City of Chełm contributing the land on which the facility will be built as a form of equity, it may be possible to secure 100% of the financing for the Small Investment.

The Study has seen two factors at play in the financing sector that should increase the likelihood that an all equity financing can be put together. First, the Eco-Fund, which has significant funds available for these types of environmental improvements, prefers providing grants directly for municipal projects and prefers investments that might be considered marginal by private investors. Funds from this organization can be a basis on which other funds can be built. Second, the location of Chełm on the eastern outpost of the EU provides significant and not so subtle pressure on both the national government and the international funding sources to assist Chełm.

Assuming that the revenue risk profile is made acceptable, the Small Project can likely secure a construction and long term loan with conditions similar to the one likely to be secured by the Large Project. The only open issue will likely be the term of the repayment schedule.

Based on its discussions with both equity and debt providers, PCI believes the Large Investment will be able to secure private sector financing using a non-recourse or limited recourse project finance type structure.

On the equity side, PCI discussed the Large Investment with at least six target equity providers and all registered a strong level of interest. This interest is based in large part on:

1. The risk profile.

2. The size of the investment (an equity investment in the range of $9 - $11,000,000 is large enough to justify the amount of analytical and implementation work required to make the investment).

3. The projected economic returns.

4. The stable heat load of the City of Chełm.

5. The sales of electricity to the regional electric distribution company under the current cogeneration tariff structure and a competitive price if that tariff were to go away over the life of the Investment.

6. The proven technology to be used.

7. The use of waste fuel(s).

8. The opportunity to participate with PCI in the Large Project.

On the debt side, PCI expects that the Large Project can secure an interest only construction loan for the period of construction, testing and start-up. Once the Large Project has passed all required performance tests as outlined in the PC Contract and is operational, the construction loan will convert into a term loan with a repayment schedule of between 10 and 15 years.

The debt component should be at a minimum 70% of the total cost of the Large Project. In discussions with particular lenders and leasing companies, if the Large Project meets certain debt service coverage tests, a higher percentage of debt is possible. There is also significant interest among certain financial institutions because the Large Project plays to lenders' growing interest in financing projects that include a component of waste fuel, whether waste coal, MSW or waste sludge from treatment facilities. One international bank has a strong specialty in Waste-to-Energy Project finance transactions and has recently opened an office in Warsaw.

The results of these discussions with lenders regarding debt terms and conditions for a construction loan and a permanent loan, interest rates, fees, length of the permanent loan, expected closing costs and required reserves have been incorporated into the Large Investment's most recent financial projections. The results show an investment that meets both the return requirements of the equity investors as well as the coverage ratios and return requirements of targeted lenders.

The financial portion of this Study has shown that two types of Waste-to-Energy Project investments could be supported in the Chełm region. The major effort of the Study has been concentrated on the RDF/compost facility option based on the City of Chełm's preference for this option.

1.9 Evaluation of Regulatory, Social and Political Issues

From the first definition of a potential Project involving MSW through its development, financing, permitting, construction, testing and start-up – there are well over 1300 specifically identified tasks that must be completed. As the Project is being defined, the Project developer is constantly assessing the issues and risks associated with each task to determine those issues that might cause the investment to fail or be delayed. The Project developer must then determine if he can develop strategies that will remove or mitigate such issues as obstacles to the Project's success or acknowledge that the identified issues cannot be resolved. If resolution can not be achieved, the resulting investment opportunity has a low probability of success.

To establish the list of potential issues as well as possible mitigation options, PCI undertook a three-part investigation effort. First, using internally developed checklists from its own past evaluations of investment opportunities in Poland, PCI developed a list of more than 75 critical issues to evaluate in reference to the proposed Chełm Project. After an initial review, this list was reduced to fewer than 20 items.

Second, PCI held discussions with the Polish regulatory offices and agencies charged with the oversight at the local, regional and national levels of the construction and operation of investment projects, including those in which ownership interest might be held by non-Polish entities. Particular attention was focused on investments that include the handling and

combustion of MSW.

Third, PCI spoke with local officials and worked with a group of specialized consultants to verify the information gained in steps one and two. This was the basis to establish the final list of issues and to evaluate and to develop the logical mitigation approaches necessary and appropriate for this type of investment in Chełm. These specialists included consultants experienced in local issue identification, analysis and public relations, engineers aware of the current waste combustion technologies, heat production and fuel use technologies and EU standards for waste handling and combustion.

The issues that might arise as a result of the implementation of the proposed Project are minor. Further review of the twenty issues reduced the list to eight issues on which PCI focused final attention, only three of these might be viewed as problematic. First, for the investment to be successful, the City of Chełm must make a binding long term commitment to allow the City of Chełm's and region's MSW to flow to the facility. Second, the Project must meet all environmental discharge standards. Since the facility is simply sorting, separating and shredding the waste, not changing the nature of the waste – for example, not burning or gasifying the waste – it will be able to meet all standards without difficulty. Third, the local residents have already accepted the presence of the licensed landfill and since the facility is in effect extending the life of the landfill and encouraging a valuable type of recycling, it is unlikely that strong local opposition will be present.

1.10 Analysis and Conclusions

The Study has addressed several areas in assessing the feasibility of a Waste-to-Energy Project for the City of Chełm. Technical assessments were made of the quantity and quality of the MSW available in the Chełm regions as well as the state of the current disposal facilities. Potential sites for combustion of MSW either as a mass burn or RDF were identified and ranked by preference with the City of Chełm's management. Alternatives for the utilization of various components of the MSW were evaluated and a conceptual design was developed for the selected technologies. To support the technical approach for utilization of the MSW, investigations were made of the environment regulations, social issues and political issues which would impact the Project. To complete the Study, a financial analysis and pro forma were developed for the conceptual design and a financial plan was developed.

This Study has identified the following conclusions:

- An appropriate Waste-to Energy technology for Chełm is a facility the recovers recyclables, prepares RDF for sale and composts organic wastes.
- The facility will substantially reduce the volume of waste sent to the landfill.
- The facility will use proven U. S. based technology with equipment that is low tech, inexpensive to purchase, install, operate and maintain.

- The Study developed a cost estimate and Project schedule which supports a timely completion of the Project.
- The Project should be sited at the existing City of Chełm landfill.
- The Project can be permitted to Polish and EU standards.
- Combustion facilities, cement plant or MEHC, must be permitted to Polish and EU standards.
- The volumes of waste in the Chełm region support the small project.
- The facility will derive revenue from tipping fees for waste and sale of recyclables, RDF and compost.
- Success of the Project is based on long term delivery of waste and sale of recyclables, RDF and compost.

A viable Waste-to-Energy Project can be developed in the City of Chełm with the quantity of MSW currently available.

2. INTRODUCTION

In May of 2002, the City of Chełm, Poland ("Chełm" or the "City of Chełm"), the United States Trade and Development Agency ("TDA") and PCI Energy International, Inc.("PCI"), a United States company incorporated in the State of Illinois with its principal offices located in Schaumburg, Illinois, entered into a contract whereby PCI would prepare a feasibility study (the "Study") on the Chełm Waste-to-Energy project (the "Project"). On May 24, 2002 an agreement was signed between PCI and the City of Chełm for the Study. On May 29, 2002, a Grant Agreement was signed by the TDA whereby 50 per cent of the Study was would be as grant from the TDA and the other 50 per cent would be funded by PCI. The analysis performed as part of this Study could serve as the basis for an investment in the Chełm Special Economic Zone, including an investment made by PCI.

2.1 Study Concept

The City of Chełm, in response to a need to expand its existing landfill, extend the useful life of the landfill and desirous of finding an environmentally responsible way of addressing its region's waste problems sought the assistance of PCI and TDA. PCI is a firm with experience in dealing with municipal waste issues and in the design, implementation, financing, construction and production of investments that produce energy from waste fuels. The City of Chełm requested PCI to undertake a Study that explored the feasibility of designing, implementing and operating a waste-to-energy plant to be located in the City of Chełm.

In defining the scope of the Study, representatives of both the City of Chełm and PCI identified a number of key criteria that should guide or direct the efforts of the Study. The principle criteria are summarized as follows:

1. The recommended U.S. provided technology should maximize the use of the waste stream and minimize the material that ultimately goes into a landfill.

2. The recommended technology must be proven, simple and safe to operate and maintain. Similar commercial-sized facilities should exist that demonstrate continuous operating capability and have established an acceptable operating record.

3. The recommended technological solution must be able to meet all the environmental discharge standards of the existing Polish regulatory regime and be able to meet the expected standards that will be put in place when Poland becomes a member of the European Union.

4. The recommended solution must be able to secure external funding as the City of Chełm had little capability to provide capital for such an investment.

5. The recommended solution should leave as much of the control of the facility as possible in the hands of the City of Chełm; although the City of Chełm recognizes that goals four and five may be in conflict.

6. The recommended solution should be cost effective to build, operate and maintain. It should be seen as a model that other cities in Poland of similar size to Chełm could use to address a similar set of problems.

Midway through the Study a new City of Chełm Mayor was elected in the municipal elections of November 2002 and a new Vice Mayor was appointed. The previous administration did not express a strong opinion as to the direction the Study should follow. While the new City of Chełm management team remained committed to the original intent of the Study and desired its timely completion, the goal of this new City of Chełm leadership was to have the Study fully explore a specific outcome that it believed was in the best interest of the City of Chełm. A formal request was made by the City of Chełm to the USTDA to allow the Study to explore this option. USTDA approval was received by the City of Chełm and PCI added this option to the Study.

The Study focus shifted from primarily evaluating different waste handling and treatment technologies and combustion options to be sited at the Municipal Energy Heating Company ("MEHC"). The new focus was to explore those options that would produce refuse derived fuel ("RDF") as part of a waste handling and recycling system. The expectation of the City of Chełm and of Cementownia – Chełm, a local cement plant, was that the RDF produced by this facility could be combusted in the calciner of the local cement plant. Ultimately, the Study evaluated all the originally proposed options, although the order of this work was adjusted to more closely reflect the City of Chełm's goal.

The final Project configuration defined in the Study is the option that the City of Chełm asked the Study to fully explore. The Study also lays out a second option at the MEHC that is viable from a technological, economic and financial perspective.

2.2 Study Content & Process

In addition to the detailed work plan and schedule and the final report that any TDA Grant requires, the substance of the Study was set out in eight tasks that provided the basis for evaluating and identifying the optimal option(s) for the City of Chełm. These tasks were as follows and have been completed and are part of this report:

1. The evaluation of the existing municipal solid waste ("MSW") system to establish a reliable base of information and data from which to determine appropriate options or plans.

2. The assessment of the existing City of Chełm heat company, Municipal Energy Heating Company ("MEHC"), its equipment and operations to determine if the installation and operation of a new MSW based energy conversion technology or the modification of existing equipment to burn some type of MSW derived fuel was possible or feasible.

3. Based on the findings of Tasks 1 & 2, an evaluation of conventional waste to energy technical alternatives, including RDF, mass burn and gasification, was undertaken. This

evaluation included a screening process which took into consideration the volumes of MSW available in the geographical region of Chelm, the potential sites for the installation of any such facility, the possible uses for the product(s) produced by the facility, the environmental aspects and public acceptance of the alternatives.

4. The Study analyzed the conventional or proven nature of each technology and the technology's financibility from a variety of available funding sources. It also looked at the operations, maintenance and reliability aspects of each technology as well as its overall cost both to construct and to operate the facility to determine the economic feasibility of the option. Three technical options to make greater use of the MSW in the Chelm geographical region ("Chelm Collection Area") were explored. A final screening process yielded two acceptable options that met the various evaluation criteria. The screening identified a technical configuration preferred by the City of Chelm, a preferred site for the facility and two possible alternatives for the use of the primary product of this preferred technical configuration.

5. The development of a conceptual design for the technical configuration preferred by the City of Chelm in order to make preliminary selections of major equipment items, prepare plant layouts and estimate capital and operating costs.

6. The evaluation of the environmental impact of the preferred alternative in order to determine if the preferred alternative can be designed and operated in compliance with current Polish environmental emission standards as well as the currently expected emission standards that will be established when Poland becomes part of the European Union.

7. The preparation of a detailed financial analysis of the proposed Project based on the preferred technical configuration and taking into consideration the alternative uses of the primary products of this preferred configuration. A preliminary analysis of a second option that proved to be technically and economically viable was also undertaken.

8. The preparation of a financing plan identifying and evaluating the critical risk areas of the three potential technical options identified in 3 above. During this review one of the three options was eliminated and the emphasis was placed on the two remaining options. The financing plan for each option looked at possible ways of reducing or mitigating risk areas, alternative ways of structuring such an investment and identifying possible sources of debt, equity or government funding/grants. The availability of such funds for an investment depends upon a final risk and structure profile of the Project and the range of possible rate of return characteristics.

9. The identification of the key regulatory, social and political issues or risks that could potentially affect an investment based on the two potential technical options. Eight issues were identified and mitigation strategies that can be undertaken to control or minimize the potential negative impact of these issues on the timely execution and completion of the Project were identified.

2.2 Overview of the Study Results

Based on the results drawn from tasks 1 & 2 and the technical conclusions established in tasks 3 & 4, the Study effectively identified two waste handling solutions for the City of Chelm.

The first is the construction and operation of a small waste handling and preparation facility at the City of Chelm landfill that would use the waste stream of the Chelm waste collection area (the "Chelm Collection Area"). This facility would most likely be totally owed by the City of Chelm and would substantially reduce the volume of waste flowing into the City of Chelm's existing landfill.

The second is the construction and operation of the facility noted above plus the construction and operation of a boiler system at the MEHC's Main Heating Plant capable of burning the RDF produced by the facility. The size and design of the new boiler may also allow the use of other waste or low quality fuels available in the region. Under this scenario, MEHC and the Large Project would likely be purchased and controlled by a private investor not related to the City of Chelm. The City of Chelm would shed all responsibility to fund any of the capital improvements associated with environmental improvements that must be made at MEHC.

The Study then evaluated these solutions against the remaining critical criteria outlined in tasks 5 though 9. Based on this extended evaluation and the preferences of City of Chelm management, the Study concluded the optimal solution for the City of Chelm is to design, construct and operate a simple waste handling and preparation operation that will dramatically reduce the flow of waste into the City of Chelm's landfill. This waste handling and preparation facility will effectively receive, sort, separate and compost components of the received waste. Shredding of selected components of the MSW delivered to the facility from the Chelm Collection Area will provide a sellable RDF.

The Study explored the possibility that the facility could function as a waste handling facility for the Chelm Collection Area as well as for the larger region. While the Study actively explored several of these possibilities, its overall scope did not call for systematic and in-depth discussions or negotiations with neighboring communes about the use of the MSW of these communities in the Chelm facility. As a result, the Study assumed a Chelm Collection Area scope and used this MSW supply as the basis for its sizing, costing and investment evaluation conclusions. At any time in the future, the facility can accept and process additional delivers of MSW for two reasons. First, the flexible nature of the facility's operations allows it to process an additional 20% to 25% more waste with minimal equipment adjustments during a one shift operating. Second, the facility can add a second shift which gives it the capability to nearly double the volume of waste it can receive and process.

A by-product of this waste sorting process is that the facility will produce RDF from waste that is combustible. The RDF can be sold as an alternative fuel, thereby in part helping to off-set the cost of the installation and operation of the facility. Glass, metal and other recyclable non-combustible materials will also be collected and sold. The remaining waste that cannot be composted will go into the existing City of Chelm landfill.

The choice for the City of Chełm is how it seeks to implement and finance this preferred solution. This choice will have an impact on how much control that the City of Chełm retains over the ultimate Project and the existing MEHC.

The first option assumes that the City of Chełm undertakes this Project as a stand-alone City of Chełm endeavor, goes forward with no outside private investor. This provides the City of Chełm with maximum control but more financial uncertainty and there is the possibility that this alternative will prove not to be financable.

In this option, the Project relies solely on sales of the RDF to the local cement plant and accepts the risk that at some point the cement plant may no longer purchase this fuel or closes down for economic reasons. It is not practical to burn RDF in the existing boilers of MEHC nor is it possible to modify the fuel flow and combustion chambers of these boilers to accept RDF. Therefore, under this option, a new waste fuel boiler would need to be installed at MEHC. It is unlikely that any such changes can be made because neither MEHC nor the City of Chełm has the funds to make these modifications.

The reliance on only one end-user of the RDF product increases the overall risk of the Project. This higher level of risk, coupled with the low level of investment returns from the Project, makes the Project an investment that can only be financed through public sector or public-private sector funds, such as the Eco-Fund or the National Fund for the Environment.

The second option assumes that the City of Chełm brings in an outside investor into the Project, either as a sole owner or as a joint venture partner with the City of Chełm, in order to design, build and operate the Project. Because of the low returns from the Project, this outside investor, in order to secure an overall acceptable rate of return on its investment, will likely require the right to purchase a controlling stake in the existing MEHC. If such an arrangement were made, the City of Chełm would be relieved of any funding obligation for the Project and for any of the required environmental upgrades or capital improvements that will be needed at MEHC over the life of the facility.

3. EVALUATION OF CITY OF CHEŁM's EXISITNG MSW SYSTEM

3.1 Introduction

In order to be able to determine which technologies are the most appropriate for the City of Chełm ("City of Chełm") to optimally utilize its municipal solid waste ("MSW") in the production of energy, PCI undertook an evaluation of the City of Chełm's existing MSW system. This included a review of the existing collection system, the costs of this collection system, actual charges to end customers, staffing patterns, hours of operations and workflow at the landfill. In addition, a review was made of the schedules of pick-ups by type of customer, by location and the frequency of pick-ups and usual volumes of pick-ups, the seasonality of pick-up volumes, particularly in rural areas, current recycling programs in effect and the overall impact on these programs on the volume of MSW being delivered to the City of Chełm's landfill.

The evaluation of the quality of MSW available in the Commune Union of Chełm Region was made based on a physical inspection of the City of Chełm's collection procedures and equipment, inspection of the existing and new landfills and interviews with personnel of the Municipal Enterprise for Communal Economy, Ltd. (MPGK) in Chełm. PCI also evaluated the documentation provided by MPGK concerning the generation, collection and disposal of MSW in the Commune Union of Chełm Region.

In addition to the determination of MSW available in the Chełm Region, meetings were held with waste management officials of the cities of Lublin, Zamosc and Krasnystaw to assess the potential for and interest in obtaining additional waste from these communities.

The Commune Union of Chełm Region consists of the towns of Chełm and Rejowowiec Fabryczny and the following communes: Bialopole, Chełm, Dubienka, Kamien, Lesniowice, Rejowiec, Rejowiec Fabryczny, Ruta Huta, Sawin, Siedliszcze, Wierzbica, Wojslawice and Zmudz. The town of Chełm is the population center with 70,724 inhabitants. The total population of the area is 148,175 with 51 per cent living in towns.

Currently, the 15 administrative units of the Commune Union of Chełm have their solid waste collected and then delivered to 12 different landfills, the largest and most utilized in terms of volume being the existing Chełm landfill in the village of Serebyszcze. Most of these other 11 landfills are not constructed to meet current environmental standards and are approaching closure.

3.2 Methods and Procedures

A PCI senior staff member performed an on-site inspection of the City of Chełm's MSW collection and landfill operations on June 11 and 12, 2002. The individual that made this inspection is an experienced professional engineer with over thirty five (35) years of experience in energy related fields including the development, design and construction of MSW incineration facilities, biomass fired cogeneration facilities and landfill process designing.

The following methods and procedures were used in the evaluation of the existing MSW collection and landfill operation.

- Inspection of collection containers used as single family and multi-family housing units.
- Review of procedures for segregation of waste components; glass and plastics, etc.
- Inspection of collection vehicles.
- Inspection of the existing landfill and the new landfill under construction during the third quarter of 2002.
- Observation of the general characteristics of the MSW delivered to the landfill.
- Observation of land usage in the area of the landfills.
- Interviewed MPGK personnel to establish MSW collection procedures and frequencies.
- Obtained and reviewed of MPGK documents defining the current waste handling and disposal practices in the Commune Union of Chełm Region.
- Secured and reviewed of MPGK documents that forecast future population and waste generation trends in the Commune Union of Chełm Region.
- Evaluation of MPGK documentation and the establishment of parameters for selection of technologies for MSW reduction and utilization.
- Interviewed waste management personnel in Lublin, Zamosc and Krasnystaw to determine if additional quantities of waste are available.

3.3 Description of Waste District

The Commune Union of Chełm Region consists of the towns of Chełm and Rejowowiec Fabryczny and the following communes: Bialopole, Chełm, Dubienka, Kamien, Lesniowice, Rejowiec, Rejowiec Fabryczny, Ruta Huta, Sawin, Siedliszcze, Wierzbica, Wojslawice and Zmudz. The communes that belong to the Union are located in eastern Poland in a region between the middle part of the Bug River and the Wieprz River near the Ukraine border.

The town of Chełm is the population center with 70,724 inhabitants. The balance of the communes have populations that range between 3,100 to 12,250 inhabitants. The total population of the area is 148,175 with 51 per cent living in towns with the balance living in rural areas.

The Union consists of 15 towns and communes which are currently responsible for collect and disposal of MSW in their individual areas. Twelve (12) landfills are being utilized for the disposal of MSW, most of which do not meet modern construction standards and are approaching closure. Seven municipally owned companies are responsible for the collection and disposal of MSW in the Union. The largest operation is that of MPGK of Chełm which collects from the town of Chełm and in the area of Chełm, Kamien, Ruta Huta and Zmudz communes.

In addition to the MSW, a number of the administrations are responsible for the disposal of waste water treatment sludge.

The option of expanding the waste collection area was explored by meeting with officials of Lublin, Zamosc and Krasnystaw. Lublin is a city of approximately 500,000 inhabitants. Zamosc is a city of approximately 70,000 inhabitants, similar in size to the city of Chełm. Krasnystaw has approximately 35,000 inhabitants. These communities are within a 80 kilometer radius of Chełm. The transportation of waste en-mass or as refuse derived fuel from these communities to the proposed Project in Chełm is practical.

3.4 Waste Collection

The waste collection methods used in the City of Chełm have been assumed as typical for the Commune Union of Chełm Region. Collection from single-family dwellings is by single 110-liter container. All household waste is placed in the container which is picked up every other week on a regular schedule. Some single-family dwellings utilize a 240-liter container which is picked up every fourth week or once a month. Trucks used to collect from single-family dwellings do not compact the waste.

The volume of waste from single-family dwellings that have their own coal heaters are lower than the average per household waste volumes during the heating season because these households burn the combustible materials in the coal heaters. The remaining waste from these households is also of lower heating value due the replacement of combustible components with the ash from the coal fired heating system.

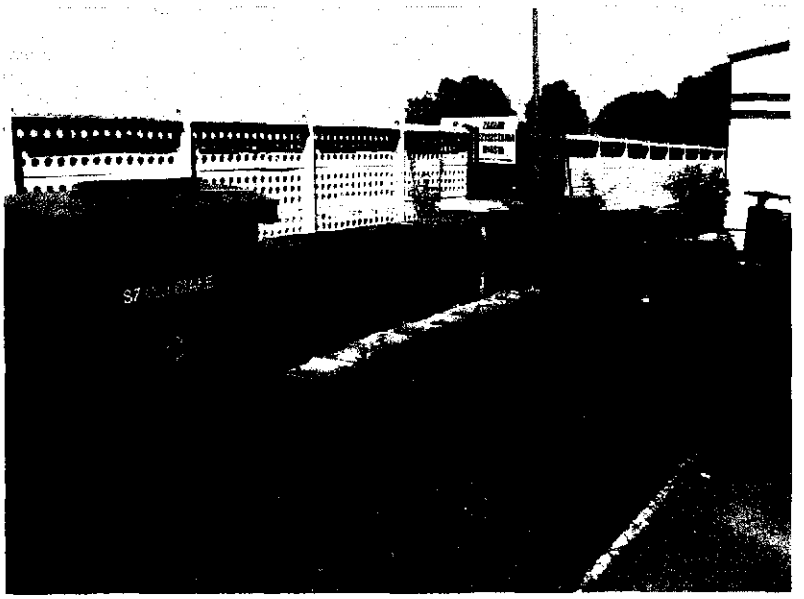


Figure 3-1 - Typical Collection Containers

Multifamily dwellings and apartments are serviced with 2.2 m^3 containers. The residents are responsible for placing the MSW in containers located adjacent to the dwelling. Collection of waste from the multifamily dwellings is on an as needed basis. The building management calls MPGK for pickups when the collection bins are full or approaching being full. Trucks used to collect from multifamily dwellings are equipped to compact the waste. MSW pickup is available to the multifamily dwelling on a six-day a week basis.

Figure 3-2 - Waste Separation Containers at Multifamily Dwelling

Chelm has started a program to separate the recyclable components of the MSW at the collection point. At selected multifamily dwellings separate containers are provided for plastics, clear glass, colored glass and all other waste.

Waste collected by MPGK is delivered to the City of Chelm's landfill at the village of Serebryszcze just outside of Chelm. The waste is placed in lifts and covered with selected soil. The delivered waste was not weighted at the landfill site during the first visit. A truck scale was added as part of the new landfill site addition and is currently in use. Private haulers as well as MPGK trucks were observed using the landfill. Private haulers are charged a tipping fee of $4.55 per cubic meter ($16.20 /tonne) which is applied on a selective basis by the operator at the landfill. Private/individual scavengers are allowed to sort through the waste to recover recyclables before it was compacted with a crawler tractor and covered. The existing landfill cell has almost been filled to capacity. A new landfill cell has been constructed adjacent to the existing landfill and is ready for operation. The new landfill is constructed to EU environmental standards complete with impermeable lining and monitoring facilities.

Figure 3-3 - MPGK Truck at Landfill

Discussions with the communities of Lublin, Zamosc and Krasnystaw have centered on determining the level of interest in utilizing incineration facilities in Chelm and the quantity of waste that would be available. It is assumed that Krasnystaw is close enough to Chelm that the collection vehicles would be used to transport MSW to Chelm. The distance from Zamosc and Lublin is such that the establishment of a transfer station and the use of a fleet of special purpose trucks to transport the waste would be required.

3.5 Waste Composition

The MPGK has classified the components of MSW into eight (8) categories. These categories are:

- Organic waste of vegetable and animal origin.
- Paper and cardboard.
- Glass.
- Plastics.
- Fabrics.
- Metals.
- Organic left-overs (rubber, leather, packaging wood, etc.).
- Non-organic left-overs including small mineral waste, debris, ash from hearth and furnaces.

The composition of the waste is projected to change over time as the use of prepackaged food products become more common and more individual residences are added to the district heating system. The projected comparison is shown in Table below.

Waste Composition Comparison By Weight

Year	2000	2010 (estimated)
Household organic waste	43.8 %	40.4 %
Paper and Cardboard	18.5 %	20.2 %
Glass	10.1 %	10.9 %
Plastics	6.0 %	6.8 %
Fabrics	2.0 %	1.9 %
Metals	2.7 %	2.5 %
Organic left-overs	3.4 %	4.7 %
Non-organic left-overs	13.5 %	12.5 %

Based on its discussions with the waste management personnel of neighboring communities, PCI anticipates that the composition of these neighboring waste streams will be similar to the MSW in the Chełm Region.

3.6 Waste Evaluation

The MSW generated in the Chełm Region contains the typical components of MSW found in Western Europe or North America. The waste appears to be higher in household organic waste and non-organic left-overs than a typical North American waste stream. In addition, the amount of paper and cardboard, which has a higher Btu value, is lower in the Chełm stream than in the North American stream. The MSW stream as received at the Chełm landfill would have a higher heating value closer to the low end of the normal range for MSW, probably in the range of 3,100 to 4,000 Btu/lb (7 to 9 MJ/kg). This fuel could be utilized in a mass burn incinerator or other waste-to-energy process. The use of selective sorting, removal of glass, metals and other non-combustibles will increase the heating value of the Chełm waste stream to 4,000 to 4,500 Btu/lb (9 to 10.1 MJ/kg). Separation of the household organic waste from the fuel stream or drying of the stream will increase the heating value even further. It will be necessary to leave all plastics in the waste steam in order to attain these higher levels of heat content, a heat content level necessary for refuse derived fuel.

Chełm has initiated a program to collect segregated waste from multifamily dwellings and by the use of strategically located containers for use by single family dwellings. Currently the MPGK is collecting glass and plastic separately from the remainder of the waste stream at selected collection points. This approach can be extended to the general population by the use of additional collection containers and separate pickups or by having single-family residences use plastic bags to separate the recyclable materials including metals from the waste stream. This approach would provide for the potential to sell recyclable materials.

The quality of the waste stream can be improved by selective sorting to eliminate the components that provide little or no heating value and to collect those components that can be sold for recycling – such items as glass or metal. The energy value of the waste stream can also be improved by additional fuel preparation in the form of shredding in order to optimize the creation of a refuse derived fuel. The remaining waste that cannot be sold or combusted can be composted or that waste that cannot be composted, can then be deposited in the landfill. Based on PCI's evaluation, if a waste separating, sorting, shredding and composting operation is constructed and operating, less than 15% of the MSW steam that now goes into the City of Chełm landfill will need to be landfilled in the future.

If the cities of Zamosc, Krasnystaw and/or Lublin are to supply waste to the Chełm facility, such waste could be presorted of large non-combustibles prior to delivery to Chełm. This will provide two benefits; first the presorting will reduce the load on the landfill by reducing the amount of non-combustible materials received. Second, the presorting will reduce the amount of processing that must be done at the Chełm facility.

3.7 Waste Quantities

The investigation of the quantities of MSW available in the Chełm area has been accomplished through a series of interviews with those responsible for waste collection and disposal and through the review and analysis of documentation provided by MPGK. This documentation profiled the waste currently collected and provided projections of future waste generation in the Commune Union of Chełm Region. It has become apparent that two potential cases for waste disposal exist in Chełm. The first case would be to base the waste-to-energy facility on the MSW that is available in the Commune Union of Chełm Region. The second case would be to expand the collection area to include waste from areas such as Zamosc, Krasnystaw and Lublin.

The volumes of MSW generated in the Commune Union of Chełm can not be accurately documented by MPGK. An independent analysis by PCI based on the data presented to PCI indicates that approximately 122 tonnes of unprocessed MSW is being collected in the Commune Union of Chełm per day, seven days a week. This is equivalent to 91 tonnes of combustible, recyclable and compostable waste per day. This quantity of waste would be sufficient to supply a portion of the fuel that the cement plant requires or support the installation of a new incinerator, gasifier or boiler conversion at the City of Chełm's heat company. A detailed breakdown of the waste is presented in Appendix 1.

The addition of waste from neighboring cities would increase the scale of the production of RDF for the combustion operation. Interviews at Zamosc and Krasnystaw have identified an additional 122 tonnes of unprocessed waste. The addition of this waste would effectively double the amount of the RDF for combustion that could take place at Chełm and dramatically improve the economics of any type of Waste-to-Energy Project due to the scaling factor.

Lublin produces approximately 455 tonnes of MSW per day. Discussions with officials in Lublin did not generate any interest in the transport of MSW to Chełm as Lublin already has a full scale program for handling its MSW.

Based on the quantities of waste available, PCI has determined that after the completion of the Study, the City of Chełm should continue to evaluate two options. The first would be to utilize the waste generated in the Commune Union of Chełm Region, 122 tonnes. The second would be to look at a facility that would be a regional facility with a capacity to process between 225 and 290 tonnes of unprocessed waste on a daily basis. A detailed breakdown of the waste is presented in Appendix 1.

3.8 Conclusions

The Commune Union of Chełm Region is responsible for the collect and disposal of MSW within its area. Currently waste is collected from single family and multi-family dwellings under the direction of 15 administrative units and by seven different collection organizations. The City of Chełm has initiated a program to segregate components of the waste stream for possible recycling.

The MSW components reported by MPGK are typical of MSW found in Western Europe or North America. The percentage of high moisture components, vegetable and animal waste, and the lower percentage of paper and cardboard indicate that the MSW in Chelm would have a heating value toward the lower end of the range reported for MSW in North America or Western Europe. This waste stream could be utilized in a mass burn, refuse derived fuel or gasification application. The quality of the fuel from the MSW can be improved by sorting, shredding, and pretreatment making a refuse derived fuel a viable alternative.

The MSW will make a satisfactory RDF fuel for a Waste-to-Energy Project to be located at the City of Chelm. Based on the quantities of waste available, PCI has determined that after the Study is complete, the City of Chelm should continue to evaluate two options, regardless of technological choice. The first would be to utilize the waste generated in the Commune Union of Chelm Region, 122 tonnes. The second would be to look at a facility that would be a regional facility with a capacity of perhaps 225 to 290 tonnes of unprocessed MSW.

4. ASSESSMENT OF MEHC AS A POTENTIAL PARTNER FOR MSW ENERGY PRODUCTION

4.1 Introduction

In order to help determine which technologies are the most appropriate for the City of Chełm ("City of Chełm") to optimally utilize its municipal solid waste in the production of energy, PCI undertook an evaluation of the existing heat generating assets of Municipal Energy Heating Company ("MEHC"), the City of Chełm heat company. This evaluation was undertaken to determine if there might be synergistic benefits that would accrue in any way to the proposed Waste-to-Energy Project and MEHC if their activities were more fully coordinated. An evaluation was made to determine if existing MEHC generating assets might be a user of any type of fuel that might be produced by a waste-to-energy plant. In addition, the MEHC main plant was evaluated as a host site for a new combustion facility and for a fuel preparation site.

Central to this evaluation was a review of the Centralna Cieplownia (the "Main Heating Plant") and Cieplownia Szczytowa (the "Peaking Plant") of MEHC. The initial evaluation included determining the locations of these existing two plants, the locations of the hot water distribution network, the load profile or load duration curve of the MEHC, particularly in the low demand heating months of April through September, the current and projected load forecasts for MEHC. Further investigation included a review of the maintenance records and operating history of the Main Heating Plant's four boilers and management's projections for necessary capital improvements or environmental upgrades at the Main Heating Plant. The most important portion of this review was an in-depth assessment of the Main Heating Plant that includes four coal fired hot water boilers that generate hot water for distribution to customers throughout Chełm.

The assessment of the Main Heating Plant was conducted to determine the feasibility of burning solid waste fuel, what forms of fuel could be accepted by any of the four boilers, if sufficient space exists for potential plant fuel handling and feeding modifications. An assessment was also made of the potential to install new equipment and if there is sufficient space for fuel delivery and storage for an alternative fuel.

4.2 Inspection Methods and Procedures

A PCI senior staff member performed on-site inspections of the City of Chełm's Central Heating Plant on June 12, 2002 and December 5, 2002. The individual that made this inspection is an experienced professional engineer with over thirty five (35) years of experience in all aspects of coal fired power plant design and operation. The following methods and procedures were used in the evaluation the Main Heating Plant and MEHC.

These methods and procedures included:

- Walk through inspection observing the general appearance, condition and configuration of all major equipment within the Main Heating Plant boiler building areas.

- Walk through inspection of fuel handing area of the Main Heating Plant including coal yard, coal unloading, stock piling and reclaiming equipment.

- Walk through inspection of the boiler gas discharge systems including cyclone separators, electrostatic precipitators, flues, ducts, induced draft fans and stack.

- Walk through inspection and visual observations of pumping equipment including primary pumping and main pumping facilities including pumps, piping, valves.

- Inspection of boiler control systems including control panels, instruments, transmitters, gages and related instrumentation.

- Inspection of the Main Heating Plant's electrical apparatus including electrical motor controls, substation, power distribution and related facilities.

- Walk through inspection of the Main Heating Plant's site noting configuration of all buildings, structures, roads, open areas and related facilities.

- Review and inspection of operating records of the Main Heating Plant including drawings of existing facilities.

- Meetings, discussions and interviews with management personnel regarding the operation of the Main Heating Plant.

- General review of all support facilities at the Main Heating Plant including water, sewer, electric power and related auxiliary systems.

- Observation of existing coal feed and related systems with respect to identification of modification required to burn refuse derived fuels in the existing boilers.

- Identification of space on the Main Heating Plant site for construction of new waste to energy technology process.

These inspections were made during a time when the Main Heating Plant was undergoing summer maintenance in June 2002 and during operation in December 2002. Substantial maintenance activities were observed in preparation for the winter heating season.

4.3 Chelm District Heating System

The Chełm district heating system consists of MEHC's two existing heating plants, Centralna Cieplownia (the "Main Heating Plant") and Cieplownia Szczytowa (the "Peaking Plant") and an extensive underground hot water distribution system. The Cieplownia Szczytowa plant was the first plant constructed for the district heating system. It contains four hot water boilers with a total rated capacity of 34.88 MW_{th}. The boilers were installed from 1975 through 1981. The Centralna Cieplownia plant was constructed in 1983 with the last boiler installed in 1994. It has

four hot water boilers with a total installed capacity of 115.77 MW_{th}. This Main Heating Plant has a large amount of undeveloped land associated with it.

MEHC operates a hot water distribution system consisting of 52,597 meters of underground supply and return piping that runs throughout the City of Chełm. The furthest distributing point is 6,858 meters from the nearest heating plant.

The system has an annual production rate of approximately 1,000,000 GJ of energy in the form of hot water. The system load varies for a low of approximately 10 MW_{th} during the summer months to a high of approximately 92 MW_{th} during the coldest days in the winter. During the summer months, the Peaking Plant is operated while maintenance is performed at the Main Heating Plant. Also the Peaking Plant has the smaller boilers that are a better match to the summer hot water loads.

4.4 MEHC Plant Descriptions

The inspection started with a general meeting with the president of MEHC during which the general operations of the system were reviewed. Based on these discussions it appears that the system has a total of approximately 240 employees covering all aspects of the operation including operation of the two plants together with the district heating system. It appears that employees are well trained and very capable of operating the existing facilities. In addition, the existing staff with few, if any, new employees should be capable of operating any new alternative waste-to-energy process systems including:

- Refuse derived fuel delivery and combustion system.
- Mass burn system.
- Gasification system.

From a staffing and administrative review MEHC appears to be an ideal candidate for the application of waste-to-energy technologies.

4.4.1 Peaking Plant

The first MEHC plant to be constructed was the Cieplownia Szczytowa, the Peaking Plant. The first boiler at this facility was placed into service in 1975. The build out of the facility was completed when the fourth boiler was placed into service in 1986. This plant is the smaller of the two facilities with the boiler ratings ranging from 5.81 to 11.63 MW_{th}.

The following tables provide a summary of the major equipment installed at the Peaking Plant along with the general operating conditions.

Peaking Plant Equipment

	Cieplownia Szczytowa Peaking Plant			
Boiler No.	1	2	3	4
Boiler Model	WR-10	WR- 10	WR-5	WR-5
Reported Installed Date	1975	1979	1986	1981
Rated Capacity, MW	11.63	11.63	5.81	5.81
Reported Efficiency %	78	78	82	82
Design Pressure, bars	1.6	1.6	1.6	1.6
Design Temperature, °C	150	150	150	150
Producer	"FAKOP"	"FAKOP"	"FAKOP"	"FAKOP"
Model	c-41ϕ900	c-41ϕ900	c-41ϕ900	c-41ϕ900
Manufacturer	INSAL - Lublin			
Year of Production	1985	1980	1971	1971
Particulate Collection Efficiency, %	94.5	94.5	94.5	94.5

Peaking Plant Pumps

	Cieplownia Szczytowa Peaking Plant			
Pump No.	1	2	3	4
Service	Circulating	Circulating	Recirculating	Supplemental
Model	W14PC	W14PA	5A20	50PM180
Year of Production	1980	1980	1980	1980
Quantity	5	2	4	2
Power, kW	45.0	30.0	15.0	22.0
Type of Control	Manual	Manual	Manual	Regulating Valve

A site visit was not made to the Peaking Plant due to the small capacity of the boilers and the facility's distant location from the City of Chelm's landfill.

4.4.2 Main Heating Plant

The second MEHC plant is the Centralna Cieplownia, the Main Heating Plant. This facility has four hot water boilers, which were installed starting in 1983 with the fourth boiler installed in 1994. This plant was laid out to facilitate future expansion. The current boiler house has space to install two additional boilers rated at 46.0 MW. Adequate land is available for future expansion for new combustion technology or alternate fuel handling or storage. A separate boiler facility for alternate fuel could be erected on the site including fuel preparation and storage areas.

The Main Heating Plant has a large area for coal storage. Coal can be received by rail or truck. Currently coal is being received by truck based on an analysis of the delivery costs. The roads and infrastructure support this method of fuel delivery and would support the delivery of an alternate fuel.

The combustion and gas cleaning equipment including operating conditions are described in the following table.

Main Heating Plant Equipment

	Centralna Cieplownia Main Heating Plant			
Boiler No.	1	2	3	4
Boiler Model	WR-46	WR- 25	WR-25	WR-10
Reported Installation Date	1994	1984	1984	1983
Rated Capacity, MW	46.00	29.07	29.07	11.63
Reported Efficiency, %	84	83	83	78
Design Pressure, bars	1.6	1.6	1.6	1.6
Design Temperature, °C	150	150	150	150
Producer	"AEFAKO" - Sedziszow			
Model	Electrofiltr EGBMI-17-96-2	Cyklon DI-1120		
Manufacturer	SF-Cleanair-fin	"Konwent"		
Year of Production	1993	1982	1982	1982
Particulate Collection Efficiency, %	99.0	90.0	90.0	90.0

The pumping assets of the Main Heating Plant are listed in the following table:

	Main Heating Plant CENTRALNA CIEPLOWNIA							
Pump No.	1		2	3	4	5	6	7
Service	Circulating		Circulating	Recirculating	Recirculating	Recirculating	Supplemental	Stabilizing
Model	20W39A		W14PC	12C40	6C20	8A25	PJM65	32YSM
Year of Production	1990	1983	1983	1982	1982	1992	1982	1982
Quantity	1	3	2	1	2	2	2	2
Power, kW	250.0		90.0	37.0	15.0	70.0	7.5	5.5
Type of Control	VFDI	Manual	Manual	Manual	Manual	Manual	Manual	Manual

4.4.3 Main Heating Plant Evaluation

The site of the Main Heating Plant is large enough to accommodate any of the proposed refuse-to-energy technology installations that were evaluated as part of this Study. Therefore an inspection and evaluation of the Main Heating Plant is an important and necessary part of this Study.

An inspection of the Main Heating Plant was made to determine the general condition of the existing equipment and facilities. The Main Heating Plant is located on a large site of approximately 39 acres. It consists of three buildings; a water treatment building and two-boiler buildings that are joined together. In addition, an administration building and a maintenance building are provided on the site.

Figure 4-1 - Main Heating Plant

The boiler buildings are located between the coal storage area and the pollution control equipment and common stack. The water treatment equipment building is adjacent to the building that houses the older boilers. The older boiler building contains three boilers; (2) – WR-25 and (1) – WR-10. During the initial inspection, the Main Heating Plant was down for maintenance. The coal chutes had been removed from the boilers and the boiler fronts removed to access the stoker grates. The general appearance of the equipment is good. No abnormal wear was noted on the grates, grate supports or drives. The WR-10 boiler was undergoing extensive repair work on the sidewalls and insulation. This repair work appeared to be first class. During the second inspection in December 2002, all boilers had been restored to operating condition. Coal feed systems had been reinstalled and several boilers were in operation.

Routine maintenance activity was noted on the WR-46 boiler. In general, the boilers appeared to be in good condition and the boiler buildings are maintained in good condition.

Figure 4-2 - Stoker Discharge - WR-25 Boiler

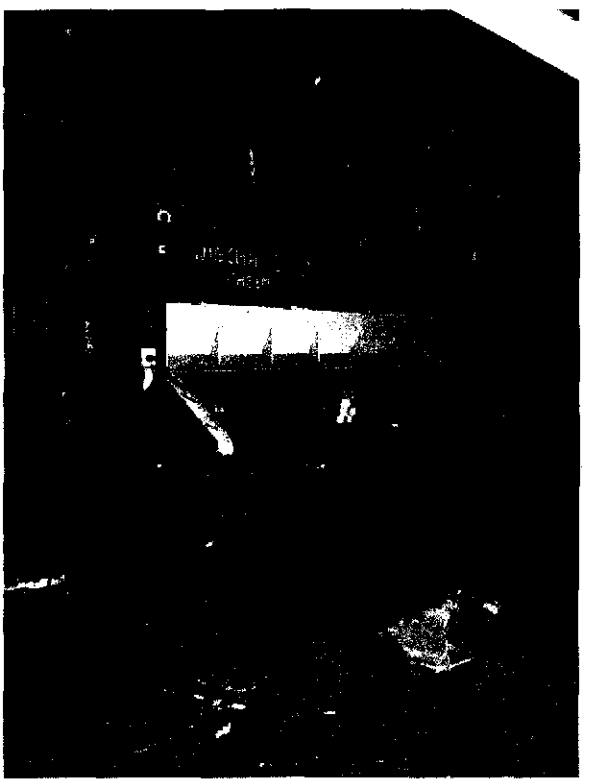


Figure 4-3 - Stoker Discharge - WR-10 Boiler

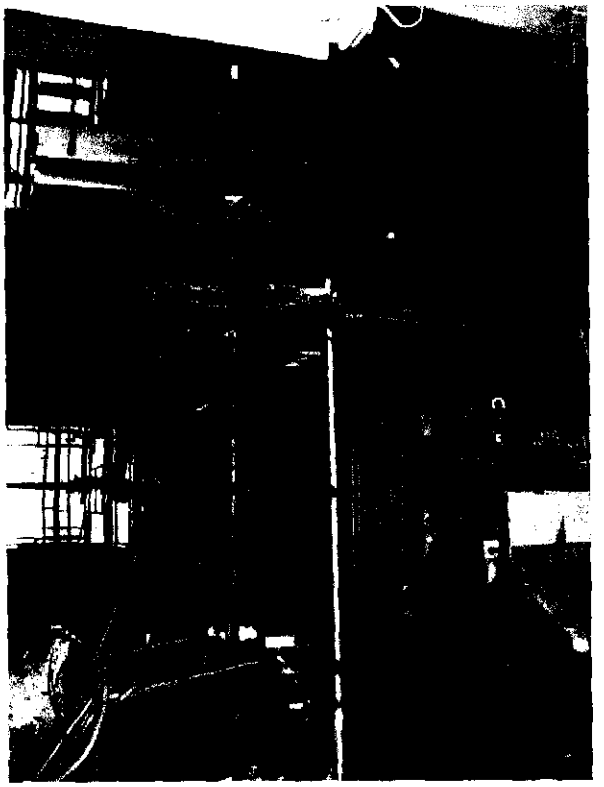


Figure 4-4 - WR-10 Boiler Sidewall and Insulation Repair

A general inspection was made of the major pump systems. Both process pumps and hot water distribution pumps were inspected. The pumps were well maintained. No indications of leaks or misalignments were noted. Pipe supports and insulation were in good condition.

Figure 4-5 - Process Pump

Figure 4-6 - District Distribution Pumps

Two types of flue gas cleaning equipment are used at the plant. The older boilers are equipped with cyclone separators. These units are reported to have a particulate removal efficiency of 90 per cent. These units will not meet the future Polish or current European (EU) emission standards for dust removal. The collection efficiency for these units can probably be brought into compliance with the addition of a baghouse installed between the cyclones and the stack. The WR-46 boiler is equipped with an electrostatic precipitator. This provides a collection efficiency of 99.0 per cent which meets current emission standards for particulate. All of the boilers discharge to a common 100 m high stack. All ductwork, dust collectors and the stack appear to be in good condition.

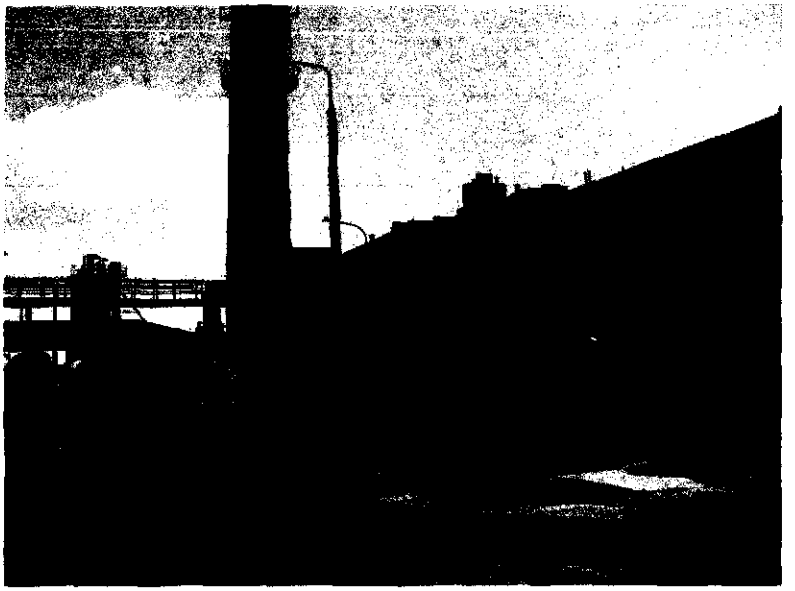


Figure 4-7 - Cyclone Separators, Ductwork and Stack

Figure 4-8 - Electrostatic Precipitator and Ash Silo

The ash generated from the combustion of coal is conveyed from each boiler by a system of mechanical conveyors to a single ash storage area. The ash is disposed of by transporting it to the local cement plant for use in the cement manufacturing process. MEHC trucks haul the ash to the cement plant. Ash is also used by farmers as a road building material.

4.5 Alternate Refuse Fuel Options

An evaluation was made to determine if the Main Heating Plant is capable of being modified to burn alternate fuels derived from municipal solid waste. The plant currently burns stoker grade coal fed to the boiler from the coal storage area to the boilers through a series of conveyors and coal feed chutes. To utilize the existing boilers to burn an alternate fuel, such as prepared RDF, a system must be developed to convey the alternate fuel to the boiler(s). It is envisioned that the alternate fuel would be a mixture of paper, plastics and other combustible materials that have been separated from the municipal solid waste stream and pretreated to form an acceptable solid fuel. The pretreatment would be a combination of shredding, mixing, compacting and/or pelletizing to create a material that can be uniformly distributed on the stoker grate along with the coal.

Alternate fuels will normally not have physical properties similar to the coal. The difference in physical properties makes it impractical to blend the alternate fuel with the coal at the storage area. The coal and alternate fuel will segregate during the conveying process and become a non-uniform fuel mix when distributed to the stoker grate. This condition could create combustion control problems and hot spots on the grate that would damage it. To assure uniform feeding of an alternate fuel, a separate alternate fuel feed system must be provided to the stoker system.

During the initial inspection, the coal feed chutes were removed or partially removed from the fronts of the boilers. This condition complicated the visualization of the exiting coal feed system configuration. During the second inspection of the plant the boiler fronts and feed chutes were in place. The general observation is that sufficient space is not available along the boiler front aisle and at the front of the boilers to convey and deliver an alternate fuel. The coal conveying system occupies all of the space along the boiler fronts between the building supports. The boiler fronts do not have sufficient free space for the addition of a second set of feeders.

Based on the configuration of existing equipment including boilers, fuel (coal) handling equipment and limited spare in the existing boiler building at the front of the boiler(s) it is not practical to burn RDF in the existing boilers.

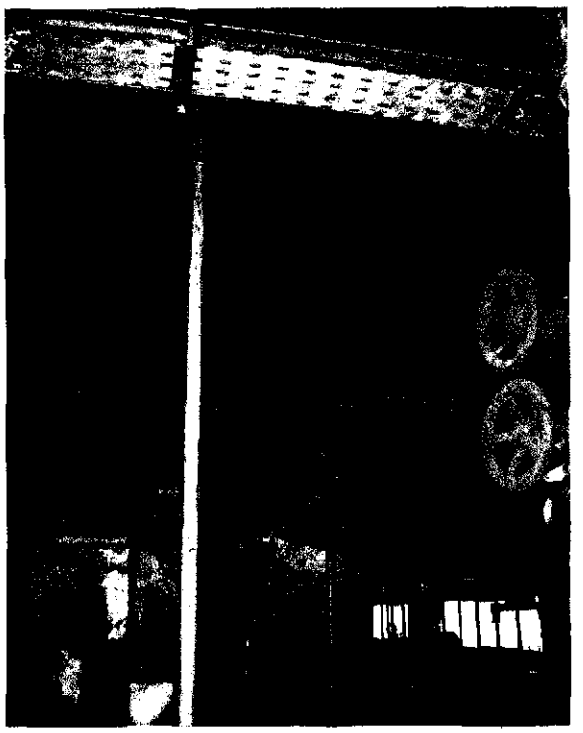


Figure 4-9 - Boiler Front and Coal Chutes

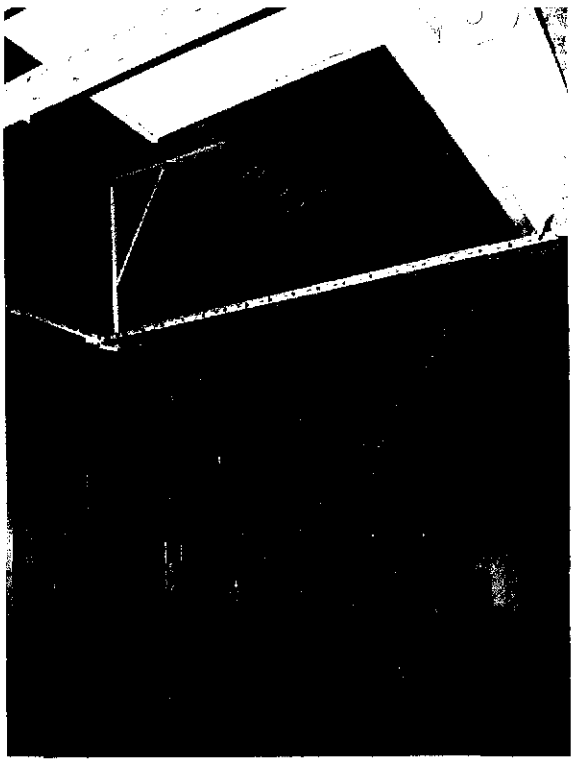


Figure 4-10 - Boiler Front and Coal Chute

To utilize a fuel produced from the Municipal Solid Waste at the MEHC main plant site, a new combustion boiler specifically designed to burn RDF would be required. One approach would be to provide a hot water boiler which would burn a fuel prepared from the combustible components of the MSW. This fuel could be prepared at the plant site or at a remote location. The utilization of a prepared fuel would minimize the amount of ash and non-combustible residue that would have to be disposed.

The second approach to utilizing MSW as an alternate fuel would be to minimize the pre-combustion preparation and "mass burn" the waste. Mass burn technology would not be practical with the existing boilers. The grate system utilized in mass burn applications is substantially different from the grates in the existing boilers. A new boiler designed to mass burn refuse, complete with fuel storage, fuel conveying and feeding system as well as ash handling and emission controls would be required. The ash generated from mass burning would not be compatible with the cement making process and would require disposal in the landfill. If the mass burn technology were to be used, sorting of the ash for recyclables may be an option to reduce the load on the landfill. Mass burn technology is not the preferred method of incinerating waste in Europe. The recovery of recyclable materials prior to combustion is the technology of choice.

The third approach would be to gasify the municipal solid waste and burn the produced gas in the existing boilers. This approach would require limited presorting of the waste to remove large non-combustible items and the installation of gas burners on two of the existing boilers. The

utilization of the produced gas in engines to drive electric generators will also be considered. The quantity of gas generated would be sufficient only as a supplemental fuel for one of the existing boilers. Gasification is the newest of the technologies being considered in this Study and will require the most in-depth evaluation to assure a reliable system is provided. The residue generated from the gasification process would not be compatible with the cement making process and would require disposal in the landfill. Again, sorting of the residue for recyclable materials may be an option to reduce the load on the landfill.

4.6 Equipment Installation Options

The Main Heating Plant has been constructed on approximately 39 acres. The second boiler building was constructed with adequate space for the installation of two additional WR-45 boiler. The addition of an additional hot water boiler in this space would be unlikely if a gasifier or MSW incinerator is installed. This free space could be used for a steam turbine generator or other auxiliary equipment required for a gasifier or MSW incinerator. Due to the fuel feeding requirements, a gasifier or MSW incinerator would be constructed in a separate building adjacent to the existing boiler building.

The plant site has sufficient open land adjacent to the existing boiler building for construction of an additional MSW fired boiler and related auxiliary equipment. A site plan is attached showing potential new installation sites, see Appendix 2.

Figure 4-11 - Area Adjacent to Main Heating Plant

The area from the coal pile adjacent to the boiler house is essentially open except for an access road. In addition, the areas to the back of the boiler house and to the right of the boiler house are also open and available for new facility construction. This preliminary investigation indicates that sufficient area is available to construct either a gasifier or a MSW incinerator and provide adequate fuel storage to assure continuous operation.

Figure 4-12 - Open Space Adjacent to Main Heating Plant

4.7 Conclusions

The Main Heating Plant is situated on a large site of approximately 39 acres. The plant has good road access and is currently receiving all coal deliveries by truck. The plant consists of a coal receiving and storage area, a water treatment building, two adjoining boiler building and particulate collection equipment, ductwork and a common stack. In addition, the site has an administration building, maintenance facilities and an ash storage area.

A visual inspection of the equipment determined that it is maintained in good condition. During the initial site visit all four boilers were down for summer maintenance. A visual inspection showed the interior of the boiler(s) to be in good condition. The WR-10 boiler was undergoing substantial repair to the sidewalls, insulation and lagging. All of the pumping equipment is in good repair and well maintained.

The Main Heating Plant is a good candidate site for the burning of select alternate fuels. The initial assessment indicates that sufficient space is not available along the boiler front aisle and at the boiler fronts to convey an alternate fuel supply. To utilize the existing boilers, it is assumed that the alternate fuel would be burned along with coal. This will require the installation of additional alternate fuel feeders on the boilers. Space considerations have eliminated the use of existing boilers as combustion sources.

The use of MSW incineration technology or gasification technology will require the construction of a new boiler or gasifier. The space is available on the site for the new facilities and fuel storage. All the utilities required to support the new facility are available on site.

5. EVALUATION OF TECHNOLOGICAL ALTERNATIVES

5.1 Introduction

Using the base of information gathered from its evaluation of the City of Chelm's MSW system and Municipal Energy Heating Company ("MEHC"), PCI next undertook an evaluation of alternative waste-to-energy technologies available in order to select the most appropriate technology for the Chelm Project. To accomplish this task, PCI investigated the available sites for a waste-to-energy facility, the logistics of waste handling, the available waste reduction/separation technologies and a range of waste combustion and utilization technologies.

5.2 Methods and Procedures

In addition to the methods and procedures already outlined in Sections 3 and 4 of this Report, PCI staff undertook the following procedures to evaluate the available options for the design and construction of a waste-to-energy facility in the City of Chelm.

- Made additional observations of the general characteristics of the MSW delivered to the landfill.
- Completed the evaluation of MPGK documentation and established the parameters for selection of technologies for MSW reduction and utilization.
- Evaluated the available space for new equipment at MEHC's Main Heating Plant.
- Concluded an evaluation of the current operations, the configurations of the boilers and the material handling systems at MEHC's Main Heating Plant.
- Made a site visit to and inspected the cement plant to determine equipment configurations.
- Selected potential waste-to-energy facility locations at each site.
- Developed preliminary conceptual process designs.
- Identified potential equipment suppliers based on these conceptual designs.
- Obtained operating data and drawings from potential equipment suppliers.
- Established a ranking methodology and evaluation system for technologies being considered.
- Established a ranking of potential sites/end users of energy.
- Developed a preliminary rating matrix for technologies.

5.3 Description of Existing Facilities

PCI identified three (3) sites in the Chełm region at which a potential waste-to-energy facility could be located.

Site 1 – The Existing Landfill: The City of Chełm currently operates its landfill facility in the commune of Serebryszcze. The landfill consists of two (2) cells. The older cell is anticipated to close in 2003 and the new cell, completed in 2002, was constructed to modern design standards including impermeable linings and monitoring systems. A new entrance has been constructed to the landfill area complete with a truck scale. This entrance, including the truck scale, is currently being utilized to obtain accurate records of the amount of waste being deposited in the landfill. The area around the landfill is undeveloped land. This land has been allocated by the City of Chełm for a waste utilization facility.

Site 2 – MEHC Main Heating Plant: The Main Heating Plant of the MEHC has been developed on a large property in an industrial area of the City of Chełm. The property currently consists of a coal storage area, a water treatment building, a boiler building with four (4) boilers, flue gas cleanup equipment, ductwork, stack and ash storage area. In addition, the site contains an administration building, maintenance facilities and access roads. A survey of the MEHC site indicates that sufficient space is available for the installation of additional combustion equipment for either mass burn technology or refuse derived fuel ("RDF"). The boiler building has space to install two additional 46 MW_t hot water boilers. This space would be available for either combustion equipment, a turbine generator or water treatment equipment. Sufficient space is available for a waste utilization facility if RDF is to be prepared on site. Roads for site access currently support the delivery of coal by truck for the existing boilers, although in the long run, upgrading of the existing roads will be required.

Site 3 – Cement Manufacturing Plant: Plant management has expressed an interest in utilizing alternate fuels in the cement plant production process and a mixture of shredded plastic film and paper, making up approximately 3% of its fuel, is currently be burned in its calciner. It is the management's desire to increase the use of alternate fuel to approximately 10% of the plant's total fuel requirement. The plant currently operates one kiln. This equipment was installed in 1998 and the use of an alternate fuel might also be considered in the rotary kiln. The cement plant is on a large open site on which there is more than sufficient open space to install a waste-to-energy facility or even a waste handling facility capable of producing RDF.

The three sites are within a reasonable distance of each other. The landfill and the cement plant are within line of sight of each other and are an estimated 5 to 7 kilometers from each other by road. The heating plant is within 7 to 10 kilometers of the other two plants. All of the facilities are in industrial or rural settings that would be satisfactory for industrial development.

5.4 Combustion Technologies

There are three general types of combustion technologies that PCI evaluated in its Study of the Waste-to-Energy Project in Chełm.

1. Mass burn technology.

2. Production of a fuel derived from the waste RDF that is in turn combusted.

3. Gasification technology.

5.4.1 Mass Burn Technology

The simplest incineration approach is the mass burn technology. The waste as collected is fired in a boiler with a specifically designed grate system for the combustion of mixed waste. No presorting of the waste is required except for large items such as household appliances, which would not pass through the boiler feed system. This technology reduces the volume of waste by approximately 90 per cent and 75 per cent by weight. Recyclable materials, metals and glass, can be recovered from the ash thus further reducing the amount of material that is placed in the landfill.

5.4.2 Refuse Derived Fuel ("RDF")

Several combustion technologies based on the preparation of RDF are suitable for consideration for application at Chelm. RDF is produced by sorting and separating the waste stream in order to collect the combustible materials and then by shedding or using other methods of size reduction to create a prepared fuel. Depending on the methods of preparation, RDF can be fired on conventional chain grate stokers, spreader stokers, in starved air combustors/gasifiers, fluidized bed boilers or process equipment like cement plant calciners or rotary kilns.

One potential use of RDF would be as a supplemental fuel in the existing boilers of MEHC's Main Heating Plant. The handling characteristics of the RDF are substantially different than the coal that these boilers currently burn so that a separate feed system including major boiler modifications would be required to obtain uniform distribution of the RDF on the stoker. In addition, the RDF could only make up a limited percentage of the heat input to the boiler. Considering the heat load of MEHC during the summer versus the quantity of RDF available at the same time, MEHC summer operations would not fully utilize the available RDF. RDF is not a material that can be stored for an extended period of time when the heat required from MEHC is less than the quantity of fuel that needs to be burned.

A second potential user of RDF is the local cement manufacturing plant. As noted in the previous section, the cement plant currently burns about 3% of alternative fuel – paper and plastic - in its calciner and management would like to increase that percentage to about 10%.

RDF could also be the fuel for a new boiler facility to be installed at the MEHC Main Heating Plant. A new boiler facility would be designed to generate steam and electricity and allow for steam extraction from the steam turbine to provide a heating load when required.

5.4.3 Gasification

The utilization of heat to manufacture a gaseous fuel from waste is called gasification. This technique is an emerging technology for the creation of clean gaseous fuels for use in boilers and internal combustion engines. In Chełm the gasified fuel could be used as supplemental fuel in the existing hot water boilers or in new boilers to generate steam and electricity. The gasification product could also be used as a fuel for spark ignition engines to drive electrical generators.

Several "gasifier" technologies were investigated for application in Chełm. The commercially available units were in fact two stage incinerators in which the first combustion chamber is operated in an oxygen starved condition to produce a gaseous fuel which was used to fuel the second stage combustion chamber to complete the combustion cycle. This type of unit is applicable to the Chełm Waste-To-Energy Project but is not considered a true gasification process. Production of gasified fuel has been demonstrated on a commercial level with bio-mass fuels and in smaller units on medical waste.

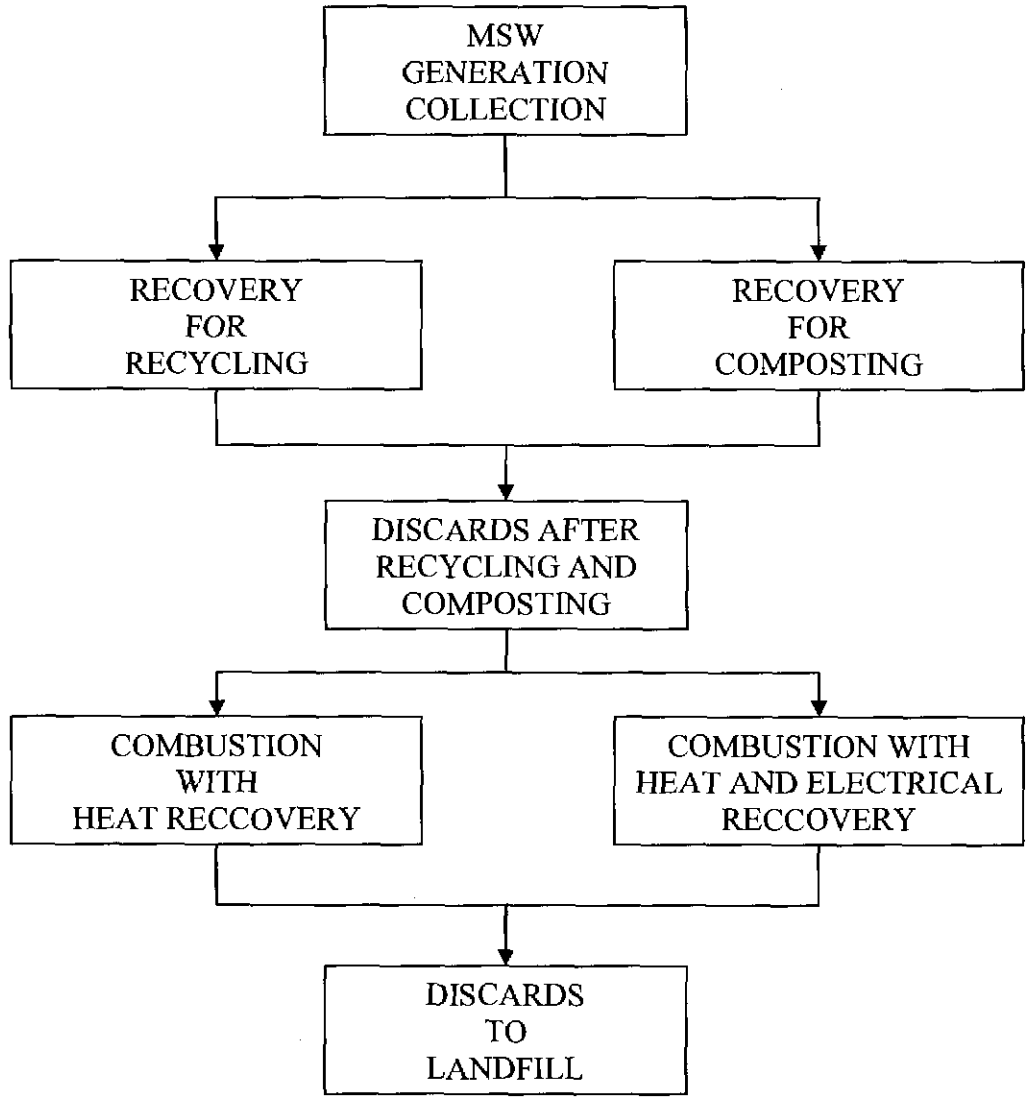
The utilization of thermally produced gasifier fuel in engines is normally less effective since the required gas cleaning removes both heat and fine combustible particulates from the fuel stream. Gasification technology is not applicable to the Chełm Waste-To-Energy Project.

5.5 Technology Evaluation

Several technologies have been identified for each phase of the potential waste-to-energy facility for the City of Chełm. The primary phases are:

- MSW Generation/Collection.
- Recovery of Recyclables.
- Recovery of Compostable Materials.
- Utilization of Combustible Materials.
- Disposal of Residual Materials.

The relationship of the phases is shown in the following flowchart.



The following evaluations have been made for each phase of the waste-to-energy process.

Collection of waste can be accomplished as mass collection or with segregation of components like glass and plastics. Chełm has initiated the process of collecting segregated waste. This practice should be expanded to the full City of Chełm and the other communes in the Commune Union of Chełm Region.

Two sites have been identified for the delivery of the collected waste, the landfill area and MEHC's Main Heating Plant. The landfill at Serebryzcze is currently receiving MSW from the

City of Chełm and several other communities in the Chełm Region. The landfill is adjacent to a major highway that is in good condition and can handle the anticipated traffic from the current deliveries of MSW as well as the additional traffic that would be required to transport any fuel that would be produced from selected components of the MSW to a different site for combustion. The landfill site is located in an undeveloped area that provides space for the installation of a facility to receive and sort the MSW. The final selection of the combustion technology and the location of the combustion site(s) will determine the amount of material handling and fuel preparation that will be required at the landfill or at a site such as MEHC's Main Heating Plant. The locating of the waste handling and preparation facility at the landfill site has the advantage of allowing the City of Chełm to be a supplier of fuel to more than one combustion facility as well as being the site at which any waste not combustible, recyclable or compostable, can most easily be landfilled.

The second potential site for the delivery of the collected waste is the Main Heating Plant of MEHC. Road access to this site is through an industrial area that currently supports heavy truck traffic. Fuel for the heating plant is presently delivered by truck. The road leading up to the heating plant is showing signs of wear in the form of cracks and heaving of the concrete. The Main Heating Plant is located on a site with a large amount of undeveloped land. Adequate space is available to receive the MSW collected in the Chełm Region, sort out the combustible components to utilize as fuel on site and remove the non-combustible components by truck for recycling or disposal in the landfill. This location has advantages if the Main Heating Plant is the dedicated consumer of MSW fuel either for mass burning or as RDF.

The management of the cement plant is not interested in having any type of fuel preparation facility on the site of the cement plant.

The location of the MSW receiving and fuel preparation facility at the landfill is the preferred site. The facility would be an extension/expansion of the operations that are currently being performed at the landfill. Preparation of a RDF would be accomplished in an indoor facility that would minimize any impact on the environment. The proximity of the landfill to the RDF preparation facility would provide the lowest cost option for disposal of the non-combustible, non-recyclable or non-compostable materials. Access to a major highway will provide for ease of transportation of the materials that are to be shipped off site. Preparing the RDF at the landfill will provide the City of Chełm with the opportunity to provide fuel to more than one end user.

The method of treatment/utilization of the collected waste is dependent on the combustion method(s) selected. The simplest combustion method is the mass burning of the MSW as collected with only the separation of items that are too large to pass through the feed system of the combustor. This technology is used when the MSW is delivered directly to the combustion site. In the case of Chełm, this could only work if a new incinerator is constructed at the Main Heating Plant.

The preparation of a fuel by sorting the combustible components from the MSW provides the most flexibility for MSW utilization. Recyclable materials can be removed from the waste stream and sold thus reducing the flow of waste to the landfill and gaining revenue for the City

of Chelm. A flow diagram and preliminary equipment layout drawing are included in Appendix 3.

The preparation of fuel allows for customizing of product to meet the specific needs of the end user. Specifically, the cement plant must have a fuel that is completely combustible and it must burn in a short period of time. A preparation facility that produces a fuel that meets the cement plant requirements will be capable of producing a fuel that can be burned in other boilers and incinerators. The installation of a fuel preparation facility requires that an end user be available to take the fuel for a period of 15 to 20 years. The ability to prepare a fuel that can be utilized in more than one facility will help insure a continued source of disposal of the fuel.

The combustion technologies investigated for this Project were the modification of the existing boilers at MEHC's Main Heating Plant, the construction of a new mass burn incinerator at MEHC's Main Heating Plant, the construction of a new incinerator at the same location to burn RDF and the preparation of RDF for combustion at the local cement plant. A thorough inspection of the MEHC Main Heating Plant showed that the use of the existing boilers is not practical. The construction of the existing boilers and coal feed system will not permit the installation of a feed system for a RDF. The combustion chambers would limit the amount of RDF that could be burned to approximately 10 per cent of the total fuel input. Under these combustion conditions, the Main Heating Plant will not be capable of utilizing the entire daily production of RDF available during the spring through fall period when the system heat load is low.

The installation of a mass burn incinerator at the Main Heating Plant is feasible from a technical approach. Sufficient space for the installation is available and the infrastructure with some upgrading would support the increased truck traffic. The incinerator would be designed to produce hot water if the lower level of waste was available. If waste were to be collected from a larger area, the system would be designed to generate electricity with an extraction from the steam turbine to heat water. This option would increase the handling recyclables and non-combustibles. The quality of the recyclables would decrease since collection would occur after combustion and the wear on the incinerator would increase due to the increased amount of non-combustibles that would be processed through it.

The installation of a incinerator to burn RDF at MEHC's Main Heating Plant will provide a more compact installation, reduce double handling of waste produces and provide equipment that would be easier to operate and maintain. A preliminary layout for an incinerator facility at the Main Heating Plant is presented in Appendix 4. Utilizing the waste from the Chelm Region, the incinerator would support the summer heat loads by producing hot water. With an expanded waste collection area, the production of high pressure steam and the production of electricity would be required. These units would experience fewer outages that a mass burn incinerator since the removal of the non-combustible components would reduce abrasion in the incinerator.

The utilization of the local cement plant as the combustor for the RDF provides the lowest cost option to the City of Chelm. To use this option, the preparation of the RDF must be carefully controlled. The residue from the combustion process must not contaminate the cement being produced. To accomplish this sorting of the non-combustibles must be complete and the control

of the shredding and grinding process must be precise. The cement plant must also be willing to commit to a long term agreement to accept the fuel from the City of Chełm. Initial discussions with the cement plant management confirmed a high level of interest in accepting the RDF, an ability to accept the quantity of fuel that would be produced and the desire to enter into a long term agreement.

Based on these considerations, PCI developed two conceptual designs. The basis for the designs was the construction of a waste handling and preparation facility at the landfill that will produce RDF. Primary emphasis in this design was placed on developing a fuel that is acceptable to the cement plant. This design also considered a final drying facility at the cement plant to utilize the cement plant's waste heat to remove moisture from the organic components of the fuel and increase the heating value of the as fed fuel. The management of the cement plant believes such a facility will not be required; but as a precaution PCI concluded that such a facility could be easily designed and installed at the cement plant. The cement plant management indicated that the organic components should be eliminated from the RDF to reduce the amount of moisture to be evaporated during the combustion process.

Design work will also be accomplished on the selection of a RDF fired boiler/incinerator for the Main Heating Plant at MEHC. This option is provided in case an agreement cannot be reached with the cement plant or if the cement plant could not accept the fuel in the future.

Each technical configuration was also evaluated on a cost basis to assure the final selection was financially feasible. The following chart presents the evaluation of each technology.

Technology Comparisons

Technology	Capital Cost	Operating Cost	Environmental Impact	Land Use Requirements	Economic Benefit to Chelm
Composting	Low	Low	Medium	High	None
Landfill	Medium	Medium	Low	Medium	None
Mass Burn-Heat Production	High	High	Low	Medium	Medium
Mass Burn-Cogeneration	Higher	High	Low	Medium	High
RDF Heat Production	Medium	Medium	Low	Low	Medium
RDF-Cogeneration	Higher	Medium	Low	Low	High
Gasification and Use Existing Boilers	High	High	Low	Medium	Medium
Gasification and Use New Boilers	High	High	Low	Medium	Medium
RDF-Cement Plant	Low	Low	Low	Low	Medium

5.6 Conclusions

Three specific types of technologies have been evaluated to determine an appropriate technology for use in the proposed Waste-to-Energy Project in Chełm. Based on overall technical and cost evaluations, the quantity of the fuel available from the MSW stream, the fact that the conversion of the existing boilers at the Main Heating Plant of MEHC to burn RDF will be difficult and the preferred options of the City of Chełm and the cement company, the two preferred options are as follows, offered in the order of preference:

- The installation of a waste handling and preparation facility sited at the existing landfill and preparation of RDF acceptable to the cement plant; or

- The installation of the same facility at the landfill and the installation of a RDF boiler at the MEHC Main Heating Plant.

Design efforts and further Project development were concentrated on providing a RDF preparation and composting facility at the landfill site. The RDF will be sold to the cement plant as fuel.

6. TECHNICAL DESIGN AND COST ESTIMATE

6.1 Introduction

During the development of the municipal solid waste ("MSW") evaluations and the evaluation of the Main Heating Plant, PCI met with the Mayor and City of Chełm managers to review and validate the results of its work on the first three tasks of the Study. PCI asked City of Chełm management to thoroughly review the preliminary results of this portion of the Study in order to test Study assessments against the experience of City of Chełm management as well as to confirm that the direction that the Study was taking continued to match the expectations of City of Chełm management.

PCI was particularly interested in City of Chełm management's responses to three critical assessments PCI made from the data collected to this point of the Study:

1. Did the volumes and make-up of the expected MSW stream and the proposed processing descriptions match City of Chełm expectations? Are the approximate levels of MSW identified by PCI what was expected?

2. Did the recommendation to build a waste handling and preparation facility that would include the production of refuse derived fuel ("RDF") to be located at one of two sites, match the expectations of City of Chełm management based on their experience in the Commune; and did City of Chełm management have a preference as to where to locate this facility;

3. Did City of Chełm management have any information about or preferences as to either of the two sites that had been identified for the combustion of the RDF about which PCI did not know.

During its discussions with City of Chełm representatives, it became clear that City of Chełm management agreed with the Study conclusions outlined in 1 above; believed that the construction of the proposed facility was the correct route to follow and that it should be sited at the existing City of Chełm landfill; and felt very strongly that the primary focus of the Study's final efforts should be to design a facility that would produce an RDF product that would be acceptable for burning at the local cement plant.

Therefore, the major effort for this task of the Study was to develop the design of a facility, that would produce a refuse derived fuel acceptable for use in the cement plant's calciner and for which the identification of other combustion options was a secondary effort.

6.2 Waste Utilization Options

The limited land availability in Europe has placed a premium on land available for landfill use. To minimize the amount of materials going into landfills, programs are being established through out Europe to recover reusable materials primarily glass, plastics and metals from MSW streams.

In addition, the combustible components of MSWs are being utilized in combustion processes or gasification processes as alternate fuels replacing more expensive fuels. Alternate fuels from MSW can be in the form of mass burn fuels or refuse derived fuels. The mass burn fuels consist of the as received MSW with only those components removed that will not process through the feed system of the combustion unit. This method of waste utilization produces the largest quantity of ash to be land filled even when metal is recovered from the ash.

The preparation of a refuse derived fuel from MSW provides the most flexible fuel alternative and minimizes the amount of material that is sent to the landfill. The preparation of refuse derived fuel consists of the sorting of MSW to remove oversize materials, recyclable materials and non-combustibles. Once the combustible components of the waste are isolated from the waste stream, additional processing including shredding, grinding and drying is accomplished to customize the fuel for the combustion process. The preparation of refuse derived fuel has been selected for the Chelm Project to provide maximum flexibility in the utilization of the fuel.

Two primary applications have been identified for the use of refuse derived fuel. The local cement plant, which currently utilizes a small percentage of alternate fuel, has indicated it can utilize all of the refuse derived fuel that can be produced from the Chełm region's MSW. The utilization of the refuse derived fuel by the cement plant will minimize the size of the investment required for the proposed Waste-to-Energy Project. The alternate use for the refuse derived fuel would be at the Municipal Energy Heating Company ("MEHC") central heating plant. This option would require the construction of a new combustion facility or a gasifier to utilize the fuel. The new facility at the Chełm heating plant would generate heat to replace heat currently generated from coal and possible provide electrical generation if gasification technology is utilized.

The cement plant has been identified as the primary user and customer for the refuse derived fuel for the following reasons:

- A RDF preparation facility can be sited at the landfill.
- The landfill is close to the cement plant.
- A fuel preparation facility only is the lowest cost option.
- A fuel preparation facility is the technology preferred by Chełm.

6.3 Fuel Preparation Requirements

The cement plant will burn the refuse derived fuel in the calciner, which utilizes 75 percent of the heat input to the cement making process. An acceptable alternate fuel for the calciner must have a minimum heating value of 14,000 KJ/kg. In addition, the fuel must have a maximum chloride content of 1 per cent and complete combustion must be accomplished in the 3 second residence time. The calciner operates at a temperature of approximately 900°C. To achieve these conditions from MSW, all of the non-combustible components that do not contribute heating value will need to be removed from the prepared fuel stream. In addition, moisture

content which is normally high in MSW will have to be reduced either in the processing steps required to produce the refuse derived fuel or by drying or preheating the fuel prior to introduction into the calciner to achieve the minimum heating value required. The City of Chelm and cement plant management have expressed the desire to eliminate food wastes and vegetable waste from the fuel stream to reduce the moisture content.

The design of the Waste-to-Energy facility is based on preparing a Refuse Derived Fuel (RDF) which will consist if paper and plastics separated from the Municipal Solid Waste stream delivered to the facility. It is reported that that the paper and plastic represent 17.0 and 7.2 weight per cent of the MSW. Based on this analysis, paper will make up 70.3 per cent of the RDF and Plastic will make up 29.7 per cent. The generally accepted heating values for these materials are 18,600 KJ/Kg for paper and 45,350 KJ/Kg for plastics. The heating value of plastics can vary depending on the specific plastics in the mix. Based on these values, the RDF to be prepared by the City of Chelm will have an approximate heating value of 26.5 GJ/tonne. This comparable to the 27 GJ coal currently being utilized by the cement company.

This value will be sensitive to the quantity of plastics in the mix. The trend is for more plastics to be found in MSW with time as more prepackaged foods are utilized by a society. PCI is suggested that a contract for the sale of RDF be based on the heating value of the fuel delivered. This would require a sampling program and an adjustment protocol for the pricing based on delivered heating value.

A facility designed to prepare fuel for the cement plant would also be capable of preparing fuel for a conventional incineration or gasification processes. These processes, incineration or gasification, will not require the level of control of particle size distribution required for the calciner and the level of non-combustible materials can be greater. In general if the cement plant can not accept the refuse derived fuel in the future, the proposed RDF preparation process will be adequate to prepare a fuel suitable for other applications.

6.4 Fuel Preparation System Description

Several U.S. suppliers of RDF systems were reviewed and evaluated. For this study PCI selected equipment and systems provided by Norcon International, a U.S. based supplier of material handling equipment with extensive experience processing MSW, developed a conceptual equipment configuration for a refuse derived fuel facility to be constructed at the existing landfill in Chelm. The process, including waste receiving area and process fuel holding area, will be housed in a large ventilated building. The process will consist of a series conveyors, screens, manual sort stations, metal removal equipment, shredders and mills to produce a uniform fuel product. The system will be controlled from a central control room. The process is shown on PCI drawing 02074-F-01, Process Flow diagram – Fuel Production.

During the detailed design phase bids for equipment and system configuration should be requested from several U.S. manufacturers including:

- Advanced Combustion Systems, Inc.

- Consutech System, LLC.
- Energy Products of Idaho.
- EnerWaste International Corporation.
- Lundell Manufacturing, Inc.
- Norcon International Inc.
- RRT Design & Construction

Investigations conducted under Task 2 of this Study concluded that approximately 125 tonnes per day of MSW are available in the Chelm region. This quantity includes an allowance for future growth in waste generation. Equipment selections were made based on processing 125 tonnes in an 8 hour period and operating the facility 6 days a week. The capacity of the facility can be increased by adjusting equipment operating rates, increasing the length of the work shift or using a two shift operation. A future maximum through put of 250 to 300 tonnes per day can be achieved without major capital investment.

Waste delivered to the site is weighed to establish the tipping fee and maintain an inventory of material received and processed.

The start of the process is the tipping floor where the MSW is received from the waste collection trucks. Waste is dumped on the tipping floor and spread out with a front-end loader. The waste is inspected, oversized and/or hazardous materials are manually removed from the raw waste and bags of waste are opened and the contents are spread for inspection. Following initial inspection and separation of over size and hazardous components, the waste is either placed on the take away conveyor for processing or piled up for short term storage. Operation of the tipping floor is expected to be 8 to 10 hours per day. The tipping floor is sized to store 1 to 1 ½ days delivery of waste. The tipping floor will be isolated from the balance of the process by a floor to ceiling masonry wall. The facility equipment arrangement is shown on drawing no. 02074-G-01, RDF Building Arrangement.

MSW is removed from the tipping floor by a steel belted infeed conveyor. The conveyor is mounted with the belt at floor level and conveys the waste through the dividing wall while elevating it on an incline to a vibrating sizing screen.

A vibrating sizing screen is used to make the initial separation of materials. The vibrating sizing screen will be approximately 35 feet long by 6 feet wide by 6.5 feet deep. The vibrating sizing screen is a heavy duty sizing screen used to separate material 10 inch in size and over from the remainder of the waste. The oversized material will be primarily paper, plastics, cardboard and other combustibles. The oversize material will make up approximately 50 per cent of the volume and 30 per cent of the weight of refuse to be sorted. The oversized materials will be conveyed to a stack out area for further processing through size reduction equipment. The take away

conveyor will be approximately 43 feet long by 5 feet wide with a travel speed of 5.8 feet per minute.

The superior performance of vibratory processing and the simple jam-proof movement over an unique finger screen configuration delivers highly efficient separation and classification of commingled materials. The unit's vibrating motion spreads material evenly across the deck for maximum separating efficiency. Multiple size separating decks enhance classification while staggered finger positions help to prevent material bypass. Separation performance is enhanced as material freely cascades through the unit -- with less "trapping".

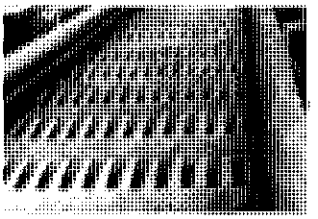


Figure 6-1 – Vibrating Sizing Screen

The finger screen advantages have been proven in hundreds of material classification applications, the Finger-Screen works better and costs less when compared to rotary trommel or disc type screening equipment.

- Finger-Screen does not "fluff" or increase the material volume of paper or other lightweight materials.
- Efficient bulk handling eliminates the need for the additional downstream equipment.
- No periodic production interruptions to remove wound material common to rotating or disc screen classification equipment.
- "Cam-out" design helps prevent material catching or binding.
- Fingers gradually increase in width to free "on-size" pieces.
- Design with no obstructing supports permits materials to fall freely to lower collecting deck.
- Vibratory action orients long slender materials for separation with the undersize materials.
- Easy-to-replace modular deck meets present and future needs.
- Custom engineered for specific applications, with a wide range of finger deck designs and materials, including abrasion or corrosion resistant alloys for specific customer needs.

The screened overs material can contain large glass items, etc. A small picking station can be located on each side of the overs discharge conveyor. Hand-sort personnel can then remove any un-wanted items. No additional equipment is required to separate non-combustibles from the oversized materials stream.

Materials that are less than 10 inches in size will be screened onto a take away conveyor for transfer to a sorting mezzanine. The vibrating sizing conveyor is designed to distribute the material across the width of the conveyor and provide a free flowing transfer of material. The under size take away conveyor will be approximately 25 feet long by 5 feet wide with variable belt speed of 30 to 60 feet per minute.

The sorting mezzanine consists of 6 sorting stations, one for magnetic separation of ferrous metals and five manual stations. The five manual sorting stations will be manned based on the materials being separated. It is anticipated that only three of the stations will be manned during initial operation of the facility to separate clear and colored glass and undersized combustible materials (plastics, paper and cardboard) from the waste stream.

The mezzanine is elevated with collection bins/bunkers underneath for materials like ferrous metals, clear glass, colored glass etc. and undersized combustibles. The mezzanine will be constructed with several spare work stations to allow for the sorting of additional materials in the future. The sorting mezzanine is configured with a 5 feet wide variable speed conveyor in the center with picking stations on each side. The mezzanine will be provided with stairs, work platforms and safety devises to meet all current Polish safety standards. The ventilation at the sorting stations will be designed with fresh air introduced at the work stations and exhausted over the conveyor belt to minimize the exposure of the staff to odors and contamination from the waste. The segregated materials collected under the mezzanine will be removed in bins or by front-end loader for recovery, resale or remixing with the oversized combustible materials.

An overbelt electro magnet will be used to remove ferrous metal from the waste stream on the sorting mezzanine. A cross conveyor belt will be used to remove the ferrous materials from the magnet and deposit them in a bin under the mezzanine.

The Overbelt Electro Magnet will be located at the end of the manual sorting stations before the Eddy Current Separator. The Overbelt Electro Magnet is a simple device consisting of an electro magnet sized for the height it will be mounted above the manual sorting conveyor and the size of the ferrous metal materials that are to be removed. The separator works as follows:

- The magnet attracts ferrous metals from the sorting belt to the magnets surface.
- The magnets surface is covered by a driven belt which moves perpendicular to the sorting conveyor.
- The moving belt transfers the ferrous metals from the surface of the magnet to outside of the magnetic field.

- The ferrous metals are discharged to a bin located under the manual sorting stations.

The magnet will be sized to remove all ferrous metals that are not removed on the tipping floor.

Once the remaining material is discharged from the sorting mezzanine, it will be passed under an eddy current separator for the recovery of non-ferrous metals. Selective sorting can be accomplished with this devise since its action on a metal is effected by its specific mass and resistivity. It may be desirable to separate aluminum from other non-ferrous metals that are separated from the balance of the waste stream.

An Eddy Current Separator is used to automatically separate non-ferrous items such as aluminum and copper from a mixed stream of waste materials. The Eddy Current Separator will be located after the manual sorting stations and the Magnetic Separator. This positioning allows the separator to work on a waste stream that has been reduced in volume and has had materials that might effect the operation of the Eddy Current Separator removed from the waste stream. The Eddy Current Separator works as follows:

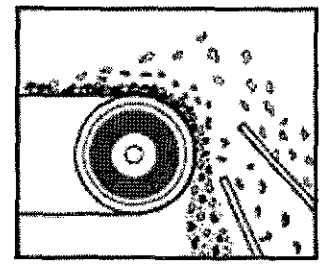


Figure 6-2 – Eddy Current Seperator

- A vibrating pan feeder is used to spread incoming material over the total width of the eddy current separator conveyor.

- Material is fed onto the eddy current separator conveyor and is conveyed across the eddy current magnetic rotor where separation occurs.

- The discharge housing is equipped with a splitter that separates the non-ferrous metals from the other non-metallic items such as household organic wastes, paper, plastic, wood, fluff, etc.

- The key component of the eddy current separator is the magnetic rotor, which has a series of rare earth magnets mounted on a support plate attached to a shaft. The magnetic rotor is surrounded by (but not attached to) a wear shell which supports the conveyor belt. This allows the rotor to spin independently and at a much higher speed that the wear-shell and belt.

- When a piece of non-ferrous metal, such as aluminum, passes over the separator, the magnets inside the shell rotate past the aluminum at high speed.

- This forms eddy currents in the aluminum which in turn create a magnetic field around the piece of aluminum.

- The polarity of that magnetic field is the same as the rotating magnet, causing the aluminum to be repelled away from the magnet.

- This repulsion action makes the trajectory of the aluminum greater than that of non-metallic material, allowing the two material streams to be separated. Each non-ferrous metal will have a unique trajectory and can be separated by the proper placement of splitter plates to direct each material to a separate collection bin.

The Eddy Current Separator will be set up to remove all remaining metals from the waste stream and separate them as required to maximize the recycling value of the materials.

The remaining waste will be conveyed to an inerts separator to separate the non-combustible materials from the food and vegetable waste left in the waste stream. The inert waste stream, estimated to be 13 to 15 per cent by weight of the received MSW, will be weighted with the site truck scale and transported to the landfill for disposal.

The Inerts Separator known as a destoner is used to separate materials of different densities and sizes. Energy-efficient vibratory action and high velocity, low pressure air streams work in tandem to fluidize and stratify commingled materials according to differences in terminal particle velocity. Many systems are designed with "air curtains" to provide further separation after initial cuts of "heavies" has been made. The Inerts Separator works as follows:

- Incoming material is deposited onto the feeder portion of the Inerts Separator.

- Vibratory action moves the material through the Inerts Separator.

- High density material settles to the bottom of the Inerts Separator trough.

- A fines drop out section is the first phase in the separation process. Here smaller items such as dirt, small glass and stones are removed prior to reaching the air fluidizing portion of the Inerts Separator.

- The air fluidizing section assists in the stratifying of the light materials.

- A high velocity, low pressure air stream is directed through the material.

- As material is conveyed into the air stream, heavy materials such as glass, metals and stones fall through the air stream to a discharge chute.

- Marginal density material is caught on an adjustable slope plate and falls back into the discharge chute.

- Acceptable material for fuel feedstock is carried beyond the slope plate and travels to a discharge chute.

- Light material, dry paper, film plastics, etc. are removed through the air exhaust on the stationery hood over the discharge and taken to a cyclone separator.

The Inerts Separator will be very effective in separating the inerts from the compostible materials.

Food and vegetable waste will be conveyed from the inerts separator by the organics take away conveyor to a slow speed shredder. The shredder is used to provide a uniform sized material to be used as feed stock for a composting operation. The shredder will be located at the end of the sorting line. The shredder is a heavy duty machine with a 152 cm by 100 cm cutting chamber. The machine is instrumented to detect jams and reverse the blades to clear the cutting chamber. The shredder take away conveyor will discharge outside of the RDF preparation building adjacent to the composting operation. Material will be transported from this location to the compost operation by front-end loader.

Combustible materials from the manual sorting station and the oversize materials from the vibrating sizing screen will be processed through a high speed vertical mill to reduce the particle size of the fuel to a size that will be combusted in the residence time available in the calciner. The vertical mill with associated conveyors and material handling equipment are operated as a separate process from the sorting operation. This provides the flexibility to operate each portion of the fuel preparation system at an optimal rate.

The high speed vertical mill will be located in the same portion of the processing building as the sorting equipment. The equipment train will start with an infeed conveyor to the high speed vertical mill. The vertical mill shredder is used to obtain a uniform small particle size product to fuel the calciner at the cement plant. A large volume of air is drawn through the shredder when it is in operation. This volume of air aided by the heat input from the shredding process will provide a substantial reduction of moisture in the final fuel product. Further investigations will be required during the detailed design phase of the Project to determine if sufficient drying is obtained in the shredding process to meet the minimum heating value for fuel to the calciner. Since the organic waste is not part of this waste stream, it is anticipated that no additional drying will be required.

A cyclone separator is used to release the entrained air from the final shredded product. In addition, the cyclone separator will remove any dust and particulate matter from the air before discharge to the atmosphere. The refuse derived fuel is than conveyed to the fuel storage area for transport to the end user.

The major separation equipment for the Chełm Waste-to-Energy feasibility Study has been carefully selected to accomplish each required separation. This selected equipment has been

operated effectively and efficiently in numerous installations in the United States. The equipment which is of rugged construction will operate with minimal maintenance requirements and minimal need for manufacturer's service.

The fuel preparation process is controlled by a central control system. The sorting equipment is controlled as one operation and the shredding operation is controlled as a second operation. Either operation can be out of service while the other is running.

6.5 Composting Technology

Composting is a natural process that utilizes microorganisms to decompose waste organic materials to produce a recyclable organic material known as compost. Compost is a humus rich material which can be used as a soil amendment; mulch for trees and landscapes as well as making an excellent potting mix. Composting can be found in nature in the decomposition of waste materials on forest floors and in open fields. Small scale composting has long been practiced by private property owners and farms. The scaling up of the composting process to a commercial operation requires minimum technical advances but does require large amounts of land. With a large composting operation, the control of pile configuration, moisture content and pile internal temperature have a significant impact on the rate of the composting process. To maintain optimal conditions, commercial composting is normally done on a hard surfaced site that is pitched to collect the leachate that is generated and under a roof to protect the pile from moisture content variation due to rain, snow or excessive drying from the sun.

Composting utilizes microorganisms to decompose organic feedstock into simpler components which produce a humus rich material that can be utilized as a soil amendment. Composting consists of a series of microbal activities which stage the decomposition of the waste to produce the final product.

Food waste, the organic component of MSW, in general can be composted. Materials such as fruits, vegetables, dairy products, grains, bread, some paper products, eggshell and meats can be composted. Red meats and paper products must be present in limited quantities since they take longer to decompose. In addition, grease can not be composed.

The food waste must first be separated form the balance of components in MSW. This is being accomplished in the RDF preparation facility. Food waste has unique characteristics for a feed stock for composting. This material has high moisture content and compact dense physical structure. These characteristics need special attention in the composting process. The compost pile must have the proper combination of moisture content, temperature and aeration to allow the decomposition process to proceed at the optimal rate. This is critical since meats and other slow decomposing components can cause odors and attract rodents if not properly handled.

The activity of microorganisms takes places in three phases. Bacteria have the most significant effect on the decomposition process. In addition, actinomycetes and fungi are involved in the process. Composting goes through three temperature cycles; Initial Mesophilic temperature (up to 40°C), Thermophilic (40 to 70°C) and a second Mesophilic (40°C to cooler) phase to complete

the decomposition process. Different microbal strains are active in the two temperature ranges. The heat generated during the thermopilic phase is sufficient to destroy any pathogens and to sterilize weed seeds that are present in the feed stock.

The particle size of the feed stock affects the composing process. Smaller particle size tends to accelerate the composting process because of the increased surface area. The RDF facility provides particle size control by shredding the organic materials to be composted. The smaller particle size also increases the compaction in the pile providing an insulation factor and heat retention so the pile reaches the desired internal temperatures. The major concern with food wastes is that with the high moisture and soft texture it will compact under its own weight and proper aeration will not be obtained. This is usually overcome by blending bulkier materials such as leaves or yard waste with the food waste.

Maintaining the proper nutrient levels and balance are essential to creating an efficient composting operation. Nutrient levels are evaluated based on the ratio of carbon to nitrogen present in the composted materials. The optimum ratio for efficient composition is 30:1. Food waste has a report C:N ratio of 15:1. This would indicated that other materials would need to be blended with the food waste obtained from the MSW. Material such as bark, foliage, leaves, sawdust, wood and straw have high C:N ratios and can be blended with the food waste to improve the composting operation. Since current data does not identify the components of the household organic waste stream, a Study will have to be made during the detailed design phase of the Project to optimize the feed stock going to the composting operation. It is anticipated that some blending will have to be accomplished not only to adjust the C:N ratio but to assure that the compost pile will properly aerate.

Control of the composting operation is dependent on the maintaining of the proper ratio of nutrients, oxygen and moisture. The nutrients are controlled by providing feed stock with a correct mixture of carbon and nitrogen. The oxygen content is controlled by providing a feed stock with controlled particle sizing and bulking characteristics to permit natural aeration of the compost pile by natural permeation. Aeration is also enhanced by periodic turning of the pile. An oxygen content of at least 10 per cent is required to maintain aerobic reaction. Moisture content is managed by feed stock blending control, aeration to provide evaporation, turning of the pile and adding leachate or water to maintain a moisture content of 40 to 60 per cent. Moisture content control is also enhanced by providing a roof over the compost area and an open sided structure.

6.6 Composting Facility

The composting facility will be located adjacent to the landfill and RDF preparation facility to the west and parallel to the highway. The composting facility will occupy approximately 3 acres. Final sizing of the composting facility will be accomplished during the detailed design phase of the Project. The facility will consist of a hard surfaced pad, concrete or asphalt, which will be sloped to allow any leachate or water runoff from the compost piles to be collected for recycling. This material would be used to adjust the moisture content of the compost piles or disposed of with the leachate from the landfill. An open sided roof structure will be provided over the entry site to assist in maintaining environmental control of the compost piles.

Several methods of composting were considered for application at Chełm. The simplest is passive composting or piling. This method involves the stacking of the material to be composted and allowing it to decompose in place. This method is very slow, does not provide good aeration and can produce undesirable odors if the process goes anaerobic or if meats and other slow composting materials rot and putrefy. This method will not be satisfactory for use at Chełm.

The pile method of composting can be modified by placing perforated pipes in the pile to provide a method to control the oxygen content in the pile by blowing air through the pile. This method increases the control of the composting process by the control of oxygen and the ability to evaporate any excess moisture in the pile. It will also maintain the composting process in aerobic conditions which will reduce or eliminate odor problems. The major disadvantage of this process is that the outer layer of material on the pile does not get exposed to the high temperatures generated in the internal portion of the pile and will have to be separated and recomposted to obtain the desired final produce.

PCI has selected the process identified as Turned Windrows as the preferred technology for use at Chełm. This technology is simple to operate, provides efficient composting but does require a large area of land. The initial estimate of land requirement is 3 acres, approximately 280 feet wide by 460 feet meters long. Windrows are elongated piles that are arranged parallel to each other with sufficient space between them for material handling equipment to operate and provide space to turn the windrows. The piles would be a nominal 10 feet wide by 5 to 6.5 feet high. The piles would be monitored primarily by heat generation to determine the degree of decomposition that has occurred. Windrows are turned frequently to blend the material being composted, aerate the pile to maintain aerobic reaction and control the moisture content of the pile. Turning of the windrows is accomplished in a method that will place the cooler outer layer of the pile in the center of the new pile to assure that the entire content of the pile will be exposed to the higher temperatures of the thermophilic phase of the composting process. As the composting process reduces the volume of material in the pile, parallel windrows can be combined to maintain piles of optimal cross section and make space available for additional windrows of fresh compost feed stock.

The composting process is monitored in several ways. The internal temperature of the pile can be observed by direct reading temperature probes. When a pile is turned, its internal temperature should be observed. If the temperature increases, this is an indication that microbal activity is still present and the composting process is still active. Another method is to place a sample from the turned pile into a plastic bag for 24 to 48 hours. If a foul odor is observed when the bag is opened, the composting process is still active and should be continued. The composting stage can take anywhere 2 to 5 months to complete depending on moisture content, aeration of the pile, internal heat generation and ambient conditions.

Once the composting stage is complete, a curing stage is accomplished. The compost is moved to a curing area for final stabilization by microbal decomposition of the remaining nutrients in the pile. This process normally happens in a 30 day period. This process is slow and passive. Piles should be configured to provide natural aeration to prevent the pile from going anaerobic and creating odor problems. Uncured compost can create odor problems. In addition, uncured

compost can have a high C:N ratio which will tie up otherwise available nitrogen in the soil and utilize oxygen that would otherwise be available for the desired plant life. Cured compost will be moist, odorless humus material that will not adversely affect plant growth.

It is anticipated that final processing of the compost will be a screening operation to assure a uniform particle size of the final product. The shredding of the feed stock coming from the RDF building should assure a uniform compost product. This could change if the detailed design establishes the need for bulking agents to facilitate good natural aeration of the compost piles. If wood chips are used as a bulking agent, they can be recovered at this stage of the processing and recycled.

The equipment required for the composting operation is very minimal. One front end loader and a final screen will be the primary equipment. If a bulking agent is required, a chipper will probable be required for wood or tree trimmings.

A market will have to be developed for the final compost product. It is anticipated that the compost will be of low commercial value. It might be utilized by farmers as a soil supplement, in landscape applications or as part of the landfill cover.

6.7 Infrastructure

The RDF facility and the composting site will be located at the current landfill site. The landfill is located adjacent to a major highway that is capable of handling all required traffic to and from the site. A common entrance will be provided to the site with a common truck scale to be utilized by the RDF facility, the compost facility and the landfill. On site roadways and vehicle access will be provided to the RDF building and the composting site as shown on drawing 02027-G-03, RDF facility Site Plan.

Electrical service will be provided to the site for the operation of the RDF facility. It is assumed that a new electrical feed and substation will be required.

6.8 Operations

The operation of the refuse derived fuel facility will be on a one shift six day a week basis which is consistent with the scheduling of the collection of MSW. Chełm personnel will determine how the new facility is staffed. One approach would be to make it part of MPGK operation. Staffing of the plant is envisioned to consist of the following:

- 1 Supervisor/Manager.
- 1 Clerk/Office Staff.
- 2 Front End Loader Operators.
- 2 Receiving Material Inspectors.

- 4 to 6 Picker/Sorters.
- 1 Lead Operator.
- 2 Maintenance Personnel.
- 2 Compost Pile Operators.
  TOTAL Staff Level 15-17

A total of 15 to 17 facility staff members will be required. If the facility is organized as a separate company, a president. vice president and accountant will also have to be added to the staff

The front end loader operator(s) will be responsible for moving bulk material in the receiving area, placing waste on the infeed conveyor, moving sorted waste to the shredder infeed conveyor and loading processed fuel onto trucks for transport to the end user. In addition, the front end loader will move organic household waste to the composting area, prepare and turn the windrows and load out the final compost product.

Receiving material inspectors will screen the received waste for oversized materials, hazardous material and slit open any large bags of waste.

Picker/sorters will man the manual sorting stations. They will remove specific material such as clear glass from the Sort Conveyor and deposit it in the bin or bunker under the mezzanine.

The Lead Operator will be capable of operating any piece of equipment in the facility. He will assist or fill in as required.

The Maintenance Personnel will maintain all of the equipment and fill in as operators as required.

6.9 Utility Requirements

The utility requirements for the process consist of electrical power, water, compressed air, heating fuel and waste water. Electrical power will be the major utility requirement. The majority of the process equipment has small horsepower demands to drive belt conveyors, electromagnets, vibrators and similar equipment. Major horsepower motors are included on the shredder and vertical mill for a total of approximately 410 kilowatts. Total electrical requirements for the facility will be approximately 650 kilowatts.

Water requirements for the facility will be minimal. The fuel preparation process does not require process water. The major water requirement will be for wash down and clean up. If a water distribution system does not exist in the area of the landfill, a well would be a reasonable alternative.

Compressed air will be required primarily for maintenance applications such as operating air drive hand tool and service air for cleaning equipment. No air operated equipment has been included in the fuel preparation process.

The major waste that will be sent to the waste water system will be wash down water from the clean up of the process areas. This liquid waste will have many of the same characteristics as the leachate that will be generated in the landfill. It is recommended that the two waste streams be combined and treated in one treatment facility.

A source of heating the building is required. It is assumed that either make up air or unit heaters will be used. A fired heater using either natural gas, propane or fuel oil would be the heating source of choice. Electric heaters could also be evaluated in the design phase.

6.10 Estimated Costs

Based on this conceptual design, an engineering cost estimate has been prepared for the development, design and construction of the RDF preparation facility and composting facility for the City of Chełm. The estimate is based in both facilities being located on City of Chełm owned land at the current landfill site. It has been assumed that the land will be provided to the Project at no cost. The cost estimate was prepared utilizing U.S. vendor quotations for process equipment and engineering estimates for building, structures, foundations, lighting and paving. The cost for the design, procurement and construction of the facility is $6,423,662. This is broken down as follows:

Description		Cost U.S.
RDF Process Equipment		2,770,000
RDF Equipment Installation		606,000
RDF Building, Foundations, HVAC and Lighting		1,705,000
Composting Facility		568,000
Site Roads		300,000
Front End Loaders		75,000
Electrical Interconnection		84,000
Site Utilities		67,000
Commissioning and Training		21,000
Project Management		150,000
Builder Risk Insurance		79,000
TOTAL		**6,425,000**

In addition to the cost for design and construction, the Project will be subject to development costs including permitting costs, permitting fees, special technology consultants, legal, other financial consultants and a contingency. This cost will be an additional approximately $1,025,650.

6.11 Conclusions and Recommendations

Demonstrated United States provided technology exists for the design and construction of a refuse derived fuel facility and associated composting facility for organic household wastes for the City of Chelm at the City landfill. Major components; conveyor, screens, magnets, eddy current devises, shredders and mills are commercially available from a large number of United States suppliers. The assembly of these standard components along with control systems has been accomplished many times by a large number of vendors. Structures and support systems required to complete the facilities are of conventional design and constructability.

6.12 Acknowledgements

The following United States vendors have provided technical input to the development of the conceptual designs:

1. Refuse Derived Fuel preparation and handling equipment:

    - RTT Design & Construction
      125 Baylis Road, Melville, NY 11747-3895
      Phone: 631/756-1060, Fax: 631/756-1064
      Contact: Mike Jones (e-mail: mjones@rrtenviro.com)

    - Norcon International Inc.
      4369 Shallowford Industrial Parkway, Marietta, GA 30066
      Phone: 678/445-1800, Fax: 678-445-5195
      Contact: Eugene Evans (e-mail: ge8837@comcast.net)

    - Lundell Manufacturing Inc.
      P.O. Box 171, Cherokee, IA 51012-0171
      Phone: 800/831-4841, Fax: 712/225-5185
      Contact: Mike Brooks (e-mail: brooksm@ncn.net)

2. Incineration and gasification equipment:

    - Norcon International Inc.
      4369 Shallowford Industrial Parkway, Marietta, GA 30066
      Phone: 678/445-1800, Fax: 678-445-5195
      Contact: Eugene Evans (e-mail: ge8837@comcast.net)

    - EnerWaste International Corporation
      P.O. Box 1194, Bellingham, WA 98227
      Phone: 360-738-1254, Fax: 360-738-1376
      Contact: Dan Heffeman (e-mail: enerwaste@aol.com)

- Consutech Systems, LLC
  P.O. Box 15119, Rimchond, VA 23227
  Phone: 804/746-4120. Fax: 804/730-9056
  Contact: Bob Lee (e-mail: blee@consutech.com)

- Energy Products of Idaho
  4006 Industrial Avenue, Coeu d'Alene, ID 83815-8928
  Phone: 208/765-1611, Fax: 208/765-0503
  Contact: Kent Pope (e-mail: kmpope@energyproducts.com)

- Advanced Combustion Systems, Inc.
  1999-T Alpine Way, Bellingham, WA 98226
  Phone: 360/676-6005, Fax: 360/467-9439
  Contact: Mike Milnes (e-mail: info@acs-acs.com)

7. ENVIRONMENTAL IMPACT ASSESSMENT

7.1 Introduction

PCI subcontracted with WS Atkins Polska Sp. z.o.o. ("Atkins") to provide environmental consulting services for the Waste-To-Energy study ("Study") for the City of Chełm. PCI requested Atkins to identify the applicable regulations for the Project, identify the permits that are required, define the emissions limits, the permitting procedure(s) and estimated the time required to obtain all necessary permits. Environmental regulations in Poland are currently undergoing change to bring them into compliance with the EU environmental requirements. It is possible to identify the objectives to be achieved by the regulations that are currently being enacted but some changes may occur in the finalized regulations. This Section addresses the broad range of environmental issues investigated during the Study. The final design concept is governed by a smaller portion of the regulations.

7.2 Waste Utilization Technologies

During PCI's work on Tasks 2, 3 and 4 of the Study several waste utilization technologies were identified to reduce the amount of municipal solid waste ("MSW") that is being sent to the landfill. These options consisted of:

- Mass burning incineration.
- Refuse Derived Fuel ("RDF") preparation and combustion.
- Gasification of MSW to provide a fuel gas.
- Composting.

The first three options will provide heat energy that can be used for the production of hot water and /or steam for electrical generation or as a supplementary fuel for one of several combustion processes. These options were provided to WS Atkins as the basis for their investigations. Completion of Tasks 2, 3 and 4 has identified two uses for the MSW. Both options utilize the preparation of a RDF. Both options include the preparation of RDF in a facility to be built adjacent to the landfill at Serebryszce. The first option would be to truck the RDF to the Cementownia – Chełm facility for combustion in the calciner as a supplementary fuel displacing a portion of the coal currently being used. If required, waste heat from the cement process would be available to dry the RDF to improve the as combusted heat content of the fuel. The second option would include the construction of an incinerator at Municipal Energy Heating Company ("MEHC") central heating plant to combust the RDF and produce hot water to displace hot water produced in coal fired boilers. Both options would have to meet the environmental requirements for large plants and for incineration of waste. To enhance the heating value of the RDF, the final design included the separation of vegetable and animal matter from the other combustible components of the MSW. These components will be composted at the landfill site.

7.3 Environmental Limits

1. Air emissions in Poland are governed by the three following acts:

    - Act of 7 April 2001 "Environmental Law" (Dz.U.2001.62.627. as amended).
    - Act of 27 April 2001 on Wastes (Dz.U.2001.62.628).
    - Act of 27 July 2001 on introducing Environmental Law, Waste Law and changing some other regulation (Dz.U.2001.100.1085).

2. In Poland air quality is regulated by controlling air emissions in two basic ways:

    - Planning and permitting some activities in a given location.
    - Limiting air emissions from active industries by permitting and enforcement.

3. Planning and permitting activities are based on a series of acts and regulations:

    - Development plans and other local and regional plans.
    - Physical planning.
    - Location permit.
    - Construction permit.
    - Operation permit (not always applicable).

All plans should be based on detailed studies, i.e. physiographical study, demographic study, waste management study etc.

Direct regulation of air emissions from a facility is a little bit vague since it is regulated by Decree of Ministry of Environment of 30 June 2001 on discharging to the air of polluting substance originating from technological processes and technical operations (Dz.U.2001.87.957 of Aug 2001 r.). This decree is based on and refers to the "old" act on environmental protection and management of 31 Jan 1980 through April 2001. The new act Environmental Law was accepted (Dz.U.2001.62.627 z dnia 20 czerwca 2001 r,). An ambiguous situation has resulted due to the willingness to implement as much as possible of the EU legislation but not the logics and structure of the legal regulation was not preserved.

It is worth noting that in some Polish regulations understanding of some terms and therefore the practical implementation of some regulations sometimes differ from those in the Western Countries and in common EU law. One of these differences in meaning of the term "source" of

emission §7 and § 8 of Decree of MoE Ministry of 30 June 2001 on discharging to the air of polluting substances originating from technological processes and technical operations. Says:

1. § 7 - Till 31 Dec 2002, the permissible amount of pollutants born in burning processes from which the exhaust/flue gases are lead through single emitter and for which the construction permit has been issued after 6 Oct 1998 is permissible amount of polluting substances appropriate for total thermal power of the sources.

2. For all the sources constructed after 30 June 1987 the rule will come in force on 01 January 2003.

3. The same applies for sources extended by 50 MW or More after 30 June 1987.

Limit values for air emissions from combustion of municipal waste is given in annex 4 to Decree of MoE Ministry 30 June 2001. It is import to remember that this regulation will expire on 30 June 2003 and a new regulation is being prepared which is based on the current EU LCP Directive. It is not clear to what extend municipal wastes or RDF can be regarded as a fuel in understanding the Decree when mixed/multi-fuels are regarded and it is not if emissions from co-firing fuels (coal, gas, oil) with municipal wastes is covered by the regulation. The modification of existing facilities will have to meet the same emission standards as a new facility.

A MSW incineration facility will have to include continuous monitoring for dust, CO and HCl. In addition, periodic monitoring will be required for heavy metals, HF, SO_2 organic compounds, dioxins and furans.

7.4 Waste Water Discharge

Water protection legislation is contained within two framework acts: Water Law Act, Environmental Protection Act and several executive orders issued by various ministers. As a result of coordination with EU regulations, Polish regulations change dynamically and not all executive regulations which are envisioned in the framework acts have been issued. All water discharges are subject to regulation: industrial waste waters, sanitary waste water, storm water run-off and cooling water discharge. Surface water discharge is regulated by Ministerial regulation 5.11.91 on water classification and the requirements for waste water discharge into water or ground. Industrial wastewater discharge to the municipal sewer system is regulated by the Governmental Regulation from 19th May 1999 (Dz.U. 1999.50.502) on terms of waste water discharge to public sewer systems which is no longer in force.

A Sanitary Inspector is responsible for the monitoring quality of potable water. The Regional Environmental Protection Inspectorate is responsible for monitoring surface water. The Sanitary Inspectorate, Environmental Protection Inspectorate and Environmental Protection Department of the local authority are entitled at all times to take samples in order to monitor compliance with conditions of water permits.

7.5 Soil and Groundwater Pollution

Pursuant to Art. 102.1 of the Environmental Protection Act, the holder of the land is liable for its remediation. Minister of Environment set limit values for pollutant contractions levels that allows for classifying some land as "contaminated" (MoE Decree of September 2002 on Soil Quality Standards, Dz.U. This regulation does not apply to underground water and no underground water standards were established.

According to the Environmental Protection Act and transition Act, there are several cases when former owner or polluter is liable for contamination. In some special cases when the land was polluted by a third party before the Act entered into force (1 Oct 2001) and pollution was registered by appropriate county, the liability can be cancelled. Also, if it is possible to proof that the land was polluted before 1 Sept 1981, the scope of required reclamation can be limited to action securing no threat to human health and no dispersion in the environment.

7.6 Waste Management

A number of acts and secondary legislation regulates waste management with the major acts being:

- The Act of 27 April 2001 on wastes.
- The Act "Packaging and packaging waste" of 22 July 2001 r.
- The Act on implementation Environmental Law and Waste Law of 27 July 2001.
- The Act on Maintaining Cleanliness and Order in Communities as amended

Poland has enacted waste legislation of the EU and signed waste transportation treaties, thus waste management legislation in Poland is similar to that in EU Member States. The general rules of waste management are: prevention, recycling and environmentally friendly neutralization. The priorities are: minimizing generation, recycling and minimizing landfilling. Waste management plans are developed on the National, Regional (Voivodship) county and municipality levels. An extensive system of permits is in place for the generation, collection and disposal of wastes. Specific regulations exist for the incineration of waste.

7.7 IPPC and BAT Related Values

Poland has enacted Integrated Pollution Prevention and Control Directive 96/61/EC (IPPC) by incorporating it into the Environmental Protection Act. IPPC is becoming one of the main approaches to environmental control in Europe (based on the UK system) and is currently being implemented through the region. Annex I to the IPPC Directive has been enacted in its entirety in the form of Minister of the Environment Decree of 26 July 2002 on the Installations Causing significant Pollution to specific Components of the Environment or to the environment as a

whole and lists the industrial activities falling under the IPPC regime. The IPPC regulations specify which installations fall under the integrated permit requirement.

To obtain an integrated permit it is needed to demonstrate compliance of the operated installations with Best Available techniques (BAT) – if not present, a schedule is required to ensure BAT is met. For sectors for which BAT reference Documents (BREF) have been developed it is necessary to consider appropriate BREF when considering compliance with BAT.

7.8 Environmental Noise

Environmental noise levels are regulated by MoE Decree of 13 May 1998. Similarly like other regulations referring to "old" act on environmental protection, this regulation will expire on 30 June 2003. Draft document developed in regime set by "new" Environmental Protection Act (2001) will probably use the same limit values.

7.9 Environmental Fees

According to Official Announcement of MoE dated 15 November 2002 on environmental fees (for "use" of environment) in year 2003 (Monitor Polski No. 49, 715) the environmental fees are set for:

- Gases and particulates emitted to the atmosphere.
- Pollutants discharged to surface/running water or soils.
- Cooling water.
- Deposition of wastes in landfill.
- Extraction of fresh water from surface intakes or groundwater wells.
- Polluted rainwater or water from melting snow.

7.10 Limit Values for Technology Options

Polish Environmental legislation does not distinguish between mass burning of wastes and RDFs. Under current philosophy the issue would need to be addressed in an integrated permit. According to §22 of MoE Decree of 30 July 2001 (Dz.u 2001.87.957) burning products of MSW gasification (pyrolysis) is regarded as burning wastes. In addition, the Decree interpretation is that every technical facility used for MSW incineration is regarded as a Municipal Waste Incinerator. The emission limit values for the technologies proposed for this Study is the same in all cases. Utilization of the cement plant as the combustion source will require it to comply with the incineration emission requirement.

The technology options being evaluated by this Study are covered by IPPC regulations either as MSW incinerators with a capacity of more than 3 tonnes/hour or as a thermal sources of rated thermal input capacity of more than 50 MW_t and the same BREFs are applicable. Poland enacted the Large Combustion Plant (LCP) Directive (88/609/EEC) and is expected to enact and implement fully the new LCP Directive 2001/80/EC and waste incineration Directive (2000/76/EC) when they come into force. No exclusions are made for RDF in either solid, liquid or gaseous (pyrolysis) form. In accordance with the LCP Draft BREF document the minimum requirements for emissions of all the technology options are determined by the new LCP Directive and the waste incineration directive, after 2005. An integrated permit will be required for any of the evaluated combustion technologies. The responsibility for obtaining the permit belongs to the facility owner, Cementownia or MEHC. Permitting of the RDF preparation facility at the landfill will be less rigorous.

7.11 Environmental Benefits

This Project will have two major environmental impacts. The first impact will be on landfill requirements. The preparation of a RDF and composting will initially reduce the amount of material that would have been placed in the landfill by selectively removing glass and metals from the MSW for recycling. The second sorting operation removes the combustible components from the MSW. Paper, plastics and organic material are separated for further mechanical handling to prepare a fuel. This preparation will include shredding and size reduction operations to create a fuel in a form that is suitable for the final form of combustion. Providing fuel to the local cement plant will require more size reduction operations to control the particle size of the fuel to be fed to the calciner. It is criteria to obtain complete combustion in the calciner in its established residence time to prevent contamination of the product. Organic material will be separated from the balance of the combustibles and prepared for composting. The unusable balance of the MSW will be landfilled. It is anticipated that the amount of material to be disposed of in the landfill will be reduced by 90 per cent by volume and 75 per cent by weight. This reduction will substantially extend the life of the landfill thus reducing the future need for acquiring additional land and the cost of constructing new landfill cells.

The combustion of RDF does provide environment advantages. The RDF will replace coal as a fuel used in either the cement plant calciner or in a new boiler at the central heat plant. This will reduce the amount of emissions particulate, sulfur dioxide and nitrogen oxides that are related to the combustion of coal. The combustion of waste requires continuous monitoring of some emissions not currently required with the combustion of coal. The introduction of RDF at the cement plant or in a new boiler at the central heat plant will require new environmental permits. These facilities will meet the current EU emissions standards.

The environmental benefits from the Chelm Waste-To-Energy are the reduction in landfill requirements and the upgrading of emission standards for the combustion facilities.

7.12 Conclusions

PCI with the assistance of WS Atkins has completed a study of the environmental regulations for a Waste-to-Energy facility for the City of Chełm. A comprehensive listing of the regulations is attached to the Atkins draft report as Annex 1. No regulatory requirement was identified that would adversely impact any of the technologies being considered for this Project. Appendix 1 to this report outlines the permitting procedure for the Project. Appendix 2 summarizes the emissions limit that must be met. Appendix 3 is a copy of the Atkins report. The utilization of either the local cement plant or a new boiler facility at the central heating plant as a combustion source will be permitable and meet the environmental requirements for the combustion of waste.

WS Atkins has identified the environmental regulations that apply to air emissions, water, waste water discharges, soil and groundwater pollution and noise for the proposed configurations of the Chełm Waste-to-Energy Project. These configurations include:

1. Te RDF preparation facility – the garbage collection, sorting, shredding operations, this operation producing the RDF from MSW.

2. The composting operation.

3. The burning of the RDF by Cementownia – Chełm.

4. The deposit of any waste from the Chełm Waste-to-Energy Project that cannot be used in steps 1, 2 and 3.

The design criteria established and technology and equipment selected by this Study, if properly followed, will meet all current environmental discharge standards in Poland. It is also anticipated that these criteria and the technology and equipment will also met the new standards that are being adopted by Poland and the European Union. However, since these standards are still in the stages of final acceptance, when the proposed Project moves from the feasibility Study stage to design stage, it will be necessary for the design engineers to once again review the design criteria and the technology and equipment to be assured that they continue to meet any new discharge standards. Any changes are expected to be minor and will not affect function or cost of the Project.

The most stringent discharge requirements associated with the Project are air emissions standards as they apply to the incineration of MSW at either the Cementownia – Chełm cement kiln (the "Cement Plant") or at the Chełm central heating plant.

The Cement Plant is required to have an integrated permit, ICCP, in effect by December 31, 2004. This permit application must seek authorization to burn any and all fuels that will be utilized by the Cement Plant. Specifically, if the Cement Plant is to be able to burn any RDF from MSW, the ICCP application must request the right to burn such fuel and identify the quantity of RDF to be combusted and the composition of the RDF. Emission limits will be established during the permitting process based on ratios of components in the fuel being fired. The use of RDF will likely reduce the allowable limits of some of the emissions for the standards

for the cement process. This permit is not obtained by the City of Chelm, but must be obtained by the Cement Plant. Therefore, it is vital for the success of the Waste-to-Energy Project for the City of Chelm to coordinate with the Cement Plant management in preparing the ICCP to assure that the Cement Plant is authorized to burn the RDF from MSW. It is estimated that if the Cement Plant does not properly secure authorization to burn the RDF, the cost to modify an existing integrated permit to include an alternate fuel such as RDF from MSW will be $30,000 to $60,000.

The implementation of a RDF preparation facility and a composting facility is accomplished under much less stringent environment requirements. Air emission concerns are concentrated on fugitive dust and odor control, similar to the requirement for operating a landfill. Since the RDF facility will be enclosed in a building, dust emissions will be minimal and can be contained with the assistance of filters on the building exhaust system. Odor control is best handled by prompt, timely processing of the MSW on receipt at the facility. Containment and disposal of any leachate and waste water will be the major environment concern for the RDF facility. The same issues will apply to the composting facility. The composting facility is designed with a hard impermeable surface, asphalt or concrete, to facilitate the collection of leachate and runoff from the composting process. The area will also be covered with a roof structure to protect the windrows from rain or snow. The leachate and waste water collected from the RDF facility and the composting facility can be utilized in the composting process for moisture control, in the landfill for dust control or processed with leachate collected from the landfill. Compliance with current and proposed environment standards at the RDF facility and the composting facility will be achieved through careful attention to detail during the detailed design phase of the Project.

Permitting of the RDF and composting facilities will take place in four phases, Local Spatial Plan, Location Permit (WZiZT)(Initial Planning Permission), Construction Permit and Occupancy Permit. The Local Spatial Plan is the zoning of the property for the use proposed. This should not be an issue with the Chelm facilities since they are sited at an existing landfill.

The Location Permit (WZiZT) is the first stage of any development. This permit addresses items including an Environment Impact Statement or assessment, description of the investment, geodesy maps for location of the Project, ground registration extract, initial site plan with roads and infrastructure and identification of parties involved in the administrative process. This permit secures the authorization of the local authorities to proceed with the Project.

The Construction Permit requires the completion of the detailed design for the Project and supporting infrastructure. In addition, an Environmental Impact Study is required. The Construction Permit is issued by the Starosta.

The Occupancy Permit or Use permit is issued when the construction is complete and all required local permits for items such as fire protection, storm water discharge, sanitary discharge, air permits and other required permits are in place.

The proposed facility will meet all environmental regulations and can be permitted under current and anticipated environmental regulations.

Notes

Base Case No. 1 – Financial Results

8. FINANCIAL ANALYSIS

8.1 Introduction

In Task 5 of the Study, PCI has developed a conceptual design for a waste handling and preparation plant (the "facility"). This facility included a composting area, a recycling capability and the production of refuse derived fuel ("RDF"). This facility, sized to meet the current level of waste generated in the Chelm commune region, represents the alternative that best utilizes the waste stream, minimizes the waste that will flow into the existing landfill and is most acceptable to the management of the City of Chełm. Based on this design, PCI prepared a cost estimate for the facility based on manufacturer's quotations and internal engineering estimates. This cost estimate to design and construct the facility coupled with a list of other critical construction, operating and financial assumptions are the basis for the baseline financial analysis for the Study.

This baseline financial analysis ("Baseline Financial Model" or "Baseline Financial Analysis") has been refined to include inputs and comments from the City of Chełm, refined cost estimates provided by the Polish engineers that reviewed the PCI conceptual design, and comments from several financial advisors that reviewed PCI's financial assumptions. This refined analysis incorporates the optimal capital structure that the Study is proposing for the facility and examines a number of variations of the Baseline Financial Analysis to give the Study a clear profile of the different ways that the City of Chełm might structure the Investment to meet its particular criteria.

8.2 Explanation of Baseline Financial Model

The Base Financial Model is made up of a number of sections.

The first section is the summary page which provides an assumption overview. This section summarizes the capital costs, electrical usage, an analysis of the waste flowing into the facility, the annual operating costs and revenues of the facility, the capital structure of the Investment including the debt and equity requirements, the terms of the debt being provided, as well as the results of the base case financial projection in terms of a rate of return on investment and coverage ratios for the debt providers. The information presented on this page is supported by the detailed presentation of data in the balance of the pro forma.

The second section is the Income Statement. Laid out as a traditional income statement, it shows operating revenue, operating costs and the operating margin and then all non-operating expenses, income taxes and net income. This Baseline Financial Model covers twenty years of operations and assumes that income and operating costs will increase at some rate of annual inflation

The third section is the Funds Statement or the sources and usage of cash over the twenty year life of the Investment, including the use of cash to retire debt as well as to make distributions to the investors. At the bottom of this section is a net present value calculation assuming a discount rate of 8 per cent.

The fourth section is the Balance Sheet which shows expected assets, liabilities and equity of the Investment over the expected 20 year life of the Investment.

The fifth section shows all the Capital Costs associated with the Investment and the time during the implementation and construction period that these costs are incurred. This section accounts for the costs associated with the development or implementation of the Investment, the construction costs for the facility and the related facilities, financing costs, non-depreciable property costs, a contingency provision and the cost of interest during the construction period on the money borrowed to build the facility. This section presents the all-in cost of the Investment both the hard and soft costs required to accomplish the Investment - in a format that will be required by an investor and a lender.

The sixth section presents the projected Revenues including tipping fees, and proceeds from the sale of recyclables, RDF and compost. It has been assumed that the waste stream will be constant over the twenty year life of the Investment and that revenue will increase at some percentage rate per year.

The seventh section covers Debt Retirement. This section simply shows the retirement of the debt over the term of the loan repayment schedule, the capital structure, the percentage of debt and equity assumed in the financial model as well as the interest rate.

The pro forma developed for the Study follows the description of the financial analysis.

8.3 Baseline Financial Model Assumptions

In the Baseline Financial Model assumed that the City of Chełm created a separate company ("NewCo") that would own the facility. NewCo would be separate from any existing City of Chełm corporation and would be staffed and managed as a separate business venture. Projected staffing levels include a president, vice president, two administrative staff and 15 operators/maintenance personnel. It is assumed that the facility would operate 6 days a week, 8 hours per day and receive waste deliveries 6 days per week.

It assumed that the land adjacent to the landfill is owned by the City of Chełm and that the land will be provided to the NewCo at no cost. The facility has been designed to fit on the City of Chełm owned land. The detailed design of the facility may reduce the amount of land required.

The build-up of the facility's costs to be put in service is based on the cost estimates secured during the work on conceptual design and includes about $500,000 of costs necessary to be spent before the facility is ready to be constructed. These include costs of design and engineering, set-up of the NewCo, legal and permitting costs. It also incorporates costs for financing, project management, builder's risk insurance, working capital and a contingency.

On the revenue side, the economics of NewCo are based on NewCo receiving revenue from three separate activities. It has been assumed that MPGK and the other collectors of MSW in the Chełm Commune region will deliver unsorted or sorted MSW to the facility. First, NewCo will

separate all recyclable materials from this waste stream – glass, aluminum, ferrous metals, other metals and compost - and sell all the reclaimed materials.

Second, the waste collectors will pay a fee to NewCo which will approximately offset the current costs of placing the waste in the landfill, a tipping fee. In work with MPGK, its own independent analysis of MSW hauling and land fill costs in Chełm and its research on other landfill costs in Poland, the Study concluded that the cost to landfill a tonne of MSW to the Chełm landfill is in the range of $10-12.50 per tonne. Finally, NewCo will sell the RDF produced by the facility as the third source of revenue to the local cement plant at $24 per tonne.

It has been assumed the population of the City of Chełm and the Chełm region will not change significantly during the next twenty years and that the amount of waste will remain the same in both quantity and composition.

On the expense side, the Study has built up costs based on the expected operating levels of the facility and the experience of the manufacturers of the waste handling equipment to be included in the facility. When local cost information or estimates were needed, the Study consulted with MPGK management, a local engineering firm and several management personnel with Polish plant operating experience. Again the Study assumes that NewCo operates as an independent entity, paying for its own utilities, staff benefits, contracted services, insurance, etc.

To refine and update the Baseline Financial Model, the Study reviewed all the assumptions made during the development of the initial pro forma. A number of critical assumptions were discussed with financial institutions, financial consultants, consultants working with the environmental funding organizations and on MSW handling and disposal issues, the management of the City of Chełm, a Polish based engineering company and several heat company executives to test the validity of these assumptions.

While most of the base assumptions have remained the same, the Study introduced two significant changes into the second iteration of the Baseline Financial Model. First, based on discussions with the management of the City of Chełm, the Study assumed that the optimal capital structure for the Investment was 100% debt, no equity. Funding for the Investment would be first sought from environmental funding sources in the public or quasi-private sectors at the local, national and multi-national levels. With the introduction of no equity - all debt capital structure, the issues surrounding equity returns highlighted in the initial pro forma are no longer relevant and the sufficiency of year to year cash flow to service interest and principal becomes the most critical financial measurement of the Investment. The Study does show a net present value ("NPV") calculation for each case. A NPV calculation is a measurement of the discounted cash flow generated by the investment over its life divided by the cost of that investment. A positive NPV is an indication that the investment has an acceptable or positive return.

Second, the Study assumed that any costs that were included in the previous Baseline Financial Model on the assumption that the Investment had to meet the rigorous tests of a project finance structure have been stripped out. Therefore, in this second iteration total Investment costs are lower than in the previous Baseline Financial Model. However, some of these costs were

initially incorporated to provide the Investment and its lenders certain financial flexibility and now that they have been stripped from the Investment, the City of Chełm is accepting more financial risk if delays, cost overruns or problems occur in the Investment.

8.4 Base Case No. 1 Financial Results

The Study developed eleven (11) possible financial results of the Investment showing a range of critical variables and of financial outcomes. These eleven results are summarized in the following table.

Financial Sensitivity Table

	NPV (US)	Is Cashflow Positive?
Case 1-Tipping Fee @ $10.50 USD/tonne	4,767,917	Yes
Case 2-Tipping Fee @ $7.50 USD/tonne	3,554,131	No, Year 1
Case 3-Tipping Fee @ $12.50 USD/tonne	5,577,108	Yes
Case 4-Tipping Fee @ $15.00 USD/tonne	6,588,597	Yes
Case 5-Reduce Construction Costs 10%/Tipping Fee @ $10.50 USD /tonne	5,263,177	Yes
Case 6-Increase Capital Costs 10%/Tipping Fee @ $10.50 USD/tonne	4,272,554	Yes
Case 7-Increase RDF Revenue to 115 PLN/tonne/Tipping Fee @ $10.50 USD /tonne	5,293,275	Yes
Case 8-Reduce O&M Costs by 10%/Tipping Fee @ $10.50 USD/tonne	5,359,803	Yes
Case 9-Eliminate Management and Administration/Tipping Fee @ $10.50 USD /tonne	5,526,271	Yes
Case 10-Environmental Loan Forgiveness (40 % of Principal at 4 ½ Years	6,098,385	Yes
Case 11-Reduce Recycling Revenue of Aluminum and Other Metals 25 %	3,752,273	Yes

The positive NPV for each of these cases means that over a 20 year term, the Investment has a positive value. In other words the discounted cash flow generated by the Investment is greater than the cost of the Investment and in seven of the nine cases there is sufficient cash flow in every year to pay required interest and principal. In cases 2, 6 and 11, a minor shortfall of cash flow exists for five to seven years; but in these cases, there is sufficient cash flow in subsequent years to pay off the loan on time and the Investment still generates additional cash flow and a positive NPV.

8.5 Base Case No. 2 Financial Results

PCI developed a second base case, Base Case No. 2, to take into consideration the City's concerns that the volume of MSW collected would not be in the range of 44,000 tonnes per year. In Base Case No. 2, MSW collection was reduced from 44,000 tonnes per year to 35,000 tonnes per year. In addition, the capital costs of equipment and building were reduced 10 per cent and it was assumed that the City of Chelm would manage the facility with existing City of Chełm management. This eliminated the costs for a president, vice president and administrative staff. This Study developed ten (10) possible financial results of the Investment showing a range of

critical variables and of financial outcomes. These ten results are summarized in the following table.

Financial Sensitivity Table

	NPV (US)	Is Cashflow Positive?
Case 1-Tipping Fee @ $14.00 USD/tonne	4,150,689	Yes
Case 2-Tipping Fee @ $10.50 USD/tonne	3,039,447	No/Years 1-2
Case 3-Tipping Fee @ $12.50 USD/tonne	3,674,443	Yes
Case 4-Tipping Fee @ $15.00 USD/tonne	4,468,188	Yes
Case 5-Reduce Construction Costs 10%/Tipping Fee @ $14.00 USD/tonne	4,599,261	Yes
Case 6-Increase Capital Costs 10%/Tipping Fee @ $14.00 USD/tonne	3,709,851	Yes
Case 7-Increase RDF Revenue to $28.75/tonne/Tipping Fee @ $14.00 USD /tonne	4,562,953	Yes
Case 8-Reduce O&M Costs by 10%/Tipping Fee @ $14.00 USD/tonne	4,643,927	Yes
Case 9-Environmental Loan Forgiveness (40 % of Principal at 4 ½ Years)	5,335,236	Yes
Case 10-Reduce Recycling Revenue for Al and other metals 25 %	3,353,683	Yes

The reduction in waste quantity has a significant impact on the financial viability of the Project. It requires the establishment of a higher tipping fee. In addition the capital costs must be reduced and the cost of management be covered by the utilization of existing City of Chełm management. This configuration of the Project is at higher financial risk that the base line configuration.

From a financial modeling perspective, each of these base cases and their sensitivities makes reasonable assumptions about how the Investment will operate and generate positive cash flow over its entire life. Certainly, these projections are not guarantees that the Investment will perform as projected; but given the range of cases evaluated and the sizeable NPV for each of these cases, the Study shows that the Investment does have strong economics and can be justified from both a financial and environmental improvement standpoint.

General Information	
Project Name: Chelm Refuse Derived Fuel (RDF)	
Print Date	2/19/2004 8:34
-	
First Operating Year	2005

NEWCo. Results	
Discount Rate	**8.00%**
20 NPV	**4,150,689**

Capital Costs (escalated to 2005)	USD
EPC	see Capital Costs worksheet
Site Specific Costs (calculated)	
Other Development & Expenses (Detailed in Capital Cost Section)	
Total Capital Costs (calculated)	6,934,558

Financing		
Total Engineering, Permitting and Construction Period (months)	15	
Month to Order Equipment	6	
Month to Start Construction	9	
Construction Interest Rate in **Euribor**:	4.90%	
Amount of Environmental Grant (Default=0)	1,500,000	
Long Term Loan (Project Financing)-Tranche 1		
Debt, %	100.00%	
Term, Years	10	
Payments per Year	4	
Interest Rate in **Euribor**:	4.90%	
Currency Depreciation (Default=0)	0.00%	
Debt Service Reserve Fund (months)	0	
Environmental Low Interest Loan-Tranche 2		**Not used in base case**
Debt, %	0.00%	
Term, Years	12	
Payments per Year	4	
Effective Interest Rate	0.00%	
Currency Depreciation (Default=0)	0.00%	
Polish Federal Income Tax	20.00%	
Loan Placement Fee	0.0%	
Loan Commitment Fee	0.375%	
Contingency	6.5%	
Currency Exchange-Foreign Goods and Services (PLN:US$)	4.00	
Investment Income Interest Rate	1.5%	
VAT on purchased equipment	22.0%	
Builder's Risk Insurance (% of total costs)	1.25%	

Plant Electric Loads	
Non-process load-lights, ventilation, etc. (kW)	30
Processing Load (kW)	540
Load Factor	0.6
Process Load hours per day	8
Process Load days per week	6
Process Load weeks per year	52

Waste Analysis

Tonnes Per Day: 112 **based on 6 days per week**

Description	% by Weight	Tonnes/day	Tonnes/Year
House Organic Waste	43.8%	49.06	15,305
Paper and Cardboard	18.5%	20.72	6,465
Glass	10.1%	11.31	3,529
Plastics	6.0%	6.72	2,097
Fabrics	2.2%	2.46	769
Metals	2.7%	3.02	943
Organic Left-overs	3.4%	3.81	1,188
Non-organic Left Overs	13.5%	15.12	4,717
Total	100%	112	35,014

Revenues	USD ($)	Esc./Yr.	Percentage
Tipping Fees (USD/tonne)	$ 14.00	3%	
Recyclable Materials:			
Glass (USD/tonne)	$ 16.25	3%	
Aluminum (USD/tonne)	$ 675.00	3%	25%
Ferrous Metals (USD/tonne)	$ 250.00	3%	50%
Other Metals (USD/tonne)	$ 625.00	3%	25%
Compost (USD/tonne)	$ 5.00	3%	50%
RDF Revenue (USD/tonne)	$ 24.50	3%	

Use of Waste	Tonnes/Year
Material to RDF	9,330
Material to Compost	16,494
Glass Recycled	3,529
Metals	943
Materials to Landfill	4,717
Total	35,014

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Cash Flow from Funds Statement	73,739	87,265	102,585	118,275	134,340	150,788	167,625	184,858	202,492	220,534	932,240	958,139

===>Values to be inputted by user

Annual Operating Costs	2005	Esc./Yr.
Purchased Electricity (USD/MWh)	$ 55.00	3%
General O&M Escalation	see detail	3%
Management and Administration		
Benefit Multiplier	25%	
President (USD/year)	-	3.0%
Vice President of Operations (USD/yr)	-	3.0%
Accountant (USD/year)	-	3.0%
Secretary (USD/year)	-	3.0%
Staff		
Number of Operators/Maintenance personnel	15	
Wages (USD/month)	$ 5,500	3.0%
Benefit Multiplier	20%	
Repair and Maintenance Material	$ 175,000	3.0%
Contracted Services	$ 25,000	3.0%
Rolling Stock Maintenance& Fuel	$ 50,000	3.0%
Insurance	$ 20,000	3.0%
Third Party Consultants	$ 25,000	3.0%
Landfill Disposal Costs (USD/tonne)	$ 14.00	3.0%
Water	$ 12,500.0	3.0%

Chelm MSW PROJECT
INCOME STATEMENT

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Operating Revenues:											
-Tipping Payments	520,047	535,649	551,718	568,270	585,318	602,877	620,964	639,593	658,780	678,544	698,900
-RDF Payments	242,507	249,782	257,276	264,994	272,944	281,132	289,566	298,253	307,201	316,417	325,909
-Recycling Payments	555,016	571,666	588,816	606,480	624,675	643,415	662,718	682,599	703,077	724,169	745,894
Total Operating Revenues	1,317,570	1,357,097	1,397,810	1,439,744	1,482,936	1,527,425	1,573,247	1,620,445	1,669,058	1,719,130	1,770,704
Operating Costs:											
Management and Administration	0	0	0	0	0	0	0	0	0	0	0
Operators and Maintenance Personnel	99,000	101,970	105,029	108,180	111,425	114,768	118,211	121,758	125,410	129,173	133,048
Repair and Maintenance Material	175,000	180,250	185,658	191,227	196,964	202,873	208,959	215,228	221,685	228,335	235,185
Contracted Services	25,000	25,750	26,523	27,318	28,138	28,982	29,851	30,747	31,669	32,619	33,598
Rolling Stock Maintenance& Fuel	50,000	51,500	53,045	54,636	56,275	57,964	59,703	61,494	63,339	65,239	67,196
Insurance	20,000	20,600	21,218	21,855	22,510	23,185	23,881	24,597	25,335	26,095	26,878
Third Party Consultants	6,250	6,438	6,631	6,830	7,034	7,245	7,463	7,687	7,917	8,155	8,399
Material to Landfill	66,044	68,025	70,066	72,168	74,333	76,563	78,860	81,226	83,663	86,173	88,758
Water	12,500	12,875	13,261	13,659	14,069	14,491	14,926	15,373	15,835	16,310	16,799
Electricity	58,933	60,701	62,522	64,397	66,329	68,319	70,369	72,480	74,654	76,894	79,201
-Book Depreciation	344,342	344,342	344,342	344,342	344,342	344,342	344,342	344,342	344,342	344,342	344,342
Total Operating Costs	857,068	872,450	888,293	904,612	921,420	938,733	956,564	974,931	993,849	1,013,334	1,033,404
Operating Margin	460,501	484,647	509,516	535,132	561,516	588,692	616,683	645,514	675,209	705,796	737,300
Interest Expense	258,431	236,858	214,208	190,428	165,461	139,248	111,727	82,833	52,496	20,645	0
Total Income Taxes	40,414	49,558	59,062	68,941	79,211	89,889	100,991	112,536	124,543	137,030	147,460
Book Net Income	161,656	198,231	236,246	275,763	316,844	359,555	403,965	450,145	498,171	548,121	589,840

2016	2017	2018	2019	2020	2021	2022	2023	2024	TOTAL
719,867	741,463	763,707	786,618	810,217	834,523	859,559	885,346	911,906	13,973,865
335,687	345,757	356,130	366,814	377,818	389,153	400,827	412,852	425,238	6,516,256
768,271	791,319	815,059	839,511	864,696	890,637	917,356	944,877	973,223	14,913,475
1,823,825	1,878,540	1,934,896	1,992,943	2,052,731	2,114,313	2,177,742	2,243,075	2,310,367	35,403,596
0	0	0	0	0	0	0	0	0	0
137,039	141,150	145,385	149,746	154,239	158,866	163,632	168,541	173,597	2,660,167
242,241	249,508	256,993	264,703	272,644	280,824	289,248	297,926	306,864	4,702,316
34,606	35,644	36,713	37,815	38,949	40,118	41,321	42,561	43,838	671,759
69,212	71,288	73,427	75,629	77,898	80,235	82,642	85,122	87,675	1,343,519
27,685	28,515	29,371	30,252	31,159	32,094	33,057	34,049	35,070	537,407
8,651	8,911	9,178	9,454	9,737	10,029	10,330	10,640	10,959	167,940
91,421	94,163	96,988	99,898	102,895	105,981	109,161	112,436	115,809	1,774,631
17,303	17,822	18,357	18,907	19,475	20,059	20,661	21,280	21,919	335,880
81,577	84,024	86,545	89,141	91,815	94,570	97,407	100,329	103,339	1,583,544
344,342	344,342	344,342	344,342	344,342	344,342	344,342	344,342	344,342	6,886,831
1,054,075	1,075,367	1,097,298	1,119,887	1,143,153	1,167,118	1,191,801	1,217,225	1,243,411	20,663,994
769,749	803,172	837,598	873,056	909,578	947,195	985,941	1,025,850	1,066,956	14,739,602
0	0	0	0	0	0	0	0	0	1,472,337
153,950	160,634	167,520	174,611	181,916	189,439	197,188	205,170	213,391	2,653,453
615,800	642,538	670,078	698,445	727,662	757,756	788,753	820,680	853,564	10,613,812

Chelm MSW PROJECT
FUNDS STATEMENT

		2005	2006	2007	2008	2009	2010	2011	2012	2013
Sources Of Cash:										
-Book Net Income		161,656	198,231	236,246	275,763	316,844	359,555	403,965	450,145	498,171
-Book Depreciation		344,342	344,342	344,342	344,342	344,342	344,342	344,342	344,342	344,342
-Use of Maintenance Reserve										
-Recovery of Working Capital			-	-						
-Recovery of Debt Reserve										
-Recovery of Spare Parts										
-Grant	1,500,000									
-Equity Contribution	-									
-Term Debt	5,434,558									
Total Sources of Cash	6,934,558	505,998	542,572	580,588	620,105	661,185	703,896	748,306	794,487	842,512
Uses of Cash:										
-Capital Expenditures	6,886,831									
-Land	-									
-Working Capital	42,727									
-Debt Service Reserve	-									
-Spare Parts	5,000									
-Addition to Maintenance Reserve	-						-			
-Working Capital Escalation		-	1,321	1,362	1,404	1,448	1,493	1,539	1,586	1,636
-Spare Parts Escalation		-	155	159	164	169	175	180	186	191
-Debt Retirement		432,258	453,831	476,481	500,261	525,228	551,441	578,962	607,857	638,194
-Distributions		73,739	87,265	102,585	118,275	134,340	150,788	167,625	184,858	202,492
Total Uses of Cash	6,934,558	505,998	542,572	580,588	620,105	661,185	703,896	748,306	794,487	842,512
First Year Income before Capital Improvements										
NPV (Annual): 4,150,689	-	73,739	87,265	102,585	118,275	134,340	150,788	167,625	184,858	202,492

2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	TOTAL
548,121	589,840	615,800	642,538	670,078	698,445	727,662	757,756	788,753	820,680	853,564	10,613,812
344,342	344,342	344,342	344,342	344,342	344,342	344,342	344,342	344,342	344,342	344,342	6,886,831
											-
-	-	-	-	-	-	-	-	-	-	-	-
										73,929	73,929
		-									-
										8,651	8,651
											-
											-
											-
892,462	934,182	960,141	986,879	1,014,420	1,042,786	1,072,004	1,102,098	1,133,095	1,165,021	1,280,486	17,583,223
											-
											-
											-
											-
											-
	-	-	-	-	-	-	-	-	-	-	-
1,686	1,738	1,792	1,847	1,905	1,963	2,024	2,087	2,151	2,218	-	-
197	203	210	216	223	230	237	244	252	260	-	-
670,044	(0)	(0)	-	-	-	-	-	-	-	-	5,434,558
220,534	932,240	958,139	984,816	1,012,292	1,040,593	1,069,743	1,099,767	1,130,691	1,162,544	1,280,486	12,113,812
892,462	934,182	960,141	986,879	1,014,420	1,042,786	1,072,004	1,102,098	1,133,095	1,165,021	1,280,486	17,548,370
220,534	932,240	958,139	984,816	1,012,292	1,040,593	1,069,743	1,099,767	1,130,691	1,162,544	1,280,486	

Chelm MSW PROJECT
BALANCE SHEET

Assets:	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
-Property, Plant & Equipment	6,886,831	6,542,489	6,198,148	5,853,806	5,509,465	5,165,123	4,820,782	4,476,440	4,132,099	3,787,757	3,443,415	3,099,074	2,754,732	2,410,391
-Book Depreciation	344,342	344,342	344,342	344,342	344,342	344,342	344,342	344,342	344,342	344,342	344,342	344,342	344,342	344,342
Net Plant Assets	6,542,489	6,198,148	5,853,806	5,509,465	5,165,123	4,820,782	4,476,440	4,132,099	3,787,757	3,443,415	3,099,074	2,754,732	2,410,391	2,066,049
-Land	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-Working Capital	42,727	44,049	45,411	46,815	48,263	49,756	51,295	52,881	54,517	56,203	57,941	59,733	61,581	63,485
-Debt Service Reserve	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-Spare Parts	5,000	5,155	5,314	5,478	5,648	5,823	6,003	6,188	6,380	6,577	6,780	6,990	7,206	7,429
-Maintenance Reserve	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Assets	6,590,217	6,247,351	5,904,531	5,561,759	5,219,034	4,876,360	4,533,738	4,191,168	3,848,654	3,506,195	3,163,795	2,821,456	2,479,178	2,136,964
Liabilities and Equity														
-Beginning Debt Balance	5,434,558	5,002,300	4,548,469	4,071,987	3,571,726	3,046,498	2,495,057	1,916,095	1,308,238	670,044	0	0	0	0
-Debt Retirement	432,258	453,831	476,481	500,261	525,228	551,441	578,962	607,857	638,194	670,044	0	0	0	0
Ending Debt Balance	5,002,300	4,548,469	4,071,987	3,571,726	3,046,498	2,495,057	1,916,095	1,308,238	670,044	0	0	0	0	0
-Equity and Accumulated Earnings	1,587,917	1,698,883	1,832,544	1,990,032	2,172,536	2,381,303	2,617,643	2,882,930	3,178,609	3,506,195	3,163,795	2,821,456	2,479,178	2,136,964
Total Liabilities and Equity	6,590,217	6,247,351	5,904,531	5,561,759	5,219,034	4,876,360	4,533,738	4,191,168	3,848,654	3,506,195	3,163,795	2,821,456	2,479,178	2,136,964

2019	2020	2021	2022	2023	2024
2,066,049	1,721,708	1,377,366	1,033,025	688,683	344,342
344,342	344,342	344,342	344,342	344,342	344,342
1,721,708	1,377,366	1,033,025	688,683	344,342	0
0	0	0	0	0	0
65,449	67,473	69,560	71,711	73,929	0
0	0	0	0	0	0
7,659	7,896	8,140	8,392	8,651	0
0	0	0	0	0	0
1,794,815	1,452,735	1,110,724	768,786	426,922	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
1,794,815	1,452,735	1,110,724	768,786	426,922	0
1,794,815	1,452,735	1,110,724	768,786	426,922	0

Chelm MSW PROJECT
CAPITAL COSTS

Construction Loan Rate 4.90%

	Total Budget	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12	Month 13	Month 14	Month 15	TOTAL
DEVELOPMENT COSTS:																	
-TDA Repayment	230,000															230,000	230,000
-Legal and Other Consultants	15,000	7,500	7,500														15,000
-Special Technology Consultants	25,000	12,500	12,500														25,000
-Permitting Costs	50,000	5,556	5,556	5,556	5,556	5,556	5,556	5,556	5,556	5,556							50,000
-Permitting Fees	50,000								25,000	25,000							50,000
-Engineering	150,000	16,667	16,667	16,667	16,667	16,667	16,667	16,667	16,667	16,667							150,000
Total Development Costs	520,000	42,222	42,222	22,222	22,222	22,222	22,222	22,222	47,222	47,222	0	0	0	0	0	230,000	520,000
FACILITY COSTS:																	
RDF Preparation Equipment	1,800,000							200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	1,800,000
Import Taxes/Duties	396,000															396,000	396,000
Freight/Packaging	270,000										270,000						270,000
RDF Equipment Installation	485,000										80,833	80,833	80,833	80,833	80,833	80,833	485,000
Building, Foundations, HVAC and lighting	1,530,000										255,000	255,000	255,000	255,000	255,000	255,000	1,530,000
Composting Facility	568,000										94,667	94,667	94,667	94,667	94,667	94,667	568,000
Site Roads	300,000										50,000	50,000	50,000	50,000	50,000	50,000	300,000
Front End Loaders (2)	75,000										12,500	12,500	12,500	12,500	12,500	12,500	75,000
Project Management	150,000										25,000	25,000	25,000	25,000	25,000	25,000	150,000
-Builder's Risk Insurance-1.25%	71,313							7,924	7,924	7,924	7,924	7,924	7,924	7,924	7,924	7,924	71,313
-O & M Mobilization and Training	21,000													7,000	7,000	7,000	21,000
Total Facility Costs	5,666,313	0	0	0	0	0	0	207,924	207,924	207,924	995,924	725,924	725,924	732,924	732,924	1,128,924	5,666,313
RELATED FACILITY COSTS:																	
-Electric Interconnect	85,000										14,167	14,167	14,167	14,167	14,167	14,167	85,000
-Site Utilities - water, drainage etc	46,000										7,667	7,667	7,667	7,667	7,667	7,667	46,000
Total Related Facility Costs	131,000	0	0	0	0	0	0	0	0	0	21,833	21,833	21,833	21,833	21,833	21,833	131,000
FINANCING COSTS:																	
-Loan Placement Fee (1.25%)	0		0														0
-Commitment Fee (0.375%)	23,241	2,126	2,104	2,088	2,072	2,088	2,072	1,991	1,902	1,813	1,484	1,239	993	744	494	32	23,241
-Lender's Counsel	50,000	50,000				0	0	0	0	0	0	0	0	0	0	0	50,000
-Lender's Engineer	12,500	12,500															12,500
-Owner's Counsel	0	0				0	0	0	0	0	0	0	0	0	0	0	0
Total Financing Costs	85,741	64,626	2,104	2,088	2,072	2,088	2,072	1,991	1,902	1,813	1,484	1,239	993	744	494	32	85,741
NON-DEPRECIABLE PROPERTY:																	
-Working Capital	42,727															42,727	42,727
-Land		0															0
-Spare Parts	5,000															5,000	5,000
-Maintenance Reserve	0															0	0
-Debt Service Reserve	0															0	0
Total Non-Depreciable Prop.	47,727	0	0	0	0	0	0	0	0	0	0	0	0	0	0	47,727	47,727
CONTINGENCY (Percentage of EPC and Facility Costs)	376,825	25,122	25,122	25,122	25,122	25,122	25,122	25,122	25,122	25,122	25,122	25,122	25,122	25,122	25,122	25,122	376,825
TOTAL CAPITAL COSTS	6,827,607	131,970	69,448	49,432	49,416	49,432	49,416	257,259	282,170	282,080	1,044,363	774,118	773,872	780,622	780,372	1,453,637	6,827,607
CONSTRUCTION INTEREST	106,952	539	683	928	1,134	928	1,134	1,765	2,873	4,037	6,762	10,502	13,705	16,935	20,191	24,835	106,952
TOTAL PROJECT COSTS	6,934,558	132,508	70,131	50,360	50,550	50,360	50,550	259,024	285,043	286,117	1,051,125	784,620	787,577	797,557	800,564	1,478,472	6,934,558
Commitment Fee Calculation:																	
Cumulative Amount Drawn Down		132,508	202,639	252,999	303,549	252,999	303,549	562,573	847,616	1,133,733	2,184,858	2,969,478	3,757,055	4,554,612	5,355,176	6,833,648	
Undrawn Construction Loan Balance		6,802,050	6,731,919	6,681,559	6,631,009	6,681,559	6,631,009	6,371,985	6,086,942	5,800,825	4,749,700	3,965,081	3,177,504	2,379,946	1,579,383	100,910	
Commitment Fee (0.375%)	23,241	2,126	2,104	2,088	2,072	2,088	2,072	1,991	1,902	1,813	1,484	1,239	993	744	494	32	

Chelm MSW PROJECT
REVENUES

	2003		2005	2006	2007	2008	2009	2010	2011	2012	2013
TIPPING FEE REVENUES:											
Waste Received			35,014	35,014	35,014	35,014	35,014	35,014	35,014	35,014	35,014
Tipping Fee Rate	14	X	14.85	15.30	15.76	16.23	16.72	17.22	17.73	18.27	18.81
Total Tipping Fees			520,047	535,649	551,718	568,270	585,318	602,877	620,964	639,593	658,780
RDF REVENUES:											
Annual Sales of RDF (tonnes)			9,330	9,330	9,330	9,330	9,330	9,330	9,330	9,330	9,330
Price (USD/tonne)	24.50	X	25.99	26.77	27.57	28.40	29.25	30.13	31.04	31.97	32.93
Total RDF Revenues			242,507	249,782	257,276	264,994	272,944	281,132	289,566	298,253	307,201

RECYCLING FEE REVENUE	USD	TONNES/YEAR									
Glass- (USD/tonne)	16.25	3,529	60,845	62,670	64,550	66,487	68,481	70,536	72,652	74,831	77,076
Aluminum (USD/tonne)	675.00	236	168,910	173,977	179,196	184,572	190,109	195,813	201,687	207,738	213,970
Ferrous Metals (USD/tonne)	250.00	472	125,118	128,872	132,738	136,720	140,822	145,046	149,398	153,880	158,496
Other Metals (USD/tonne)	625.00	236	156,398	161,090	165,923	170,900	176,027	181,308	186,747	192,350	198,120
Compost (USD/tonne)	5.00	8,247	43,745	45,057	46,409	47,801	49,235	50,713	52,234	53,801	55,415
Total Recycling Fee Revenue			555,016	571,666	588,816	606,480	624,675	643,415	662,718	682,599	703,077

Total Tipping Revenues	520,047	535,649	551,718	568,270	585,318	602,877	620,964	639,593	658,780
Total RDF Revenues	242,507	249,782	257,276	264,994	272,944	281,132	289,566	298,253	307,201
Total Recycling Revenues	555,016	571,666	588,816	606,480	624,675	643,415	662,718	682,599	703,077
Total Revenues	1,317,570	1,357,097	1,397,810	1,439,744	1,482,936	1,527,425	1,573,247	1,620,445	1,669,058

2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
35,014	35,014	35,014	35,014	35,014	35,014	35,014	35,014	35,014	35,014	35,014
19.38	19.96	20.56	21.18	21.81	22.47	23.14	23.83	24.55	25.29	26.04
678,544	698,900	719,867	741,463	763,707	786,618	810,217	834,523	859,559	885,346	911,906
9,330	9,330	9,330	9,330	9,330	9,330	9,330	9,330	9,330	9,330	9,330
33.91	34.93	35.98	37.06	38.17	39.32	40.49	41.71	42.96	44.25	45.58
316,417	325,909	335,687	345,757	356,130	366,814	377,818	389,153	400,827	412,852	425,238
79,388	81,770	84,223	86,750	89,352	92,033	94,794	97,638	100,567	103,584	106,691
220,389	227,001	233,811	240,825	248,050	255,491	263,156	271,050	279,182	287,557	296,184
163,251	168,149	173,193	178,389	183,740	189,253	194,930	200,778	206,801	213,006	219,396
204,064	210,186	216,491	222,986	229,676	236,566	243,663	250,973	258,502	266,257	274,245
57,077	58,790	60,553	62,370	64,241	66,168	68,153	70,198	72,304	74,473	76,707
724,169	745,894	768,271	791,319	815,059	839,511	864,696	890,637	917,356	944,877	973,223
678,544	698,900	719,867	741,463	763,707	786,618	810,217	834,523	859,559	885,346	911,906
316,417	325,909	335,687	345,757	356,130	366,814	377,818	389,153	400,827	412,852	425,238
724,169	745,894	768,271	791,319	815,059	839,511	864,696	890,637	917,356	944,877	973,223
1,719,130	1,770,704	1,823,825	1,878,540	1,934,896	1,992,943	2,052,731	2,114,313	2,177,742	2,243,075	2,310,367

Total Project Costs:		6,934,558
Less Grants		1,500,000
Total Project Funding Required (Debt & Equity)		5,434,558
Equity	0.00%	0
Traditional Project Financing-Tranche 1	100.00%	5,434,558
Environmental Low Interest-Tranche 2	0.00%	-
Amount Borrowed	100.00%	5,434,558

Tranche 1

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Quarterly Payment:	172,672	172,672	172,672	172,672	172,672	172,672	172,672	172,672	172,672	172,672	0	0			
Annual Payment:	690,690	690,690	690,690	690,690	690,690	690,690	690,690	690,690	690,690	690,690	0	0			
Interest Rates-Standard Debt															
Interest Rate (LIBOR)															
Credit Spread															
Total Interest Rate	4.90%	4.90%	4.90%	4.90%	4.90%	4.90%	4.90%	4.90%	4.90%	4.90%	4.90%	4.90%			
Exchange Rate Depreciation	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%			
Term Adjusted Interest Rate	4.90%	4.90%	4.90%	4.90%	4.90%	4.90%	4.90%	4.90%	4.90%	4.90%	4.90%	4.90%			
Average Interest Rate For Term Loan	4.90%														

		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
1st Qtr	Beginning Principal Balance	5,434,558	5,002,300	4,548,469	4,071,987	3,571,726	3,046,498	2,495,057	1,916,095	1,308,238	670,044	0	0			
	Interest Payment	66,573	61,276	55,719	49,882	43,754	37,320	30,564	23,472	16,026	8,208	0	0			
	Principal Payment	106,099	111,394	116,954	122,791	128,919	135,353	142,108	149,200	156,646	164,464	0	0			
	Ending Principal Balance	5,328,459	4,890,906	4,431,515	3,949,197	3,442,808	2,911,145	2,352,949	1,766,895	1,151,592	505,580	0	0			
2nd Qtr	Beginning Principal Balance	5,328,459	4,890,906	4,431,515	3,949,197	3,442,808	2,911,145	2,352,949	1,766,895	1,151,592	505,580	0	0			
	Interest Payment	65,274	59,914	54,286	48,378	42,174	35,662	28,824	21,644	14,107	6,193	0	0			
	Principal Payment	107,399	112,759	118,386	124,295	130,498	137,011	143,849	151,028	158,565	166,479	0	0			
	Ending Principal Balance	5,221,060	4,778,147	4,313,129	3,824,902	3,312,310	2,774,135	2,209,101	1,615,867	993,026	339,101	0	0			
3rd Qtr	Beginning Principal Balance	5,221,060	4,778,147	4,313,129	3,824,902	3,312,310	2,774,135	2,209,101	1,615,867	993,026	339,101	0	0			
	Interest Payment	63,958	58,532	52,836	46,855	40,576	33,983	27,061	19,794	12,165	4,154	0	0			
	Principal Payment	108,714	114,140	119,837	125,817	132,097	138,689	145,611	152,878	160,508	168,518	0	0			
	Ending Principal Balance	5,112,346	4,664,007	4,193,292	3,699,085	3,180,213	2,635,445	2,063,490	1,462,989	832,519	170,583	0	0			
4th Qtr	Beginning Principal Balance	5,112,346	4,664,007	4,193,292	3,699,085	3,180,213	2,635,445	2,063,490	1,462,989	832,519	170,583	0	0			
	Interest Payment	62,626	57,134	51,368	45,314	38,958	32,284	25,278	17,922	10,198	2,090	0	0			
	Principal Payment	110,046	115,538	121,305	127,359	133,715	140,388	147,395	154,751	162,474	170,583	0	0			
	Ending Principal Balance	5,002,300	4,548,469	4,071,987	3,571,726	3,046,498	2,495,057	1,916,095	1,308,238	670,044	0	0	0			

Tranche 2

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Quarterly Payment:	0	0	0	0	0	0	0	0	0	0	0	0			
Annual Payment:	0	0	0	0	0	0	0	0	0	0	0	0			

Interest Rates-Standard Debt
Interest Rate (LIBOR)
Credit Spread

Total Interest Rate	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%			
Exchange Rate Depreciation	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%			
Term Adjusted Interest Rate	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%			

Average Interest Rate For Term Loan 0.00%

		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
1st Qtr	Beginning Principal Balance	0	0	0	0	0	0	0	0	0	0	0	0			
	Interest Payment	0	0	0	0	0	0	0	0	0	0	0	0			
	Principal Payment	0	0	0	0	0	0	0	0	0	0	0	0			
	Ending Principal Balance	0	0	0	0	0	0	0	0	0	0	0	0			
2nd Qtr	Beginning Principal Balance	0	0	0	0	0	0	0	0	0	0	0	0			
	Interest Payment	0	0	0	0	0	0	0	0	0	0	0	0			
	Principal Payment	0	0	0	0	0	0	0	0	0	0	0	0			
	Ending Principal Balance	0	0	0	0	0	0	0	0	0	0	0	0			
3rd Qtr	Beginning Principal Balance	0	0	0	0	0	0	0	0	0	0	0	0			
	Interest Payment	0	0	0	0	0	0	0	0	0	0	0	0			
	Principal Payment	0	0	0	0	0	0	0	0	0	0	0	0			
	Ending Principal Balance	0	0	0	0	0	0	0	0	0	0	0	0			
4th Qtr	Beginning Principal Balance	0	0	0	0	0	0	0	0	0	0	0	0			
	Interest Payment	0	0	0	0	0	0	0	0	0	0	0	0			
	Principal Payment	0	0	0	0	0	0	0	0	0	0	0	0			
	Ending Principal Balance	0	0	0	0	0	0	0	0	0	0	0	0			
	Total Interest Payments	258,431	236,858	214,208	190,428	165,461	139,248	111,727	82,833	52,496	20,645	0	0			
	Total Principal Payments	432,258	453,831	476,481	500,261	525,228	551,441	578,962	607,857	638,194	670,044	0	0			
	Total Debt Service Payments	690,690	690,690	690,690	690,690	690,690	690,690	690,690	690,690	690,690	690,690	0	0			

Total Project Costs:	6,934,558
Less:	
-Working Capital	(42,727)
-Land	0
-Spare Parts	(5,000)
-Maintenance Res.	0
-Debt Service Res.	0
Depreciable Property	6,886,831

		Percentage Of Subtotal	Allocation of IDC and Contingency	Total Depreciable With Allocation of IDC and Contingency
Depreciable Property	6,886,831			6,886,831
Less: IDC	(106,952)			
Less: Contingency	(376,825)			
Subtotal	6,403,054			
Development Costs	(520,000)	8.1%	39,288	559,288
Financing Costs	(85,741)	1.3%	6,478	92,219
Interconnects	131,000	-2.0%	-9,898	-140,898
Personal/Real Prop	5,928,313			
Personal Prop (95%)	5,631,897	88.0%	425,513	6,057,410
Real Property (5%)	296,416	4.6%	22,395	318,811
		100.0%		6,886,831

Base Case No. 2 – Financial Results

General Information	
Project Name: Chelm Refuse Derived Fuel (RDF)	
Print Date	2/19/2004 8:36
-	
First Operating Year	2005

Capital Costs (escalated to 2005)	USD
EPC	see Capital Costs worksheet
Site Specific Costs (calculated)	
Other Development & Expenses (Detailed in Capital Cost Section)	
Total Capital Costs (calculated)	7,604,424

Plant Electric Loads	
Non-process load-lights, ventilation, etc. (kW)	30
Processing Load (kW)	600
Load Factor	0.6
Process Load hours per day	8
Process Load days per week	6
Process Load weeks per year	52

Waste Analysis

Tonnes Per Day: 122

Description	% by Weight	Tonnes/day	Tonnes/Year
House Organic Waste	43.8%	53.44	19,504
Paper and Cardboard	18.5%	22.57	8,238
Glass	10.1%	12.32	4,498
Plastics	6.0%	7.32	2,672
Fabrics	2.2%	2.68	980
Metals	2.7%	3.29	1,202
Organic Left-overs	3.4%	4.15	1,514
Non-organic Left Overs	13.5%	16.47	6,012
Total	100%	122	44,619

Use of Waste	Tonnes/Year
Material to RDF	11,890
Material to Compost	21,018
Glass Recycled	4,498
Metals	1,202
Materials to Landfill	6,012
Total	44,619

NEWCo. Results	
Discount Rate	**8.00%**
20 NPV	**4,767,917**

Financing	
Total Engineering, Permitting and Construction Period (months)	15
Month to Order Equipment	6
Month to Start Construction	9
Construction Interest Rate	4.90%
Amount of Environmental Grant (Default=0)	1,500,000
Long Term Loan (Project Financing)-Tranche 1	
Debt, %	100.00%
Term, Years	10
Payments per Year	4
Interest Rate	4.90%
Currency Depreciation (Default=0)	0.00%
Debt Service Reserve Fund (months)	0
Environmental Low Interest Loan-Tranche 2	
Debt, %	0.00%
Term, Years	12
Payments per Year	4
Effective Interest Rate	0.00%
Currency Depreciation (Default=0)	0.00%
Polish Federal Income Tax	20.00%
Loan Placement Fee	0.0%
Loan Commitment Fee	0.375%
Contingency	6.5%
Currency Exchange-Foreign Goods and Services (PLN:US$)	4.00
Investment Income Interest Rate	1.5%
VAT on purchased equipment	22.0%
Builder's Risk Insurance (% of total costs)	1.25%

Not used in base case

Revenues	USD ($)	Esc./Yr.	Percentage
Tipping Fees (USD$/tonne)	$ 10.50	3%	
Recyclable Materials:			
Glass (USD$/tonne)	$ 16.25	3%	
Aluminum (USD$/tonne)	$ 675.00	3%	25%
Ferrous Metals (USD$/tonne)	$ 250.00	3%	50%
Other Metals (USD$/tonne)	$ 625.00	3%	25%
Compost (USD$/tonne)	$ 5.00	3%	50%
RDF Revenue (USD$/tonne)	$ 24.50	3%	

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Cash Flow from Funds Statement	91,051	106,358	123,874	141,814	160,186	178,997	198,255	217,968	238,142	258,787	1,058,607	1,088,099

===>Values to be inputted by user

Annual Operating Costs	2005	Esc./Yr.
Purchased Electricity (USD$/MWh)	$ 55.00	3%
General O&M Escalation	see detail	3%
Management and Administration		
Benefit Multiplier	25%	
President (USD$/year)	$ 27,000	3.0%
Vice President of Operations (USD$/yr)	$ 16,250	3.0%
Accountant (USD$/year)	$ 12,000	3.0%
Secretary (USD$/year)	$ 6,250	3.0%
Staff		
Number of Operators/Maintenance personnel	15	
Wages (USD$/year)	$ 5,500	3.0%
Benefit Multiplier	20%	
Repair and Maintenance Material	$ 175,000	3.0%
Contracted Services	$ 25,000	3.0%
Rolling Stock Maintenance& Fuel	$ 50,000	3.0%
Insurance	$ 25,000	3.0%
Third Party Consultants	$ 6,250	3.0%
Landfill Disposal Costs (USD$/tonne)	$ 11	3.0%
Water	$ 12,500	3.0%

Chelm MSW PROJECT
INCOME STATEMENT

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Operating Revenues:											
-Tipping Payments	497,032	511,943	527,301	543,120	559,414	576,196	593,482	611,286	629,625	648,514	667,969
-RDF Payments	309,033	318,304	327,853	337,688	347,819	358,254	369,001	380,071	391,473	403,218	415,314
-Recycling Payments	707,270	728,488	750,343	772,853	796,039	819,920	844,517	869,853	895,948	922,827	950,512
Total Operating Revenues	1,513,334	1,558,735	1,605,497	1,653,661	1,703,271	1,754,369	1,807,001	1,861,211	1,917,047	1,974,558	2,033,795
Operating Costs:											
Management and Administration	76,875	79,181	81,557	84,003	86,523	89,119	91,793	94,547	97,383	100,304	103,314
Operators and Maintenance Personnel	99,000	101,970	105,029	108,180	111,425	114,768	118,211	121,758	125,410	129,173	133,048
Repair and Maintenance Material	175,000	180,250	185,658	191,227	196,964	202,873	208,959	215,228	221,685	228,335	235,185
Contracted Services	25,000	25,750	26,523	27,318	28,138	28,982	29,851	30,747	31,669	32,619	33,598
Rolling Stock Maintenance& Fuel	50,000	51,500	53,045	54,636	56,275	57,964	59,703	61,494	63,339	65,239	67,196
Insurance	25,000	25,750	26,523	27,318	28,138	28,982	29,851	30,747	31,669	32,619	33,598
Third Party Consultants	6,250	6,438	6,631	6,830	7,034	7,245	7,463	7,687	7,917	8,155	8,399
Material to Landfill	63,121	65,015	66,965	68,974	71,044	73,175	75,370	77,631	79,960	82,359	84,830
Water	12,500	12,875	13,261	13,659	14,069	14,491	14,926	15,373	15,835	16,310	16,799
Electricity	63,875	65,791	67,765	69,798	71,892	74,048	76,270	78,558	80,915	83,342	85,842
-Book Depreciation	377,235	377,235	377,235	377,235	377,235	377,235	377,235	377,235	377,235	377,235	377,235
Total Operating Costs	973,856	991,755	1,010,191	1,029,179	1,048,738	1,068,883	1,089,632	1,111,004	1,133,017	1,155,690	1,179,044
Operating Margin	539,478	566,980	595,306	624,482	654,534	685,487	717,368	750,207	784,030	818,868	854,751
Interest Expense	290,286	266,053	240,612	213,901	185,856	156,412	125,499	93,043	58,967	23,190	0
Total Income Taxes	49,839	60,185	70,939	82,116	93,735	105,815	118,374	131,433	145,013	159,136	170,950
Book Net Income	199,354	240,741	283,755	328,465	374,942	423,260	473,496	525,731	580,051	636,542	683,801

2016	2017	2018	2019	2020	2021	2022	2023	2024	TOTAL
688,008	708,648	729,908	751,805	774,359	797,590	821,518	846,163	871,548	13,355,430
427,774	440,607	453,825	467,440	481,463	495,907	510,784	526,108	541,891	8,303,825
979,027	1,008,398	1,038,650	1,069,809	1,101,904	1,134,961	1,169,009	1,204,080	1,240,202	19,004,608
2,094,809	2,157,653	2,222,383	2,289,054	2,357,726	2,428,458	2,501,311	2,576,351	2,653,641	40,663,864
106,413	109,605	112,894	116,280	119,769	123,362	127,063	130,875	134,801	2,065,660
137,039	141,150	145,385	149,746	154,239	158,866	163,632	168,541	173,597	2,660,167
242,241	249,508	256,993	264,703	272,644	280,824	289,248	297,926	306,864	4,702,316
34,606	35,644	36,713	37,815	38,949	40,118	41,321	42,561	43,838	671,759
69,212	71,288	73,427	75,629	77,898	80,235	82,642	85,122	87,675	1,343,519
34,606	35,644	36,713	37,815	38,949	40,118	41,321	42,561	43,838	671,759
8,651	8,911	9,178	9,454	9,737	10,029	10,330	10,640	10,959	167,940
87,375	89,996	92,696	95,477	98,341	101,291	104,330	107,460	110,684	1,696,092
17,303	17,822	18,357	18,907	19,475	20,059	20,661	21,280	21,919	335,880
88,418	91,070	93,802	96,616	99,515	102,500	105,575	108,743	112,005	1,716,340
377,235	377,235	377,235	377,235	377,235	377,235	377,235	377,235	377,235	7,544,706
1,203,098	1,227,874	1,253,393	1,279,678	1,306,751	1,334,637	1,363,359	1,392,943	1,423,414	23,576,138
891,710	929,779	968,989	1,009,376	1,050,974	1,093,821	1,137,952	1,183,408	1,230,227	17,087,726
0	0	0	0	0	0	0	0	0	1,653,818
178,342	185,956	193,798	201,875	210,195	218,764	227,590	236,682	246,045	3,086,782
713,368	743,823	775,191	807,501	840,779	875,056	910,362	946,726	984,182	12,347,127

		2005	2006	2007	2008	2009	2010	2011	2012	2013
Sources Of Cash:										
-Book Net Income		199,354	240,741	283,755	328,465	374,942	423,260	473,496	525,731	580,051
-Book Depreciation		377,235	377,235	377,235	377,235	377,235	377,235	377,235	377,235	377,235
-Use of Maintenance Reserve										
-Recovery of Working Capital			-	-						
-Recovery of Debt Reserve										
-Recovery of Spare Parts										
-Grant	1,500,000									
-Equity Contribution	-									
-Term Debt	6,104,424									
Total Sources of Cash	7,604,424	576,589	617,976	660,991	705,701	752,177	800,495	850,731	902,966	957,286
Uses of Cash:										
-Capital Expenditures	7,544,706									
-Land	-									
-Working Capital	49,718									
-Debt Service Reserve	-									
-Spare Parts	10,000									
-Addition to Maintenance Reserve	-						-			
-Working Capital Escalation		-	1,538	1,585	1,634	1,685	1,737	1,791	1,846	1,903
-Spare Parts Escalation		-	309	319	329	339	349	360	371	383
-Debt Retirement		485,539	509,771	535,212	561,924	589,968	619,412	650,325	682,782	716,858
-Distributions		91,051	106,358	123,874	141,814	160,186	178,997	198,255	217,968	238,142
Total Uses of Cash	7,604,424	576,589	617,976	660,991	705,701	752,177	800,495	850,731	902,966	957,286
NPV (Annual): 4,767,917	-	91,051	106,358	123,874	141,814	160,186	178,997	198,255	217,968	238,142

2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	TOTAL
636,542	683,801	713,368	743,823	775,191	807,501	840,779	875,056	910,362	946,726	984,182	12,347,127
377,235	377,235	377,235	377,235	377,235	377,235	377,235	377,235	377,235	377,235	377,235	7,544,706
											-
-	-	-	-	-	-	-	-	-	-	-	-
										86,025	86,025
		-									-
										17,302	17,302
											-
											-
											-
1,013,778	1,061,036	1,090,604	1,121,058	1,152,427	1,184,736	1,218,015	1,252,292	1,287,597	1,323,962	1,464,745	19,995,161
											-
											-
											-
											-
											-
	-	-	-	-	-	-	-	-	-	-	-
1,962	2,023	2,085	2,150	2,216	2,285	2,355	2,428	2,503	2,581	-	-
395	407	419	432	446	460	474	488	504	519	-	-
752,634	(0)	(0)	-	-	-	-	-	-	-	-	6,104,424
258,787	1,058,607	1,088,099	1,118,476	1,149,765	1,181,992	1,215,186	1,249,375	1,284,590	1,320,862	1,464,745	13,847,127
1,013,778	1,061,036	1,090,604	1,121,058	1,152,427	1,184,736	1,218,015	1,252,292	1,287,597	1,323,962	1,464,745	19,951,551
258,787	1,058,607	1,088,099	1,118,476	1,149,765	1,181,992	1,215,186	1,249,375	1,284,590	1,320,862	1,464,745	

Chelm MSW PROJECT
BALANCE SHEET

Assets:	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
-Property, Plant & Equipment	7,544,706	7,167,471	6,790,235	6,413,000	6,035,765	5,658,530	5,281,294	4,904,059	4,526,824	4,149,588	3,772,353	3,395,118	3,017,882	2,640,647
-Book Depreciation	377,235	377,235	377,235	377,235	377,235	377,235	377,235	377,235	377,235	377,235	377,235	377,235	377,235	377,235
Net Plant Assets	7,167,471	6,790,235	6,413,000	6,035,765	5,658,530	5,281,294	4,904,059	4,526,824	4,149,588	3,772,353	3,395,118	3,017,882	2,640,647	2,263,412
-Land	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-Working Capital	49,718	51,256	52,841	54,476	56,160	57,897	59,688	61,534	63,437	65,399	67,422	69,507	71,657	73,873
-Debt Service Reserve	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-Spare Parts	10,000	10,309	10,628	10,957	11,296	11,645	12,005	12,377	12,759	13,154	13,561	13,980	14,412	14,858
-Maintenance Reserve	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Assets	7,227,189	6,851,801	6,476,470	6,101,197	5,725,986	5,350,837	4,975,752	4,600,734	4,225,785	3,850,906	3,476,100	3,101,370	2,726,716	2,352,143
Liabilities and Equity														
-Beginning Debt Balance	6,104,424	5,618,886	5,109,115	4,573,903	4,011,979	3,422,011	2,802,599	2,152,274	1,469,492	752,634	0	0	0	0
-Debt Retirement	485,539	509,771	535,212	561,924	589,968	619,412	650,325	682,782	716,858	752,634	0	0	0	0
Ending Debt Balance	5,618,886	5,109,115	4,573,903	4,011,979	3,422,011	2,802,599	2,152,274	1,469,492	752,634	0	0	0	0	0
-Equity and Accumulated Earnings	1,608,303	1,742,686	1,902,567	2,089,218	2,303,975	2,548,237	2,823,478	3,131,242	3,473,150	3,850,906	3,476,100	3,101,370	2,726,716	2,352,143
Total Liabilities and Equity	7,227,189	6,851,801	6,476,470	6,101,197	5,725,986	5,350,837	4,975,752	4,600,734	4,225,785	3,850,906	3,476,100	3,101,370	2,726,716	2,352,143

2019	2020	2021	2022	2023	2024
2,263,412	1,886,177	1,508,941	1,131,706	754,471	377,235
377,235	377,235	377,235	377,235	377,235	377,235
1,886,177	1,508,941	1,131,706	754,471	377,235	0
0	0	0	0	0	0
76,158	78,513	80,941	83,445	86,025	0
0	0	0	0	0	0
15,318	15,792	16,280	16,783	17,302	0
0	0	0	0	0	0
1,977,652	1,603,246	1,228,927	854,699	480,563	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
1,977,652	1,603,246	1,228,927	854,699	480,563	0
1,977,652	1,603,246	1,228,927	854,699	480,563	0

Chelm MSW PROJECT
CAPITAL COSTS

Construction Loan Rate 4.90%

	Total Budget	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12	Month 13	Month 14	Month 15	TOTAL
DEVELOPMENT COSTS:																	
-TDA Repayment	230,000															230,000	230,000
-Legal and Other Consultants	15,000	7,500	7,500														15,000
-Special Technology Consultants	25,000	12,500	12,500														25,000
-Permitting Costs	50,000	5,556	5,556	5,556	5,556	5,556	5,556	5,556	5,556	5,556							50,000
-Permitting Fees	50,000								25,000	25,000							50,000
-Engineering	150,000	16,667	16,667	16,667	16,667	16,667	16,667	16,667	16,667	16,667							150,000
Total Development Costs	520,000	42,222	42,222	22,222	22,222	22,222	22,222	22,222	47,222	47,222	0	0	0	0	0	230,000	520,000
FACILITY COSTS:																	
RDF Preparation Equipment	2,021,178							224,575	224,575	224,575	224,575	224,575	224,575	224,575	224,575	224,575	2,021,178
Import Taxes/Duties	444,659															444,659	444,659
Freight/Packaging	303,177										303,177						303,177
RDF Equipment Installation	606,353										101,059	101,059	101,059	101,059	101,059	101,059	606,353
Building, Foundations, HVAC and lighting	1,704,500										284,083	284,083	284,083	284,083	284,083	284,083	1,704,500
Composting Facility	568,000										94,667	94,667	94,667	94,667	94,667	94,667	568,000
Site Roads	300,000										50,000	50,000	50,000	50,000	50,000	50,000	300,000
Front End Loaders (2)	75,000										12,500	12,500	12,500	12,500	12,500	12,500	75,000
Project Management	150,000										25,000	25,000	25,000	25,000	25,000	25,000	150,000
-Builder's Risk Insurance-1.25%	78,798							8,755	8,755	8,755	8,755	8,755	8,755	8,755	8,755	8,755	78,798
-O & M Mobilization and Training	21,000													7,000	7,000	7,000	21,000
Total Facility Costs	6,272,665	0	0	0	0	0	0	233,331	233,331	233,331	1,103,816	800,640	800,640	807,640	807,640	1,252,299	6,272,665
RELATED FACILITY COSTS:																	
-Electric Interconnect	85,000										14,167	14,167	14,167	14,167	14,167	14,167	85,000
-Site Utilities - water, drainage etc	46,000										7,667	7,667	7,667	7,667	7,667	7,667	46,000
Total Related Facility Costs	131,000	0	0	0	0	0	0	0	0	0	21,833	21,833	21,833	21,833	21,833	21,833	131,000
FINANCING COSTS:																	
-Loan Placement Fee (1.25%)	0		0														0
-Commitment Fee (0.375%)	25,523	2,334	2,311	2,295	2,278	2,295	2,278	2,188	2,090	1,992	1,629	1,359	1,088	814	539	33	25,523
-Lender's Counsel	50,000	50,000				0	0	0	0	0	0	0	0	0	0	0	50,000
-Lender's Engineer	12,500	12,500															12,500
-Owner's Counsel	0	0				0	0	0	0	0	0	0	0	0	0	0	0
Total Financing Costs	88,023	64,834	2,311	2,295	2,278	2,295	2,278	2,188	2,090	1,992	1,629	1,359	1,088	814	539	33	88,023
NON-DEPRECIABLE PROPERTY:																	
-Working Capital	49,718															49,718	49,718
-Land		0															0
-Spare Parts	10,000															10,000	10,000
-Maintenance Reserve	0															0	0
-Debt Service Reserve	0															0	0
Total Non-Depreciable Prop.	59,718	0	0	0	0	0	0	0	0	0	0	0	0	0	0	59,718	59,718
CONTINGENCY (7.5% of EPC and Facility Costs)	416,238	27,749	27,749	27,749	27,749	27,749	27,749	27,749	27,749	27,749	27,749	27,749	27,749	27,749	27,749	27,749	416,238
TOTAL CAPITAL COSTS	7,487,645	134,806	72,283	52,266	52,249	52,266	52,249	285,490	310,392	310,294	1,155,027	851,581	851,310	858,036	857,761	1,591,633	7,487,645
CONSTRUCTION INTEREST	116,780	550	700	957	1,175	957	1,175	1,869	3,093	4,373	7,383	11,510	15,033	18,585	22,164	27,255	116,780
TOTAL PROJECT COSTS	7,604,424	135,356	72,983	53,224	53,424	53,224	53,424	287,359	313,486	314,667	1,162,410	863,091	866,344	876,621	879,925	1,618,888	7,604,424
Commitment Fee Calculation:																	
Cumulative Amount Drawn Down		135,356	208,339	261,562	314,987	261,562	314,987	602,346	915,831	1,230,499	2,392,909	3,255,999	4,122,343	4,998,964	5,878,889	7,497,777	
Undrawn Construction Loan Balance		7,469,069	7,396,086	7,342,862	7,289,438	7,342,862	7,289,438	7,002,079	6,688,593	6,373,926	5,211,516	4,348,425	3,482,082	2,605,461	1,725,536	106,648	
Commitment Fee (0.375%)	25,523	2,334	2,311	2,295	2,278	2,295	2,278	2,188	2,090	1,992	1,629	1,359	1,088	814	539	33	

Chelm MSW PROJECT
REVENUES

	2003		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
TIPPING FEE REVENUES:												
Waste Received			44,619	44,619	44,619	44,619	44,619	44,619	44,619	44,619	44,619	44,619
Tipping Fee Rate	11	X	11.14	11.47	11.82	12.17	12.54	12.91	13.30	13.70	14.11	14.53
Total Tipping Fees			497,032	511,943	527,301	543,120	559,414	576,196	593,482	611,286	629,625	648,514
RDF REVENUES:												
Annual Sales of RDF (tonnes)			11,890	11,890	11,890	11,890	11,890	11,890	11,890	11,890	11,890	11,890
Price (USD/tonne)	24.50	X	25.99	26.77	27.57	28.40	29.25	30.13	31.04	31.97	32.93	33.91
Total RDF Revenues			309,033	318,304	327,853	337,688	347,819	358,254	369,001	380,071	391,473	403,218

RECYCLING FEE REVENUE	USD	TONNES/YEAR										
Glass- (USD/tonne)	16.25	4,498	77,536	79,862	82,258	84,725	87,267	89,885	92,582	95,359	98,220	101,167
Aluminum (USD/tonne)	675.00	301	215,246	221,703	228,354	235,205	242,261	249,529	257,015	264,725	272,667	280,847
Ferrous Metals (USD/tonne)	250.00	601	159,441	164,225	169,151	174,226	179,453	184,836	190,381	196,093	201,976	208,035
Other Metals (USD/tonne)	625.00	301	199,302	205,281	211,439	217,782	224,316	231,045	237,977	245,116	252,469	260,043
Compost (USD/tonne)	5.00	10,509	55,745	57,418	59,140	60,915	62,742	64,624	66,563	68,560	70,617	72,735
Total Recycling Fee Revenue			707,270	728,488	750,343	772,853	796,039	819,920	844,517	869,853	895,948	922,827

Total Tipping Revenues	497,032	511,943	527,301	543,120	559,414	576,196	593,482	611,286	629,625	648,514
Total RDF Revenues	309,033	318,304	327,853	337,688	347,819	358,254	369,001	380,071	391,473	403,218
Total Recycling Revenues	707,270	728,488	750,343	772,853	796,039	819,920	844,517	869,853	895,948	922,827
Total Revenues	1,513,334	1,558,735	1,605,497	1,653,661	1,703,271	1,754,369	1,807,001	1,861,211	1,917,047	1,974,558

2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
44,619	44,619	44,619	44,619	44,619	44,619	44,619	44,619	44,619	44,619
14.97	15.42	15.88	16.36	16.85	17.35	17.88	18.41	18.96	19.53
667,969	688,008	708,648	729,908	751,805	774,359	797,590	821,518	846,163	871,548
11,890	11,890	11,890	11,890	11,890	11,890	11,890	11,890	11,890	11,890
34.93	35.98	37.06	38.17	39.32	40.49	41.71	42.96	44.25	45.58
415,314	427,774	440,607	453,825	467,440	481,463	495,907	510,784	526,108	541,891
104,202	107,328	110,547	113,864	117,280	120,798	124,422	128,155	131,999	135,959
289,272	297,951	306,889	316,096	325,579	335,346	345,406	355,769	366,442	377,435
214,276	220,704	227,325	234,145	241,169	248,404	255,857	263,532	271,438	279,581
267,845	275,880	284,157	292,681	301,462	310,506	319,821	329,415	339,298	349,477
74,917	77,165	79,480	81,864	84,320	86,850	89,455	92,139	94,903	97,750
950,512	979,027	1,008,398	1,038,650	1,069,809	1,101,904	1,134,961	1,169,009	1,204,080	1,240,202
667,969	688,008	708,648	729,908	751,805	774,359	797,590	821,518	846,163	871,548
415,314	427,774	440,607	453,825	467,440	481,463	495,907	510,784	526,108	541,891
950,512	979,027	1,008,398	1,038,650	1,069,809	1,101,904	1,134,961	1,169,009	1,204,080	1,240,202
2,033,795	2,094,809	2,157,653	2,222,383	2,289,054	2,357,726	2,428,458	2,501,311	2,576,351	2,653,641

Total Project Costs:		7,604,424
Less Grants		1,500,000
Total Project Funding Required (Debt & Equity)		6,104,424
Equity	0.00%	0
Traditional Project Financing-Tranche 1	100.00%	6,104,424
Environmental Low Interest-Tranche 2	0.00%	-
Amount Borrowed	100.00%	6,104,424

Tranche 1

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Quarterly Payment:	193,956	193,956	193,956	193,956	193,956	193,956	193,956	193,956	193,956	193,956	0	0			
Annual Payment:	775,824	775,824	775,824	775,824	775,824	775,824	775,824	775,824	775,824	775,824	0	0			
Interest Rates-Standard Debt															
Interest Rate (LIBOR)															
Credit Spread															
Total Interest Rate	4.90%	4.90%	4.90%	4.90%	4.90%	4.90%	4.90%	4.90%	4.90%	4.90%	4.90%	4.90%			
Exchange Rate Depreciation	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%			
Term Adjusted Interest Rate	4.90%	4.90%	4.90%	4.90%	4.90%	4.90%	4.90%	4.90%	4.90%	4.90%	4.90%	4.90%			
Average Interest Rate For Term Loan	4.90%														

		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
1st Qtr	Beginning Principal Balance	6,104,424	5,618,886	5,109,115	4,573,903	4,011,979	3,422,011	2,802,599	2,152,274	1,469,492	752,634	0	0			
	Interest Payment	74,779	68,831	62,587	56,030	49,147	41,920	34,332	26,365	18,001	9,220	0	0			
	Principal Payment	119,177	125,125	131,369	137,926	144,809	152,036	159,624	167,591	175,955	184,736	0	0			
	Ending Principal Balance	5,985,248	5,493,761	4,977,746	4,435,977	3,867,170	3,269,975	2,642,975	1,984,683	1,293,537	567,898	0	0			
2nd Qtr	Beginning Principal Balance	5,985,248	5,493,761	4,977,746	4,435,977	3,867,170	3,269,975	2,642,975	1,984,683	1,293,537	567,898	0	0			
	Interest Payment	73,319	67,299	60,977	54,341	47,373	40,057	32,376	24,312	15,846	6,957	0	0			
	Principal Payment	120,637	126,657	132,979	139,615	146,583	153,899	161,580	169,644	178,110	186,999	0	0			
	Ending Principal Balance	5,864,611	5,367,104	4,844,767	4,296,362	3,720,587	3,116,076	2,481,395	1,815,039	1,115,427	380,899	0	0			
3rd Qtr	Beginning Principal Balance	5,864,611	5,367,104	4,844,767	4,296,362	3,720,587	3,116,076	2,481,395	1,815,039	1,115,427	380,899	0	0			
	Interest Payment	71,841	65,747	59,348	52,630	45,577	38,172	30,397	22,234	13,664	4,666	0	0			
	Principal Payment	122,115	128,209	134,608	141,326	148,379	155,784	163,559	171,722	180,292	189,290	0	0			
	Ending Principal Balance	5,742,496	5,238,895	4,710,159	4,155,036	3,572,208	2,960,292	2,317,836	1,643,318	935,135	191,609	0	0			
4th Qtr	Beginning Principal Balance	5,742,496	5,238,895	4,710,159	4,155,036	3,572,208	2,960,292	2,317,836	1,643,318	935,135	191,609	0	0			
	Interest Payment	70,346	64,176	57,699	50,899	43,760	36,264	28,393	20,131	11,455	2,347	0	0			
	Principal Payment	123,610	129,780	136,257	143,057	150,197	157,692	165,563	173,825	182,501	191,609	0	0			
	Ending Principal Balance	5,618,886	5,109,115	4,573,903	4,011,979	3,422,011	2,802,599	2,152,274	1,469,492	752,634	0	0	0			

Tranche 2

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Quarterly Payment:	0	0	0	0	0	0	0	0	0	0	0	0			
Annual Payment:	0	0	0	0	0	0	0	0	0	0	0	0			

Interest Rates-Standard Debt
Interest Rate (LIBOR)
Credit Spread

Total Interest Rate	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%			
Exchange Rate Depreciation	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%			
Term Adjusted Interest Rate	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%			

Average Interest Rate For Term Loan 0.00%

		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
1st Qtr	Beginning Principal Balance	0	0	0	0	0	0	0	0	0	0	0	0			
	Interest Payment	0	0	0	0	0	0	0	0	0	0	0	0			
	Principal Payment	0	0	0	0	0	0	0	0	0	0	0	0			
	Ending Principal Balance	0	0	0	0	0	0	0	0	0	0	0	0			
2nd Qtr	Beginning Principal Balance	0	0	0	0	0	0	0	0	0	0	0	0			
	Interest Payment	0	0	0	0	0	0	0	0	0	0	0	0			
	Principal Payment	0	0	0	0	0	0	0	0	0	0	0	0			
	Ending Principal Balance	0	0	0	0	0	0	0	0	0	0	0	0			
3rd Qtr	Beginning Principal Balance	0	0	0	0	0	0	0	0	0	0	0	0			
	Interest Payment	0	0	0	0	0	0	0	0	0	0	0	0			
	Principal Payment	0	0	0	0	0	0	0	0	0	0	0	0			
	Ending Principal Balance	0	0	0	0	0	0	0	0	0	0	0	0			
4th Qtr	Beginning Principal Balance	0	0	0	0	0	0	0	0	0	0	0	0			
	Interest Payment	0	0	0	0	0	0	0	0	0	0	0	0			
	Principal Payment	0	0	0	0	0	0	0	0	0	0	0	0			
	Ending Principal Balance	0	0	0	0	0	0	0	0	0	0	0	0			
	Total Interest Payments	290,286	266,053	240,612	213,901	185,856	156,412	125,499	93,043	58,967	23,190	0	0			
	Total Principal Payments	485,539	509,771	535,212	561,924	589,968	619,412	650,325	682,782	716,858	752,634	0	0			
	Total Debt Service Payments	775,824	775,824	775,824	775,824	775,824	775,824	775,824	775,824	775,824	775,824	0	0			

Total Project Costs:	7,604,424
Less:	
-Working Capital	(49,718)
-Land	0
-Spare Parts	(10,000)
-Maintenance Res.	0
-Debt Service Res.	0
Depreciable Property	7,544,706

		Percentage Of Subtotal	Allocation of IDC and Contingency	Total Depreciable With Allocation of IDC and Contingency
Depreciable Property	7,544,706			7,544,706
Less: IDC	(116,780)			
Less: Contingency	(416,238)			
Subtotal	7,011,688			
Development Costs	(520,000)	7.4%	39,530	559,530
Financing Costs	(88,023)	1.3%	6,691	94,715
Interconnects	131,000	-1.9%	-9,958	-140,958
Personal/Real Prop	6,534,665			
Personal Prop (95%)	6,207,932	88.5%	471,918	6,679,849
Real Property (5%)	326,733	4.7%	24,838	351,571
				7,544,706

9. FINANCING PLAN

9.1 Introduction

In order to present realistic financing options for a Waste-to-Energy Project ("Project") investment in Chełm, the Study identified three potential investment alternatives and then developed a financing plan for each. These investment alternatives represent very different investment risk and return profiles with financing structures and sources that are distinctly different. They clearly show the range of options that the City of Chełm has to finance a waste handling project. Each alternative, its related financing plan and its probabilities of success will require City of Chełm management to seek a balance between the City of Chełm's desires to secure the required financing and its desire to surrender as little control as possible over this investment and MEHC in order to secure that financing.

9.2 Investment Alternatives

The three investment options are as follows:

1. The construction and operation of a waste handling and fuel preparation facility with the production of refuse derived fuel ("RDF") to be sold to local a user(s), most likely the local cement plant.

2. The construction and operation of this facility for the production of RDF to be sold to the local cement plant and MEHC. In this configuration a small waste fuel hot water boiler capable of burning RDF will be added to the MEHC's Main Heating Plant.

3. The construction and operation of some type of large waste fuel combustion system, including the waste handling and preparation facility that would be used for the production of heat for the MEHC and electricity for the sale to the regional electric distribution company.

The first two options anticipate the construction of the waste handling and preparation facility at the existing City of Chełm landfill. Depending upon the technology selected for option 3, this option would also include the waste handling and preparation facility, although the location of the facility could be at MEHC or the City of Chełm landfill.

This first option calls for the construction of a waste preparation and handling facility (the "Small Project") that would include the production of RDF for sale to an end user, a sorting operation that would remove all recyclable materials from the waste stream for sale and a composting operation. Any remaining waste will be directed to the landfill. This option is the lowest capital cost investment option.

The second option is to construct the facility at the landfill and at the same time install a small waste fuel hot water boiler capable of burning RDF at the Main Heating Plant of MEHC. The

heat produced by this new small boiler would supplement the MEHC heat supply produced from the combustion of coal. This option (the "Renovation Project") gives the City of Chelm the assurance that the facility has a reliable and controlled market for the RDF produced by the facility. The RDF produced by this option would be directed to either the cement plant or MEHC. Sufficient RDF could not be produced to support both combustion facilities unless additional municipal solid waste ("MSW") is obtained.

The third option introduces an integrated system that allows the MSW/RDF to be used as a fuel in a new large combustion facility at MEHC. Depending upon the combustion technology selected, this option might include the construction of the type of waste handling facility contemplated in the first two options as well as an investment in a new combustion facility at MEHC. The end result of this option (the "Large Project") is a combined heat and power plant that can burn a variety of waste fuels, including all of the City of Chelm's MSW. The combustion facility would produce hot water for heating the City of Chelm and electricity. This is the most capital intensive of the three options.

The City of Chelm administration in office at the start of this study did not express a strong predetermination as to which option might be preferred. The new administration, in office after the municipal elections of the fourth quarter of 2002, prefers the first option, the Small Project. Therefore, the Study has concentrated on the issues associated with this option.

From an investors' and lenders' viewpoint, the risk profiles, investment sizes and rates of return of these three options are is dramatically different. Therefore, PCI has had to develop a different financing plan for each option targeted to a different group of potential financing sources. Each plan has differing probabilities of success as well. Therefore PCI's evaluations and discussions with financing institutions and equity investors are based on the following general assumptions.

The initial TDA grant application included a preliminary schedule for investment implementation, construction and operations. This schedule is now defined as a result of the work of the past twelve months as follows:

	Large Option	**Renovation Option**	**Small Option**
Development Period	10-12 months	10-12 months	10 months
Capital Costs	$40-50,000,000	Under $14,000,000	Under $8,000,000
Construction Period	16-20 months	16 months	10 months
Operational Life	20-25 years	20-25 years	20-25 years
Operating Costs	Industry standard	Industry standard	Industry standard
Product off-takers	City heat users regional elect comp	MEHC & cement plant	Cement plant
City of Chelm Investment	None required	None required	Possible equity or off-take contract

From discussions with lenders and investors, the Study has concluded that most investors prefer a Project finance structure. This structure limits the amount of equity that an investment requires and limits the recourse that a lender has to the assets and cash flow of the investment. Under this structure, contracts acceptable to project finance lenders will be put in place for the Large Project and when possible for the Renovation and Small Projects. These contracts include, but are not

limited to, a fixed price, performance based/penalty based turnkey procurement and construction ("PC") contract, a long-term electric purchase contract with the regional electric distribution company and a long-term waste coal supply contract(s) for the Large Project and long-term RDF sales contracts for the Renovation and Small Projects.

9.3 Small Project Option Financing Plan

The Small Project is simply the waste preparation and handling facility – the waste receiving center, the waste sorting and shredding activities – producing a fuel and compost that would be sold to end users. The Small Project has no connection to MEHC as its fuel cannot be burned in the existing boilers of MEHC. The City of Chełm will retain full ownership of MEHC and any capital improvements that are required in the future at MEHC, including improvements associated with the upcoming new environmental discharge standards of the EU, will be the responsibility of the City of Chełm and MEHC.

A local cement plant, Cementownia – Chełm, has indicated that under certain conditions, it is prepared to sign a long term contract to purchase all the RDF produced by the facility. These conditions are that:

1. The price of the RDF on a per GJ basis represents a saving over its current price of fuel.
2. The fuel meets minimum heat value content.
3. The fuel meets maximum chloride content requirements.
4. The fuel must be sufficiently dry to meet necessary combustion requirements.

From its preliminary design evaluation and discussions with equipment vendors, PCI believes that the handling and production of the RDF will sufficiently dry the fuel to meet the cement plant's moisture requirements. However, if additional drying were to become necessary, the cement plant has indicated that waste heat from its cement operations could be used to dry this fuel and that the Small Project could install an inexpensive drying unit at the cement plant to use this waste heat.

9.3.1 Risk Profile of the Small Project

In general, an investor or lender active in this industry sector understands that an investment must control or mitigate six basic types of risks in order to be able to secure long term debt and equity and use a project finance type structure. These risk mitigation requirements apply whether an investment is an acquisition, a new plant or some combination of the two.

The Small Project, while dramatically less costly to build and requiring less time to implement and construct than the Large Project, has a significantly different risk profile which will likely change the financing options available to it. The Small Project has the following risk profile.

.1 *Completion Risk* - The risk that whatever is proposed to be done, i.e. the construction of a waste handling facility will be completed on time, on budget & perform as promised. The Small Project will use proven technology that is low tech and very straightforward to build. Ideally, the facility will be built by a proven constructor under a fixed price contract that will include specific performance criteria, a completion date guarantee and financial damages for failure to meet these guarantees. The challenge will be to find a contractor that will build such a small installation (under $8mm) on the terms outlined above or if it were willing to build it on these terms, that it has the financial strength to commit to the penalties of the contract. It is more likely that this Project will have to be tightly managed by a professional construction contractor. The relatively low risk associated with the technology being used and the presence of a good contingency will allow a lender to get comfortable with this level of risk. **PROBABLY ACCEPTABLE RISK**

.2 *Operations Risk* - The risk is that the facility to be operated can be operated at the output levels projected, at the availability factors projected and at the operating costs projected. This also takes into account the qualifications of those who will operate the facility.

The Small Project will simply be operating a waste handling, waste sorting and shredding and fuel and compost preparation operation. **LOW RISK**

.3 *Revenue Risk* - The risk is that the products that will be produced can be sold at a price that justifies the cost operations.

The Small Project will be selling RDF, recycled materials and compost into the local market plus it will be receiving a tipping fee for handling the waste. As long as the City of Chełm produces waste, the Small Project will receive a fee for handling the MSW.

The cement plant has indicated an interest in signing a long term supply contract to purchase all the fuel that the Small Project produces so long as the price for this fuel, on a GJ basis, is less than the price that the cement plant is paying for coal. The fuel must meet specified requirements to allow the cement plant to use it.

The risk that the price of the waste fuel, produced less than a kilometer away from the cement plant, will over time become more expensive than the price of coal newly mined and shipped to the cement plant is probably low. **ACCEPTABLE RISK**

The risk that over the life of the Small Project (at least 10 years) the cement plant remains in operation is the greatest risk. If the cement plant shuts down, the Small Project has no assured buyer of its fuel. MEHC cannot buy the fuel because its existing boilers cannot burn the shredded waste. A case can be made that if the cement plant were to shut down, the Small Project could sell its fuel into the local fuel market. However, this is uncertain and if it could sell its fuel, the price at which it could sell its fuel is also unclear. **UNACCEPTABLE RISK**

.4 *Fuel Risk* - The risk is that fuel will be available at a price that works for the investment.

In the Small Project the "fuel" is really the MSW that flows into the facility. The City of Chełm will continue to have waste that needs to be collected and disposed of and the waste fuel processing plant is critical to this process to meet the environment objective of minimizing landfill usage. **LOW RISK**

The ultimate risk is that the City of Chełm, over the life of the Small Project, receives a better financial offer for taking its waste. Given the economics of waste hauling and disposal, this is unlikely; but if such an offer were to be made, the City of Chełm under a new administration, might try to abrogate its contract with the Small Project. **ACCEPTABLE RISK**

.5 *Regulatory Risk* - The risk that the regulations/regulatory agencies that govern waste handling and energy production and distribution, whether URE, Polish or EU, will act in ways that are harmful to investors and the industry over the next 20 years. This includes the risk of changes to the environmental discharge standards and tax law changes.

The regulatory regime in Poland that controls waste handling, hauling and disposal is just now being established at the Wojewada level. The risk is that the Small Project is constructed and then subsequent administrations or regulations whether at the local, federal or EU levels enact practices that destroy this Project's ability to operate or earn a return.

The problem of waste disposal is a Polish and EU wide problem. While the local administration or Wojewada may institute in the short term certain standards; the ultimate standards will be national and EU standards. The EU standards require implementation of the types of technology being contemplated for the facility. **PROBABLY ACCEPTABLE RISK**

.6 *Financing Risks* - The risk that interest rate or currency exchange rate movements of inflation will, over the period of the investment, erode the expected returns on the investment.

The Small Project investment will put in place hedging programs to minimize the risks of increasing interest rates. The Investment will be financed using PLNs and Euros to minimize exposure to currency exchange rate risk. If Poland ultimately is part of the Euro zone, over the life of the Investment, the Euro will become the currency of Poland. **LOW RISK**

The final issue is the expected return for making the Small Project. Based on the pro forma developed as part of this Study and the assumptions on which this pro forma is based, the economics of the Small Project hinge completely on the tipping fee that the City of Chełm pays the facility for taking delivery of each tonne or cubic meter of MSW. From its initial research and interviews, PCI was told and independently concluded that this fee was in the range of $10 to $12.50 per tonne. At this level, the Small Project has a positive rate of return and could attract state or quasi public/private environmental funds. In addition, some specialized private funds

may be available to build the facility. On another occasion, PCI was told that this tipping fee was closer to $5; at this level of tipping fee, it is unclear whether the Small Project can be financially justified, even by the public environmental agencies.

The majority of equity and debt providers that are interested in these types of projects will be less interested or not at all interested in the Small Project for two reasons. First, the revenue risk factor associated with selling to only one customer will not be acceptable to most non-recourse project finance investors.

Second, most equity and debt providers view the small size of the Small Project as an obstacle to involvement. Regardless of the Small Project's rate of return, many financing sources believe that the amount of effort necessary to participate in any such small transaction exceeds the actual investment amount and the currency returned by the investment.

9.3.2 Financing Plan of the Small Project

The risk profile of the Small Project and its size will not allow for a complete non-recourse project finance structure. There are a very limited number of equity and debt sources that are willing to work on a transaction this small. They treat such an investment as a traditional corporate balance sheet lending proposition. These financing sources want transactions that have stronger credits or credit support, a more conservative capital structure (more equity, less debt) and at or above market rates of returns, whether an equity or debt provider. Based on discussions with those sources, it has been confirmed that the Small Project will likely require additional credit supports or equity commitments than those that will be required by the Large Project.

The City of Chełm needs to pursue two distinct directions in order to secure financing for the Small Project. It is uncertain given the small size of the investment, the risk profile and the possible lower equity returns of this investment and the City of Chełm's stated preference to implement this investment without bringing in an outside equity investor that financing can be accomplished with traditional private funds. Therefore, as the first step it is important for the Small Project to look almost exclusively for as much financial support as possible from the non-private sector. While it is unlikely that the City of Chełm can secure EU related transitional funds, the City of Chełm can secure funds from the national, regional and international environmental funds. Traditionally these funds require some equity commitment from the sponsor –perhaps 20% of the total capital required. By matching several programs together and the City of Chełm contributing the land on which the facility will be built as a form of equity, it may be possible to secure 100% of the financing for the Small Project.

The Study has seen two factors at play in this financing sector that should increase the likelihood that an all equity financing can be put together. First, the Eco-Fund, which has significant funds available for these types of improvements, prefers providing grants directly for municipal projects and prefers investments that might be considered marginal by private investors. Funds from this organization can be a basis on which other funds can be built. Second, the location of Chełm on the eastern outpost of the EU facing the states of the East provides significant and not

so subtle pressure on both the national government and the international funding sources to assist Chełm.

A possible way to make the Small Project more attractive to a wider array of private and/or public investors is to add elements of credit support as and when it is necessary to assure an optimum financing structure. For example, if the revenue risk profile were to be made acceptable, the likelihood of using a project finance structure, with its minimal equity requirements and maximal debt levels is greatly enhanced. Such mitigation strategies could run the spectrum from the City of Chełm establishing a fuel marketing program for the Small Project fuel, to finding alternative uses for the fuel to guaranteeing a level of revenue if the cement plant were to shut down.

Assuming that the revenue risk profile is made acceptable, the Small Project can likely secure a construction and long term loan with conditions similar to the one likely to be secured by the Large Project. The only open issue will likely be the term of the repayment schedule.

9.4 Renovation Option Financing Plan

The Renovation Project represents the exact same type of investment as the Small Project, except this second plan attempts to reduce the reliance that the Small Project places on the sale of RDF to a single source, the local cement plant. This is accomplished by installing a small waste fuel boiler capable of burning RDF at MEHC's Main Heating Plant and making the minor modifications necessary to use the hot water from this boiler as part of MEHC's heat supply. The Renovation Project would spend an additional $3-$4,000,000 over the cost of the Small Project in order to provide the Investment assurances that a second fuel purchase option existed. The overall economics of this Option are the same as the Small Project except the Renovation Project must provide a return on the additional amount of debt and equity needed to finance the capital improvements at MEHC. Therefore, the overall economics of this Option are even weaker than the economics of the Small Project.

It can be argued that by providing a second fuel purchase option, the Renovation Project has a more acceptable risk profile than the Small Project and therefore can more likely be financed using private money. While the risk profile of the Renovation Project is in fact more acceptable, the weak economics of the Renovation Project and the small size of the investment exceed the positive effects of the improved risk profile and create significant problems for the Renovation Project to raise financing.

The Renovation Option is not a viable financing alternative. Therefore, the Study has eliminated it as a realistic option and should not be pursued by the City of Chełm.

9.5 Large Project Financing Plan

The Large Project represents a fully integrated solution for the City of Chełm's waste handling needs. It assumes that an external investor, likely in partnership with the City of Chełm, will become a major equity owner of MEHC and assume two critical roles. This investor has the responsibility for the implementation, construction and operation of the waste fuel preparation

and handling facility as well as the responsibility for making the capital improvements that are necessary for MEHC to most efficiently use this waste fuel. The Large Project includes a new boiler capable of burning waste fuels, RDF and coal, and a steam turbine generator with accessories that allows the system to produce electricity throughout the entire year. The new facilities will be constructed to meet the environmental discharge standards of European Union. While the Large Project does not include any environmental upgrades required to MEHC existing equipment, it can be expected that the funding responsibility for these upgrades would be shifted to the investor. Under this option, the City of Chełm will have no capital or investment obligations as all Large Project costs including the financing costs associated with the construction of these improvements, any debt service and maintenance reserves and interest during construction are all provided as part of the Large Project.

9.5.1 Risk Profile of the Large Project. The Large Project has the following risk profile:

.1 *Completion Risk* - The Large Project will use proven technology; will be built by a financially strong proven constructor under a fixed price contract that will include specific performance criteria, a completion date guarantee and financial damages for failure to meet these guarantees. **LOW RISK**

.2 *Operations Risk* - The Large Project will be similar to dozens of plants already operating under similar operating conditions around the world. All have proven records of operations, operating costs, availability, etc. There exists a large data base of the costs associated with the operations of the Chełm heat company as well as a staff fully experienced in its operations. This provides a sufficient base of data upon which this projection can be based. **LOW RISK**

.3 *Revenue Risk* - The Large Project will be selling hot water to the City of Chełm residents in a monopoly setting. While the prices of these sales are controlled by the URE, the volume of sales is fairly stable; no one customer is so dominant that if that customer goes away the investment fails. **ACCEPTABLE RISK**

The Large Project will be selling electricity to the regional electric distribution company under terms of a long-term contract governed by provisions of energy regulations. If this legislation is repealed, the sales contract remains in place and price for electricity to be sold will still be cost competitive to other sources of electricity. **ACCEPTABLE RISK**

.4 *Fuel Risk* - The fuel for the Large Project will be from the MSW stream, available waste coal sources, possibly waste sludge from local water treatment plant and conventional coal sources. The Large Project will seek out other solid waste streams in neighboring cities; will contract for waste coal from a regional coal mine if applicable and for the lowest quality coal that can be burned from surrounding suppliers. These contracts will be long term and establish price escalation formulas to define fuel price movements during the life of the Project. **ACCEPTABLE RISK**

.5 *Regulatory Risk* - The regulatory regime for the energy industry in Poland is now somewhat established and a history of rate case procedures and timing now exists. The

law is clear on how regulators are to act; but this is still an area of some uncertainty. All sales contracts will include provisions that allow cost increases caused by regulatory mandated change to be passed along to the end customer. Despite these provisions, heat price changes will be governed by the URE. Electricity produced by the Large Project will be cost competitive with other sources in the Chelm region. Therefore, if the energy regulation provisions for a special cogeneration electric tariff were to be abolished during the life of the Large Project, the Large Project would still produce acceptable returns. **ACCEPTABLE RISK**

.6 *Financing Risks* - The Large Project will put in place hedging programs to minimize the risks of increasing interest rates. It will be financed using PLNs(Zloyts) and Euros to minimize exposure to currency rate risk. If Poland ultimately becomes part of the Euro zone, over the life of the Project, the Euro will become the currency of Poland. **LOW RISK**

The contracts that support the Large Project will include provisions to pass along cost increases fueled by inflation; although the ultimate capability of the Large Project to pass along inflation related costs to hot water customers is controlled by the URE and this is in part a regulatory risk (see 5 above). **ACCEPTABLE RISK**

The final issue is the expected return for making the Large Project. In part because the Large Project includes an eventual ownership stake in MEHC, a pro forma for the Large Project would incorporate the impact of the Large Project's cost and revenues on MEHC. Of course, in this case the value of the facility's tipping fee, so critical to the Small Project, is not as significant. The Large Project shows a rate of return that is acceptable to equity investors.

A significant number of interested financial sources perceive that the overall risk profile associated with the Large Project clearly falls within the acceptable risk profile of both equity and debt providers that regularly evaluate these types of investment. The Large Project is clearly a commercial venture that can be financed using private or quasi-private sources of debt and equity. Certainly, the Large Project can seek partial funding commitments from the same government agencies that the Small Project will approach; but the Large Project will attract substantial private sector financing.

9.5.2 Financing Plan of the Large Project.

The financing plan for the Large Project is very similar to the financing ideas presented in PCI's TDA grant application. Based on its discussions with both equity and debt providers, PCI believes the Large Project will be able to secure private sector financing using a non-recourse or limited recourse project finance type structure.

On the equity side, PCI discussed the Large Project with at least six target equity providers and all registered a strong level of interest. This interest is based in large part on:

1. The above noted risk profile.

2. The size of the investment (an equity investment in the range of 36 - 45,000,000 is large enough to justify the amount of analytical and implementation work required to make the investment).

3. The projected economic returns.

4. The stable heat load of the City of Chelm.

5. The sales of electricity to the regional electric distribution company under the current cogeneration tariff structure and a competitive price if that tariff were to go away over the life of the investment.

6. The proven technology to be used.

7. The use of waste fuel(s);and

8. The opportunity to participate with PCI in the Large Project.

On the debt side, PCI expects that the Large Project can secure an interest only construction loan for the period of construction, testing and start-up. In other words, the loan will have no principal repayment requirement until the Large Project is up and operating. Once the Large Project has passed all required performance tests as outlined in the PC Contract and is operational, the construction loan will convert into a term loan with a repayment schedule of between 10 and 15 years.

The debt component should be at a minimum 70% of the total cost of the Large Project. In discussions with particular lenders and leasing companies, if the Large Project meets certain debt service coverage tests, a higher percentage of debt is possible. There is also significant interest among certain financial institutions because the Large Project plays to lenders' growing interest in financing projects that include a component of waste fuel, whether waste coal, MSW or waste sludge from treatment facilities. One international bank with whom one of PCI's managers has worked with before has a strong specialty in Waste-to- Energy project finance transactions and has recently opened an office in Warsaw.

The results of these discussions with lenders regarding debt terms and conditions for a construction loan and a permanent loan, interest rates, fees, length of the permanent loan, expected closing costs and required reserves have been incorporated into the Large Project's most recent financial projections. The results show an investment that meets both the return requirements of the equity investors as well as the coverage ratios and return requirements of targeted lenders.

9.6 Conclusions

The Study focused on three distinct options for solving the MSW problems of the City of Chelm.

The Large Project represents an investment that will find ready market acceptance as both equity and debt providers will be available when and if this option is chosen. Sufficient work has already been done to pave the forward movement of this investment if this is the chosen path.

The Small Project represents an investment that will find less ready market acceptance because of the small size of the investment and questions surrounding the long term sales of the waste fuel. This investment is best suited for government and non-private money. If credit support mechanisms are put in place regarding the long term sales of the waste fuel, then some private money more likely will be available.

The Renovation Project does not make economic sense and was eliminated as an option.

If the Small Project Option is selected as the option the City of Chelm wishes to pursue, then additional work during the project implementation phase is required with the environmental organizations that supply grant and loan monies needs to determine the best way to secure 100% or near 100% government debt, grant and quasi-public financing.

10. IDENTIFICATION OF ISSUES

10.1 Introduction

From the first definition of a potential investment involving Municipal Solid Waste ("MSW") through its development, financing, permitting, construction, testing and start-up – there are well over 1300 specifically identified tasks that must be completed. As the investment is being defined, the project developer is constantly assessing the issues and risks associated with each task to determine those issues that might cause the investment to fail or be delayed. The project developer must then determine if he can develop strategies that will remove or mitigate such issues as obstacles to investment's success or acknowledge that the identified issues cannot be resolved. If resolution can not be achieved, the resulting investment opportunity has a low probability of success. Once a decision is made to go forward with an investment, the developer regularly reviews investment progress to determine if issues already identified have been effectively resolved or if new issues have arisen for which mitigation initiatives are necessary.

The formal issue identification review is meant to be as exhaustive an evaluation process as possible. The process looks at such straight forward issues as the appropriate technology, the availability of long-term fuel supplies at reasonable prices, the availability of skilled labor and the order time for key equipment components. But the process also seeks to undercover things that might at first glance seem to be less critical. These might include the presence of an endangered species of fauna in a region of the targeted site area, the lack of enthusiasm in a local community for the presence of an industrial plant, hidden biases that might exist in the regulatory processes, lack of local political support for a private investor, a reluctance to change an established way of operating or a projected shortage of water in a region ten years in the future.

The types of issues that surface during the identification process can generally be divided into two categories: those that are more objective or technical in nature for which there are clear technical or operational solutions and those that are less clear cut and more subjective. The majority of the tasks in any project - design, engineering, financing, construction, start-up and operation of the asset - are these objective issues. The completion of these tasks is largely driven by the developer's management team. The tasks themselves are straightforward and have been done hundreds of times before on similar investment projects.

The less objective tasks and issues are the regulatory, political and social issues that arise in the decision making processes surrounding such investments. In this context, regulation refers to those government agencies and processes with responsibility to grant the licenses, approvals and permits that are necessary for an investment to go forward and ultimately operate. In Poland these processes are now more objective than subjective, with established guidelines and evidence of how these regulations have been applied during the granting of other licenses and permits. These granting agencies include the environmental permitting agencies, the local building permit authorities, and depending on the investment, the energy regulatory body, the URE.

Politics refers to the decision making processes at the local and regional levels and the degree of support that exists for this type of investment. These processes often reflect the strength and will

of the political leadership in a City of Chełm and region, are often as subjective as objective and reflect to some degree the social attitudes of the region as well as the jockeying by political parties for advantages. Social attitudes refer to the opinions and attitudes held by the residents of any city and region towards government, commerce and investment in general and towards this investment in particular. Social attitudes and politics are related and to some degree influence one another.

Often the greatest challenge for the developer is to determine if he will be able to develop issue mitigation strategies that will gain the support of the parties in the decision-making or influencing positions. These include local, regional and national politicians, local constituents, local, regional and national regulators, the local heat company, its existing employees and union officials and the City of Chełm government.

In conducting its review for this Project, PCI started with a list of over 75 potential critical issues. These were quickly pared to fewer than 20 and after further evaluation reduced to a list of eight. PCI was able to eliminate all issues that are related to technology, design, construction or operations. The remaining eight issues are related to regulation, politics and social attitudes. The Project does not seem to raise significant issues. It does not appear to be controversial and of the eight remaining issues, perhaps three might rise to the point of being focused discussion points in the City of Chełm.

The format of this analysis identifies and defines a particular issue and then highlights a mitigation action that should be acceptable.

10.2 Issues Investigation Methods and Procedures

To establish the list of potential issues as well as possible mitigation options, PCI undertook a three-part investigation effort. First, using internally developed checklists from its own past evaluations of investment opportunities in Poland and those of a consultant that PCI uses regularly, PCI developed a list of more than 75 critical issues to evaluate in reference to the proposed Chełm Project. After an initial review, this list was reduced to just less than 20 items. PCI then undertook a literature and data collection effort to update its existing knowledge of regulations, standard procedures, and current and past practices in order to understand how these critical issues are being handled.

Second, PCI held discussions with the regulatory offices and agencies charged with the oversight at the local, regional and national levels of the construction and operation of investment projects, including those in which ownership interest might be held by non-Polish entities. Particular attention was focused on investments that include the handling and combustion of municipal solid waste.

Third, PCI spoke with local officials and worked with a group of specialized consultants to verify the information gained in steps one and two. This was the basis to establish the final list of issues and to evaluate and to develop the logical mitigation approaches necessary and appropriate for this type of investment in Chełm. These specialists included consultants experienced in local issue identification, analysis and public relations, engineers aware of the

current waste combustion technologies, heat production and fuel use technologies and EU standards for waste handling and combustion. It included lawyers fully versed in the regulations that apply to investment in Poland by foreign entities, energy regulations, municipal regulations, corporate organization and waste handling regulations, and permitting agents that are involved on a day-to-day basis in the licensing and implementation of these types of investments.

At least one of the eight issues defined below clearly relates to the environmental impacts of the investment. While these issues are referenced is this report, they are specifically explored and evaluated in much greater depth in Section 7 of the Final Report – Environmental Impact Assessment.

10.3 Primary Issues & Mitigation Approaches

The issues surrounding the proposed Project are outlined as follows:

10.3.1 Site Selection

The proposed Chełm Waste-to-Energy Project will require a site on which to build the waste handling, sorting and shredding operation. The site must accommodate truck ingress and egress allowing for regular truck traffic that delivers and unloads waste and then transport unusable waste, recyclables, compost and refuse derived fuel ("RDF") from the site.

The Chełm region, despite the presence of the landfill, remains a center for forest and meadow terrain with accompanying wildlife and natural preservation. In the northeastern part of the City of Chełm there is the Kumowa Dolina forest and in the eastern part is the Borek forest. The nature reserve Wolwinow is in its eastern area and the City of Chełm includes five city parks and the Landscape Park that includes the only carbonate peat bogs in Europe. These areas include some 40 species of protected plants and the Chełm vicinity is inhabited by rare species of birds such as the corncrake, the barn owl, the towny owl, the little owl and the crested lark.

The owners of the proposed Project, whether the City of Chełm, a private company or some form of public-private ownership, must show local residents, their elected officials and regulators that the proposed Project will not conflict with adjacent land uses or cause disturbances to biological resources.

> *Mitigation*: All approvals for the development of the proposed Project at a new site could likely be secured. But the optimal solution is to build the proposed Project adjacent to the existing landfill in the village of Serebyszcze.
>
> The majority of the waste gathered in the City of Chełm and the surrounding communities is currently delivered to the existing City of Chełm controlled landfill. From the perspective of the local community, this site is already permitted as a landfill and has been accepted as part of this section of the City of Chełm. From the perspective of long term operations, it is optimal to construct the waste handling and preparation facility adjacent to the delivery points in the existing landfill. This minimizes the required handling of the waste as well as allowing for the easy delivery to the landfill of

waste that has no commercial value and cannot be composted.

From a regulatory perspective, the introduction of the waste handling and preparation facility at the landfill is ideal. The site is already permitted for its current use. The introduction of waste handling, separating and shredding operations at the site can be shown to meet all current standards and to fall into acceptable use parameters. It does not interfere with adjacent or regional land uses; it restricts the handling of MSW and any related odor, safety and health concerns to the existing landfill site. The new facility will be designed to blend with the surrounding and not change the visual quality of the site.

If Municipal Energy Heating Company ("MEHC"), the City of Chełm heat company, and/or the cement plant were to become long-term purchasers of waste fuel from the facility, this fuel would have to be delivered to either or both sites. The landfill site already has regular truck traffic for deliveries of waste and it is anticipated that these trucks would simply haul the RDF to either or both waste fuel purchasers. There would not be a net increase of truck traffic at the landfill site. As for truck deliveries of fuel to the fuel purchaser(s), truck traffic would again not change dramatically as waste fuel would be replacing some portion of currently used coal which is currently delivered in part by truck.

10.3.2 Land Ownership

If the facility is owned by a private investor or by a joint venture in which the majority owner is a private investor, the private investor will need to secure regulatory approval to purchase or control land.

Mitigation: If private ownership dictates a regulatory approval, the approval process for such authorization is now quite standard and can be secured within six to nine months. An alternative might be a long-term agreement with renewal options between the City of Chełm and the facility providing the facility access to land currently owned by the City of Chełm. City of Chełm ownership of the facility would eliminate this concern.

10.3.3 Waste Stream Control

The proposed Project requires a regular delivery of waste in order to operate efficiently and profitably. The facility is based on the assumption that an on-going supply of City of Chełm MSW will be available to the facility. If the City of Chełm's supply of waste is cut-off, the proposed Project loses its economic viability.

Currently the City of Chełm runs its own MSW collection service and whatever MSW is collected in the Chełm region is delivered to the City of Chełm's landfill. A study of per capita MSW collection volumes in the City of Chełm, in Poland and in other European countries shows that both the volume of MSW on a per capita basis in Chełm and in Poland are below the per capita levels in other Western European countries. It is expected that over the next 10 years the per capita volumes in Chełm and Poland will begin to increase to more closely match per capita volumes in other Western European countries. Therefore, the issue of MSW availability for the

facility is not an issue of decreasing levels of MSW in the collection area, but rather the possible diversion of MSW from delivery to the current landfill to an alternative landfill.

Often a City of Chełm will out-source services such as MSW collection in order to save money in a City of Chełm's budget. The contract MSW collection service often undertakes this contract because it believes that it can improve its margin by delivering the waste to an alternative landfill whose tipping fees may be less than a City of Chłem's charges. In this case the City of Chełm loses control over where its MSW is to be landfilled.

> *Mitigation:* If the facility is built, the City of Chełm must commit to a binding long-term supply contract that all MSW collected in the Chelm region will continue to be delivered to the facility. This obligation to deliver MSW must continue even if the existing landfill was to be filled, closed and another landfill opened. If the City of Chełm ever were to contract with a private MSW collection company, this binding long-term supply contract will be binding on the new collection company, continue to be in force and must be acknowledged as binding by the new contractor. No landfills currently exist in the Chełm region that meet current construction standards and have a capacity to compete with the Chełm landfill. No community in the region is large enough to establish a competing landfill.

10.3.4 Meeting All Environmental Standards

The facility's ownership must meet all environmental requirements established by Poland and the EU in order to secure a permit to build and operate the facility.

From an environmental regulatory perspective, all levels of emissions for air, water, noise, waste streams must be in compliance with Polish and EU standards. The simple process of unloading, sorting, separating and shredding waste raises few environmental issues tied directly to the facility. The current landfill operates in compliance with leaching and residue permit tolerances; nothing will change with the introduction of the waste handling system contemplated with the facility.

The required approvals include an authorization to use the land as proposed, an authorization approving the design of the facility, compliance assurance that the facility being built is in accord with the approved design and that the facility is operating within the parameters of any permits.

From a social and political standpoint, City of Chełm leadership and residents will not want to allow the facility to operate in their City of Chełm if it poses any type of health or safety risk. If the City of Chełm government or residents perceive that the legal/regulatory standards established by the Polish government or the EU are not sufficient to protect their City of Chełm, they will work aggressively to halt the implementation of such an investment.

The larger environmental discharge issue rests with the emission levels that are authorized in the permits granted to those facilities that will burn the RDF produced by the facility - the cement plant and the City of Chełm heat company. Since the cement plant will likely be the first user of the RDF from the facility, the cement plant must make sure that its permits allow it to burn this

fuel. It must assure that the combustion of this fuel will be in compliance with all emission levels authorized at the cement plant. If and when the City of Chelm heat company installs a boiler to allow the burning of this RDF, the heat company environmental permits for air discharge would need to be reviewed and updated to allow for the combustion of the RDF.

Mitigation: There is no mitigation of this issue. Either the facility can qualify for permits or it cannot. Fortunately, there is nothing in the processing that will go on at the facility that will jeopardize the issuance of permits. The landfill operations, including its waste stream management, are operating in compliance with current standards and will continue to do so when the facility is operating.

The probability that local residents will object to the waste handling and shredding operation seems small. The Project was suggested by the past City of Chełm government and is being supported by the current City of Chełm management. Once the facility is operating, it can extend the useful life of the landfill by as much as 10 years, thereby postponing City of Chełm expenditures for a new landfill by a corresponding time.

The cement plant management has already indicated that, subject to acceptable levels of chlorides and a minimum heating value, its calciner can burn all the shredded waste fuel that the facility can produce without falling out of compliance of its emission limits. It has in the past burned alternative fuels and has remained in compliance with its permits. Implementation of a new alternate fuel handling and feeding system utilizing MSW will require the cement plant to obtain an integrated permit, which it would be required to obtain by 2004 anyway. The preparation of the permit application is proceeding with RDF combustion included as a fuel.

If the MEHC Main Heating Plant is to burn the RDF, MEHC will be required to make fuel handling changes and install a new boiler to burn the RDF. MEHC will be required to secure new permits for the heat company in order to burn the RDF. MEHC will be required to secure an integrated permit in the 2004-2005 timeframe, so if MEHC contemplates having the option to burn RDF in the next five years, it would make sense to permit for such use in the integrated permit process.

10.3.5 Foreign Investment in Chełm

It is possible that the majority owner of the proposed Project might be a foreign entity.

The City of Chełm and regional governments actively solicit foreign investment and Chełm already has such investment. Waste management is usually a service provided by the municipal government. It is possible that if the ownership of the facility were to be a foreign company, the local community or one of the local political parties might argue that a key city service would now pass into the hands of a foreign entity. This would ultimately mean residents and the City of Chełm government would have no control over quality of service or prices paid for the service.

Mitigation: Currently all MSW collection and disposal at the landfill is the

responsibility of the City of Chełm government and if the proposed Project were to go forward, this arrangement would continue. The City of Chełm will continue to control all aspects of these services including the pricing of these services until the MSW is delivered to the proposed Project's waste handling and preparation facility. The City of Chełm again controls the MSW after the combustibles, compostables and recyclables are removed from the waste stream and it is deposited in the landfill. A foreign investor has invested its own money to build a plant that will convert the City of Chełm's waste into a usable by-product that has some commercial value. The investor secures a return and the City of Chełm has delayed the need to spend City of Chełm money to build a new landfill for perhaps as long as 10 years.

10.3.6 Technological Concerns

Over the past 25 years, there has been a history of some Waste- to-Energy plants experiencing operating problems typically found in first generation designs. When this history of problems becomes public knowledge as the City of Chełm explores these types of investment, it will likely raise concerns among residents to which politicians will need to respond.

Municipal Solid Waste can be directly combusted in waste-to-energy facilities as a fuel with minimal processing, known as mass burn; it can undergo moderate to extensive processing before being directly combusted as refuse-derived fuel; or it can be gasified using pyrolysis or thermal gasification techniques. Today there is ample operating data that shows each technology can be operated safely and in an environmentally acceptable way. The production of a fuel from sorted, separated and shredded MSW is now done regularly in at least 20 such plants in North America and Europe. This fuel is burned as separate fuel or blended with other fuels to allow for combustion that meets technological and environmental discharge standards.

Mitigation: From a technical standpoint the burning of sorted, separated and shredded waste can be accomplished so as to meet all environmental and technological concerns. There is ample evidence that this combustion can be done in compliance with all regulatory requirements. The cement plant, the most likely first user of the RDF, has already indicated that subject only to minimum heating value and chlorine content issues its calciner can safely burn the fuel produced by the facility.

Concerns about combustion and the discharge of unacceptable product into the environment are a social and political issue. If uncorrected, these public perceptions can often drive decision-making processes. Therefore, the owners must help the City of Chełm residents understand that the risks associated with burning the refuse based fuel prepared at the facility are no different than the risks of burning coal at MEHC's Main Heating Plant's boilers or at the cement plant's caliner. Making available appropriate data to the City of Chełm council and having representatives visit an operating plant that uses comparable fuel in its fuel mix should help show that this issue is not a significant issue for the City of Chełm.

10.3.7 Traffic Patterns at the facility & Landfill.

Assuming, the facility is located at the existing landfill there is a risk that truck traffic will increase on the roads in the vicinity of the landfill.

Mitigation: The operation of the facility at the landfill will not change or only modestly change the truck traffic patterns coming to and going from the landfill. The truck traffic will be the same when the facility is operating as it is today, as all MSW from the Chełm community is already being delivered to the landfill.

Truck traffic could increase if the facility were to accept waste from other municipalities, in an attempt to increase the volume of waste that it processed. Currently 20 to 30 trucks run in and out of the landfill on a daily basis. Assuming that the facility could arrange with other municipalities to double the volumes of MSW that it processed (the upper limit of what the facility could process on a daily basis), this increase could translate into an additional 10 to 30 trucks per day, depending on the size of the new delivering trucks. This is on average 5 trucks per hour over a delivery day of 8 hours, well below the normal highway traffic that passes the landfill site.

10.3.8 Public Concerns and the Public Comment Period.

Over the past 25 years in North America and Western Europe, special interest groups advocating a particular cause have become particularly effective in mounting campaigns that can stop the forward movement of an activity that they do not support. While these campaigns are not always successful in stopping such activity, they certainly slow down the decision making process associated with the activity, increase the costs associated with the activity and dramatically raise the level of public scrutiny of that activity.

PCI understands that this type of issue opposition activity may be less sophisticated in Central Europe and Poland, but it certainly does exist. While the activities of the proposed facility are not at all controversial, and actually benefit the long-term waste problems of the area, there may be citizens or special interest groups that oppose the plan. The public comment period during which any local citizen can raise questions or concerns is often the platform upon which such opposition is launched.

In conversations with City of Chełm officials on these matters, PCI has been assured that the likelihood of such opposition is small. The City of Chełm and permitting authorities have already approved the collection and dumping of waste at the current landfill, it has been in operation for a number of years and local residents recognize and accept the necessity of such an operation and its current siting. The City of Chełm has completed an expansion of the landfill because the current cell is almost filled. To minimize the utilization of the landfill the City of Chełm should introduce an expanded recycling program, a composting program or a waste handling system in part based on the recommendations of this Study. These announcements have been made in local newspapers, on radio spots and on the City of Chełm's local bulletin boards in the center of town.

Mitigation: The City of Chełm has already laid the groundwork for much of what the Study will recommend with the residents of the City of Chełm. During the public comment period associated with the permitting of the facility, the announcement of which the City of Chełm government is recommending be publicized in local newspapers, radio spots and on the City of Chełm's downtown bulletin board, the City of Chełm government believes that citizens will be somewhat interested but with no opposition. Such a conclusion is based on the strong evidence that the current landfill operations are already accepted by the residents.

To assure public acceptance of the proposed Project, PCI recommends a proactive program to provide information on the benefits of the Project, general public relations and the establishment of good will with the public.

The proposed facility is just an extension of these efforts and its operations are in no way introducing any controversial practices with which the permitting agencies will be concerned. The cement plant has already been burning alternative fuel in the past and will continue to do so and such actions are in compliance with its permits. If MEHC were to be permitted to burn RDF from the facility, this activity would also be acceptable to the permitting authorities.

10.4 Conclusion & Follow-up

The issues that might arise as a result of the implementation of the proposed Project are minor. Of the eight issues on which PCI focussed final attention, only three might be viewed as problematic. First, for the investment to be successful, the City of Chełm must make a binding commitment to allow the City of Chełm's and region's MSW to flow to the facility. Second, the facility must meet all environmental discharge standards. Since the facility is simply sorting, separating and shredding the waste, not changing the nature of the waste – for example, burning or gasifying the waste – it will be able to meet all standards without difficulty. Third, the local residents have already accepted the presence of the licensed landfill and since the facility is in effect extending the life of the landfill and encouraging a valuable type of recycling, it is unlikely that strong opposition will be present.

11. ANALYSIS AND CONCLUSIONS

11.1 Introduction

This section is divided into three parts. The first part addresses the evaluation of five critical factors that led to the Study's conclusions regarding the type of Waste-to-Energy Project to build in the City of Chełm. The second part presents the specific conclusions and recommendations of the Study. The third part acknowledges those parties that assisted in the execution of this Study.

11.2 Analysis of Critical Variables

The results of the evaluation of five critical factors clarified the options that the City of Chełm had regarding the facility.

11.2.1 The first task was to evaluate records, reports and observations provided by City of Chełm management to develop reliable data about the waste stream that flows into the City of Chełm landfill and several smaller landfills in the Chełm area. Of particular importance was the need to develop a reliable estimate of the volume of waste that flows into the landfill, to identify the scheduling and seasonal timing of such deliveries and then to develop a reliable profile of the contents of the waste stream. Like the load duration curve that shows the load profile of a heat company, the results of these efforts gave the Study its first reliable profile of waste volumes and make-up. This profile immediately allowed PCI to narrow the realistic technological, financial, siting and sizing options for the facility.

11.2.2 Utilizing the waste supply data, PCI evaluated how to best use this waste in the waste-to-energy setting. Given the low daily volumes of waste flowing into the Chełm region landfills, it was clear that the quantity of fuel produced by the facility would be a supplemental fuel – not the primary fuel - for ultimate end user(s). This led to the analysis of three possible options regarding end users and possible utilization technologies. These evaluations were not full-blown feasibility reviews as economic and financial assessments were only undertaken after end user and technology options were evaluated and their viability ranked.

The first evaluation was of Municipal Energy Heating Company ("MEHC") Main Heating Plant to determine if the boilers of this Plant could currently or as a result of fuel handling and boiler modifications burn the waste fuel to be produced by the facility. The second evaluation was of building a new boiler plant at the Main Heating Plant that would use this waste fuel as part of a larger fuel stock and produce heat for MEHC and electricity. During this evaluation several waste-to-energy technology choices were thoroughly reviewed. The third evaluation was of alternative sites where a waste fuel could be used.

This analytical process yielded two viable options: 1) the construction of small waste handling and preparation facility at the landfill that would sell, RDF ("RDF"),

recyclables and compost; and 2) the construction of some type of waste handling facility and a boiler plant that would produce heat for use by MEHC and electricity for sale to the grid.

11.2.3 The Study then undertook the full evaluation of each option from a technology design, construction, equipment, cost, siting, licensing, regulatory and environmental permitting perspective. This evaluation included securing the perspective and preferences of the City of Chełm management. As a result of this exercise, the two options were ranked. The preferred option based on this analysis is the construction of the waste handling, sorting, separating, recycling, fuel preparation and composting facility that will be sited at the Chełm landfill. A major product of this facility will be RDF for use as an alternative fuel. Cementownia – Chełm, a local cement plant, has expressed a strong desire to utilize the RDF produced by the facility.

11.2.4 Next, the Study analyzed the two ranked options plus a third option, to determine the financial viability of each option. The financiblilty, the likely capital structure, ownership structure and the sources of funding for each option was formulated. During this analysis, the City of Chełm indicated that its preference was to retain full ownership of the facility. Based on this requirement, a 100% debt financing structure was the preferred option with the expectation that the debt for the Project would come from public and quasi-public environmental funding organizations. The alternative to this preferred option is the construction of the facility at the landfill with the additional construction of a new boiler plant at the Main Heating Plant of MEHC. While this second alternative is technologically and financially practical, the implementation of this alternative will probably require an outside equity investor, the potential sale of MEHC to this investor and the loss of control of MEHC and the facility by the City of Chełm. This is an alternative that the management of the City of Chełm will consider only if the preferred option proves not to be viable.

11.2.5 Finally, with the comprehensive evaluation of the options complete, the Study stepped back from the particular options evaluated and looked to identify and analyze key regulatory, social and political issues or risks that could potentially affect such a waste-to-energy investment in Chełm. This analysis showed no significant issues surrounding this Investment and identified reliable mitigation strategies available to handle the eight highlighted risk areas.

11.3 Conclusions and Recommendations

This section presents the conclusions and recommendations of the Study. As noted in 11.1.4. above, the option that best addresses the City of Chełm's desire to have an environmentally friendly solution to its the waste-to-energy problems and to retain maximum City of Chełm control of waste utilization activities is for the City of Chełm to build and own a waste handling and preparation facility at the existing landfill. The conclusions noted below provide the build up for and support of this case as the preferred solution. The conclusions also provide a viable second alternative should the City of Chełm's overall goals or financing options change as it is making its final decisions regarding this Project.

11.3.1 The appropriate technology for the facility is a waste handling and preparation plant that sorts and separates the incoming waste stream into waste that can be recycled, waste that can be composted and waste that can be shredded, and made into a RDF. Markets will be established for these materials during formal project development. The remaining waste is delivered to the City of Chelm landfill. This type of waste processing is readily accepted in Europe and is environmentally friendly.

11.3.2 This waste handling facility effectively reduces the volume of waste flow into the landfill by approximately 85%, thereby meeting key City of Chelm goals to significantly extend the life of the landfill, to recycle as much of this waste as possible and to find alternative uses for large portions of the waste stream.

11.3.3 The facility uses proven U.S based technology with equipment that is low tech, inexpensive to purchase, install, operate and maintain. The equipment is reliable and dependable to operate and is readily available. The detailed design facility should be accomplished by a Polish engineering company. Its installation is straight-forward and should be done by a Polish construction company. The operating staff should come from the local community's labor pool and be trained at the facility by representatives of the equipment manufacturers.

The technology and equipment selected are already being used in existing facilities in North America and Europe where dependable and environmental friendly operating and maintenance records have been established.

11.3.4 The Study has developed a cost estimate and a schedule to build the facility. This estimate lays out the costs associated with the activities and time needed to build the facility; including the design of the facility, its permitting, the creation of the appropriate corporate structure for the facility and the securing of the financing for the facility. It identifies the costs and schedule for building, insuring and testing the facility as well as the costs associated with the financing, start-up of the facility, its working capital, an initial order of spare parts and a contingency. These are all-in cost and start-to-finish schedule estimates.

While these numbers and the schedule may seem high or long to the City of Chelm, both estimates represent realistic assessments of what is necessary to complete the facility. The financing strategy and funding sources that the Study is recommending will require such realistic assessments. To discuss the Project with these funding sources from any other basis will call into question the experience and skill of City of Chelm management to successfully execute this Project.

11.3.5 The Study includes a cost for the project management of the Project in its cost estimate. The delivery of a completed facility capable of operating according to design specifications and on budget and on time requires full-time management attention and control. Such control is necessary if the City of Chelm is going to secure the financing package that the Study is proposing.

Therefore, the Study recommends that an experienced outside project management company should manage this Project. The project management team must have extensive experience managing a turn-key fixed price, performance based procurement and construction contracts for this type of facility. It also must have experience with training, the start-up and commissioning of comparable facilities and working closely with the management of the entities providing the financing for the facility.

11.3.6 The facility should be sited at the existing City of Chełm landfill as the infrastructure for such a facility is already largely in place, including a new environmentally acceptable landfill unit. The site is already permitted and is accepted by the community for such activities. The combination of the facility's waste handling operations with the end point repository of unused waste minimizes the handling of waste and therefore the costs of waste handling.

11.3.7 The facility will be easy to permit as the waste handling elements of the facility do not raise any environmental permitting issues either based on the current Polish standards or the upcoming EU standards. The landfill is already permitted and while new permits will be required for the facility, the new activities being contemplated at the landfill will not change the permitted profile of the landfill.

11.3.8 Any industrial entity that desires to burn the RDF produced by the facility must secure appropriate permits. The RDF itself and the combustion process by which this fuel is burned are not an environmental or health hazards to the local community.

The two logical users of this fuel are the local cement plant and MEHC. The cement plant already has approval to burn alternative fuels in its production cycle and its current fuel mix includes perhaps as much as 5% of this alternative fuel. In discussions with the management of the cement plant, management in its current permitting application is seeking approvals to burn a fuel mix that includes as much as 10% of RDF in its calciner. According to the cement plant management as well as the outside permitting consultants that the Study worked with, such approval can be expected.

Currently, the boilers at the Main Heating Plant of MEHC cannot burn RDF. If at some point a new boiler installation were to be contemplated at MEHC, the boiler to be selected would be required to meet all discharge standards set by the EU. The combustion of this RDF as the fuel for this boiler or as part of the larger fuel supply mix would fall comfortably within all of the emissions standards.

11.3.9 The volumes of waste currently flowing into the Chełm landfill from the Chełm Collection Area are sufficiently small – approximately 120 tonnes per day six days per week- that the RDF produced by the facility – approximately 25% of this waste stream – is likely to be a supplemental fuel to an end user. This user must be able to

burn the RDF on a timely basis because the calorific value of the RDF may deteriorate with time.

11.3.10 The Study did evaluate on a preliminary basis the possibilities of securing additional waste from neighboring communities in order to more optimally use or size the facility. The idea of a larger waste collection area was of modest interest to at least two neighboring communities and these initial discussions are worth pursuing.

The Study concludes however, that it is acceptable to size the facility based on the existing flow of waste into the landfill for two critical reasons. First, the facility's reasonably flexible processing and operating capabilities allows it to handle a delivery and flow of waste that is almost 25% more than is currently anticipated. Second, by adding a second shift to the facility, the volume of waste that can be processed more than doubles the capacity of the facility.

11.3.11 The volume of RDF produced by the facility fits the profile and volume of alternative fuel that the cement plant is seeking. Preliminary indications show that the shredding operation at the facility will produce acceptable sized fuel. The handling of the RDF will sufficiently dry the RDF so that no additional drying will be required. If additional RDF drying were to be required, a small drying unit can be built at the cement plant that uses the waste heat from the cement plant as the heat source for drying.

The cement plant is willing to cooperate with the City of Chelm and is prepared to sign a long-term RDF purchase contract. The revenues that will come from the long-term sale of RDF to the cement plant is an integral part of making the facility a financially viable investment.

11.3.12 The facility will receive revenue from two other sources: the sale of materials reclaimed by the sorting and separating operation of the facility, including glass, metals and the sale of compost. These sales represent approximately 47% of projected revenues. The receipt of a payment – a tipping fee - from those that deliver waste to the facility including the City of Chełm's MPGK, representing approximately 33% of projected revenues. The establishment of this tipping fee and the payment of this per tonne tipping fee to the facility by MPGK - at a level that assures the economic viability of the facility will be required. The Study estimates that the cost to landfill a tonne of waste in Chełm is between $10-$12.50 per tonne. In the Study's financial analysis section, this fee was set at $7.50, $10.50, $12.50 and $15.00 for evaluation purposes.

11.3.13 The long-term success of this Investment and the facility is largely dependent upon the facility receiving delivery of a steady stream of waste from the Chełm Collection Area for the next 20 years. Currently, the City of Chełm runs its own municipal solid waste ("MSW") collection service, through the City of Chełm owned company MPGK, and whatever waste is collected by MPGK is delivered to the City of Chełm's landfill.

MPGK, the City of Chełm, area communes and the facility must commit to a binding long-term supply contract that requires the delivery of all waste collected in the Chełm Collection area to the facility. This obligation to deliver to the facility must continue even if the existing landfill was to be filled and another landfill opened. If the City of Chełm or MPGK were ever to contract with a private waste collection company, this long-term supply contract calling for delivery of all collected waste to the facility must be binding on the new collection company and must be acknowledged by this new contractor.

11.3.14 The Study recommends that a specially created City of Chełm company own the facility. This company would be managed by two senior managers, a president and vice president, and would hire and train its own staff. Staffing levels for a full one-shift operation, in addition to the two managers, are projected to be 2 administrative staff and15 operators/maintenance personnel.

The City of Chełm expressed a concern that a further investigation of the MSW available in the Chełm region may produce less than the original estimate of 44,000 tonnes annually. PCI developed a financial model that would support the Project proceeding at an annual collection level of 35,000 tonnes if the tipping fees were increased and the management of the company was assigned to existing City of Chełm management personnel.

11.3.15 The financial analysis undertaken as part of the Study shows that there are two viable investment options that the City of Chełm has regarding the facility. The viability of the preferred option depends upon maintaining the financial strength and integrity of the analysis laid out as part of Section 8 of the Study. This will be the necessary economic basis for any funding that is available for the facility.

11.3.16 The preferred option for the Small Project sets a goal of securing a 100% debt financing package. The priority action for the City of Chełm is to look almost exclusively for funding from the non-private sector, from the national, regional and international environmental funds. Traditionally these funds require some equity commitment from the sponsor – perhaps 10% to 20% of the total capital required. By matching several programs together and the City of Chełm contributing the land on which the facility will be built as a form of equity to the new company that will own the facility, it is very possible to secure 100% of debt financing.

11.3.17 The second option which likely requires the City of Chełm to include a foreign investor in the company that will own the facility as well as MEHC is economically and financially viable. Such a transaction can be structured so that the City of Chełm and MEHC are relieved of any of the future funding obligations of MEHC as the operating assets of MEHC will need to be upgraded to bring them into compliance with all EU environmental discharge standards.

11.4 ACKNOWLEDGEMENTS

PCI would like to thank the following United State vendors who have provided technical input to the development of the conceptual designs:

11.4.1 RDF preparation and handling equipment:

- RTT Design & Construction
  125 Baylis Road, Melville, NY 11747-3895
  Phone: 631/756-1060, Fax: 631/756-1064
  Contact: Mike Jones (e-mail: mjones@rrtenviro.com)

- Norcon International Inc.,
  4369 Shallowford Industrial Parkway, Marietta, GA 30066
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  Contact: Eugene Evans (e-mail: ge8837@comcast.net)

- Lundell Manufacturing Inc.
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- EnerWaste International Corporation
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  Contact: Dan Heffeman (e-mail: enerwaste@aol.com)

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- Energy Products of Idaho
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  Contact: Kent Pope (e-mail: kmpope@energyproducts.com)

- Advanced Combustion Systems, Inc.
  1999-T Alpine Way, Bellingham, WA 98226
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PCI would also like to thank the following firms who provided input for the environment evaluation, construction estimates and other financial information for this study:

- Baker & McKenzie
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  Contact: Mr. Robert Adamczyk/Environmental Consultant

PCI would like to take this opportunity to thank the mayor Krzysztof Grabczuk and the vice mayor Leszek Burakowski of Chelm, Poland, Henryk Miszczuk and Longin Bozenski of the Municipal Enterprise for Communal Economy, Ltd., Chairman Miroslaw Iwinski of Municipal Heating Energy Company, Director Zygmunt Lisowski of the City Investment Bureau and others who provided very valuable assistance in the development of the information used in this report and for the time working with PCI staff while in Chelm, Poland.

Appendix I

◆

Municipal Solid Waste Quantities

City of Chelm

Waste-To-Energy Feasibility Study

Municipal Solid Waste Composition

Description	Weight Per Cent	Weight at 135 ton/day	Weight of Combustible	Weigh at 340 ton/day	Weigh of combustible
Household Organic Waste	43.8	59.13	59.13	148.92	148.92
Paper and Cardboard	18.5	24.98	24.98	62.90	62.90
Glass	10.1	13.63	0.00	34.34	0.00
Plastics	6.0	8.10	8.10	20.40	20.40
Fabrics	2.0	2.70	2.70	6.80	6.80
Metals	2.7	3.65	0.00	9.18	0.00
Organic Left-overs	3.4	4.59	4.59	11.56	11.56
Non-organic Left-overs	13.5	18.23	0.00	45.90	0.00
Total		135	99.50	340	250.58

Appendix II

◆

CHP New Boiler Site Plan

FILE NAME: CHP-Layout-081203
PLOT DATE: 08/12/03

Budynek Konserwatorni
MAINTENANCE BUILDING

Budynek uzdatniania wody
WATER TREATMENT BUILDING

Budynek Konserwatorni
MAINTENANCE BUILDING

Budynek administracyjny
ADMINISTRATION BUILDING

Magazyn węgla
COAL STORAGE

Magazyn węgla
COAL STORAGE

Kotły 1, 2 i 3
BOILERS 1, 2 AND 3

Odpylacz cyklonowy
CYCLONE SEPARATORS

Komin (100m)
STACK

Przenośnik popiołu
ASH CONVEYOR

Powierzchnia magazynu popiołu
ASH STORAGE AREA

Kocioł 4
BOILER 4

Przenośnik węgla
COAL CONVEYOR

Przyszła lokacja kotła
FUTURE BOILER LOCATION

ST/G

COOLING TOWER

BOILER

GASIFIER

TIPPING FLOOR

BAGHOUSE(S)

QUENCH

LIME SILO

STACK

ID FAN

SCRUBBER

Zbiornik wyładowczego popiołu
ASH UNLOADING SILO

Odpylacz elektrostatyczny
ELECTROSTATIC PRECIPITATOR

Proponowany alternatywny magazyn paliwa
PROPOSED ALTERNATE FUEL STORAGE

N

	INITIALS	DATE
DESIGN:	BLJ	09/17/02
DRAWN:	BLJ	09/17/02
CHKD:		
APPR'D:		
SCALE:	AS NOTED	

DRAWING NO.	REV.
02074-G-05	A

CHELM WASTE TO ENERGY PROJECT
CHELM, POLAND
CHP NEW BOILER SITE PLAN

Chełm Projekt Energetycznej Utylizacji Odpadów
Chełm, Polska

Miasto Chełm

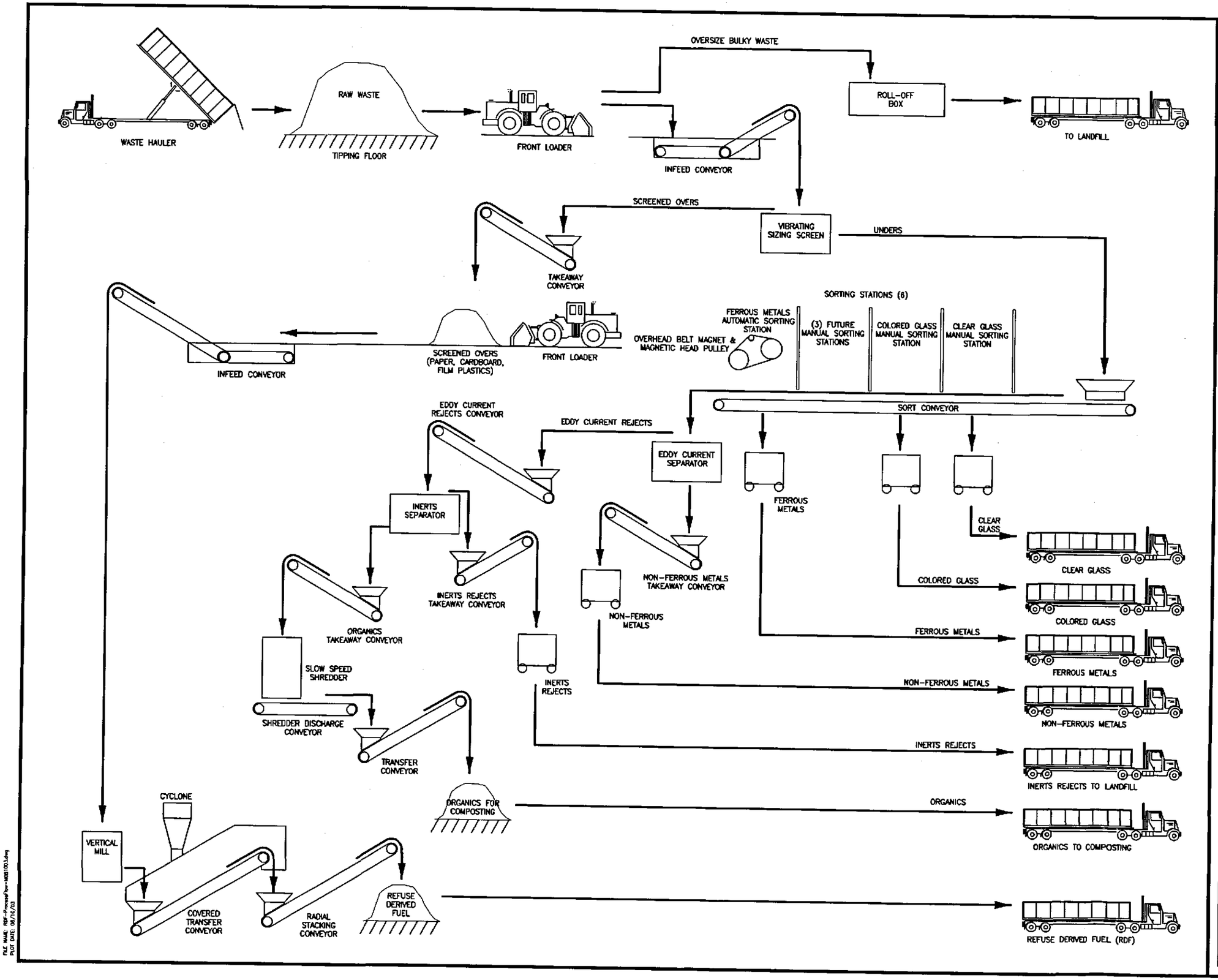
PCI Energy International, Inc.
Schaumburg, IL

REV	DESCRIPTION	DATE

Appendix III

♦

Drawings



REV	DESCRIPTION	DATE

PCI Energy International, Inc.
Schaumburg, IL

Miasto Chełm

CHELM WASTE TO ENERGY PROJECT
CHELM, POLAND
PROCESS FLOW DIAGRAM - FUEL PRODUCTION
Chełm Projekt Energetycznej Utylizacji Odpadów
Chełm, Polska

INITIALS		DATE
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DRAWN:	BLJ	02/06/03
CHK'D:		
APPR'D:		
SCALE:	NONE	

DRAWING NO. 02074-F-01
REV. C

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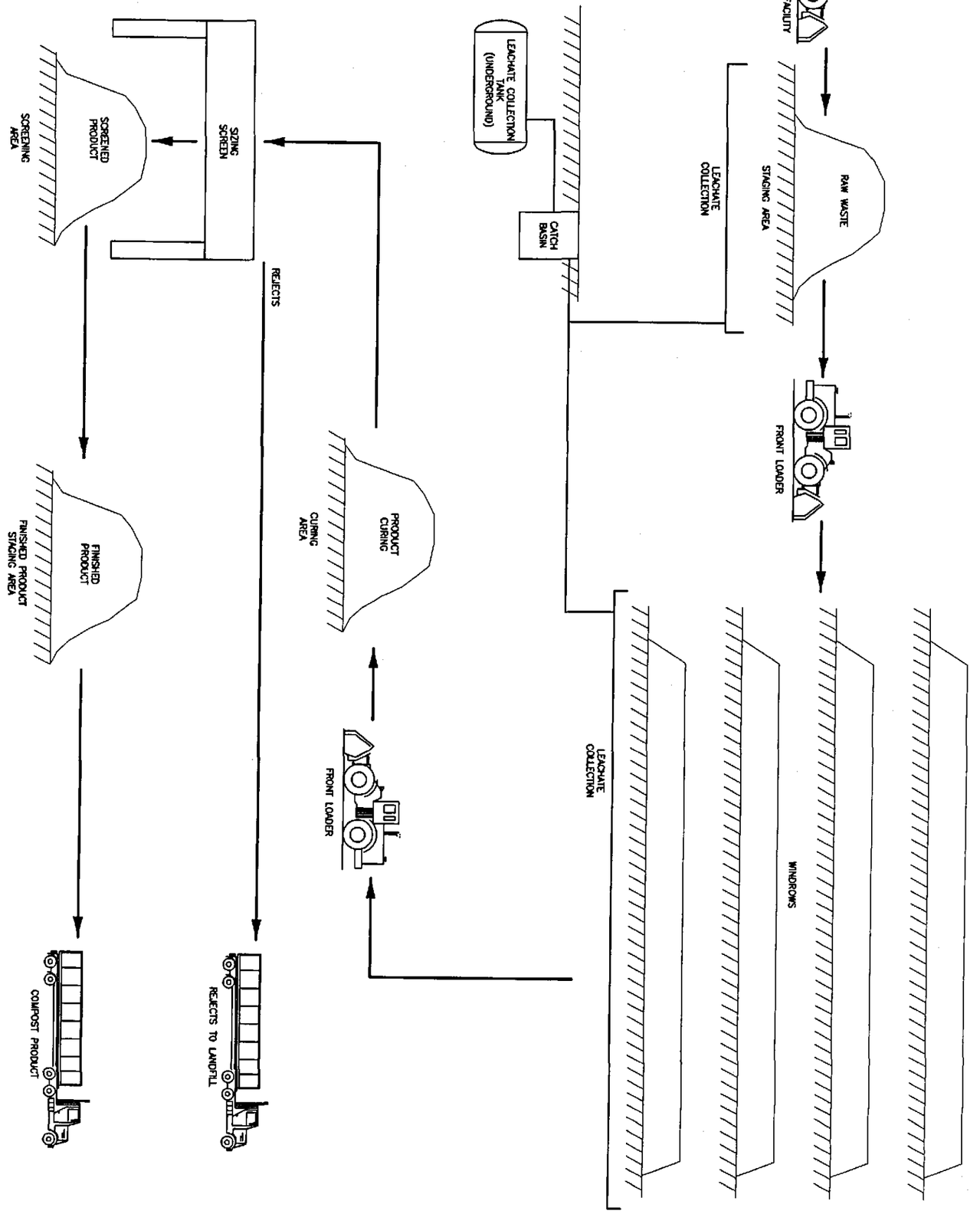
PLOT DATE: 06/10/03

FILE NAME: ROF-ProcessFlow-MOD2703.dwg
PLOT DATE: 06/22/03



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APPR'D:		
SCALE:	NONE	

DRAWING NO.	REV.
02074-F-02	A

CHELM WASTE TO ENERGY PROJECT
CHELM, POLAND
PROCESS FLOW DIAGRAM - COMPOSTING

Chelm Projekt Energetycznej Utylizacji Odpadóow
Chelm, Polska

Miasto Chełm

PCI Energy International, Inc.
Schaumburg, IL

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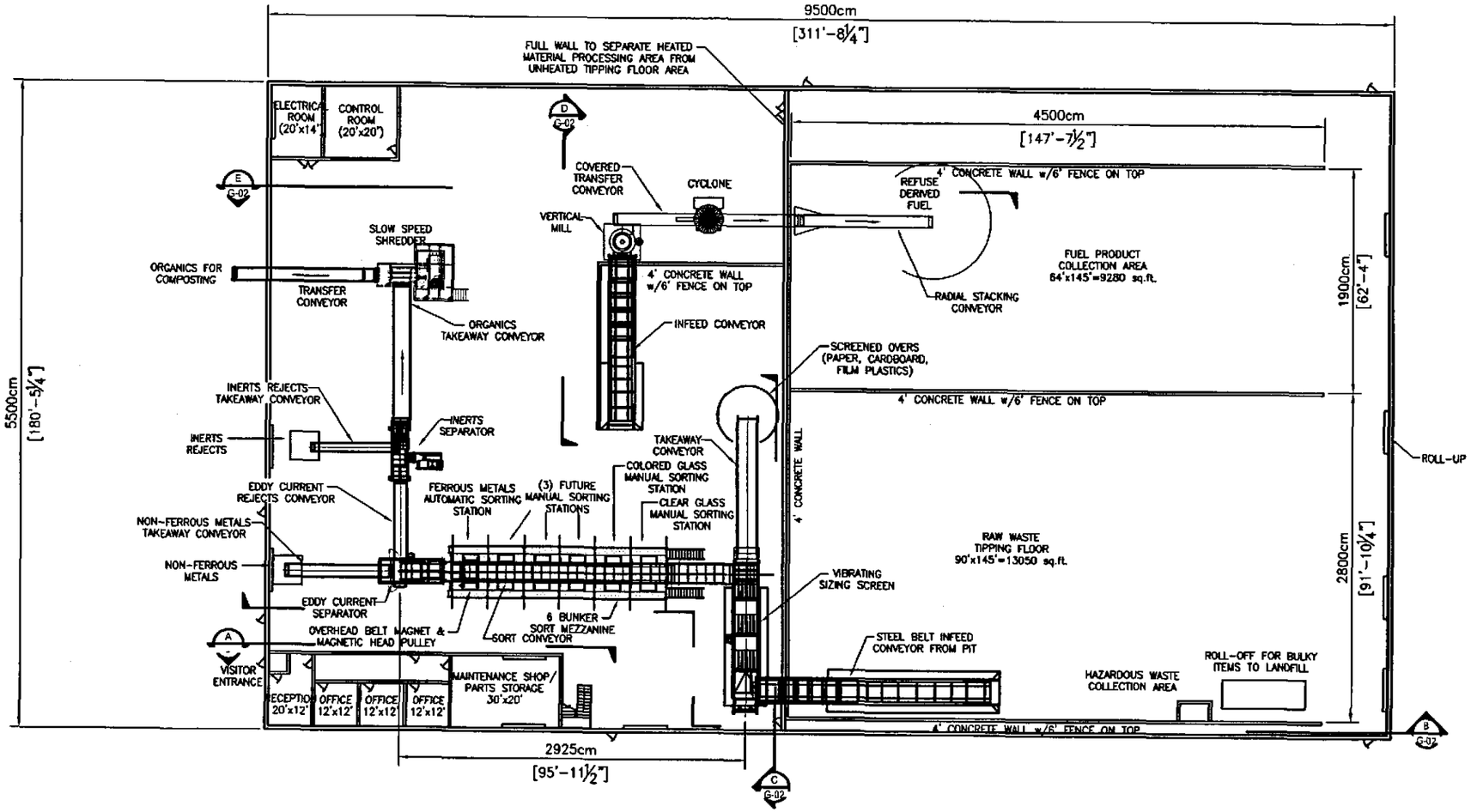

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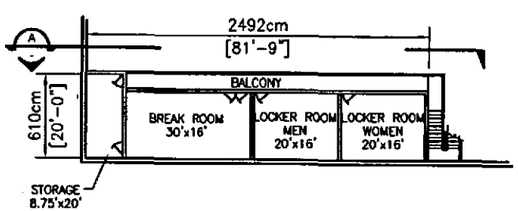

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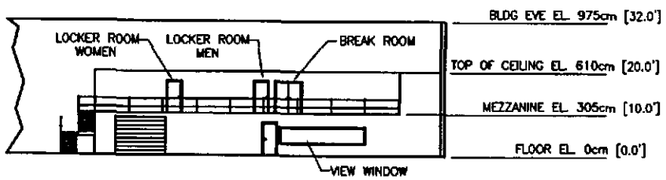

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REV	DESCRIPTION	DATE

PCI Energy International, Inc.
Schaumburg, IL

Miasto Chełm

CHELM WASTE TO ENERGY PROJECT
CHELM, POLAND
RDF BUILDING ARRANGEMENT

Chełm Projekt Energetycznej Utylizacji Odpadów
Chełm, Polska

INITIALS	DATE
DESIGN: BJJ	05/28/03
DRAWN: BJJ	06/01/03
CHK'D:	
APPR'D:	

SCALE: AS NOTED

DRAWING NO. 02074-G-01

REV. C

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PLOT DATE: 06/01/03

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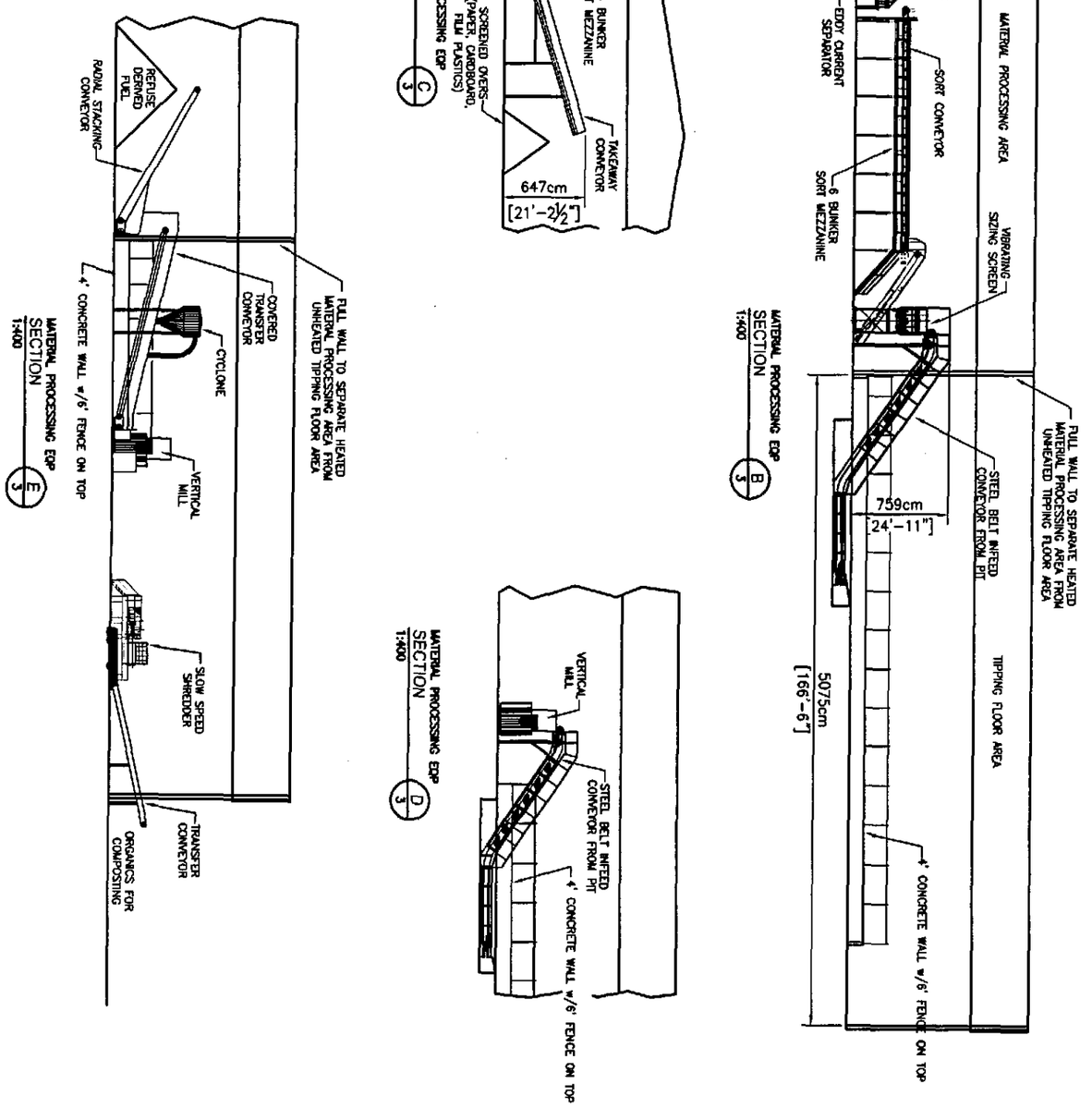
PLOT DATE: 06/26/03



INITIALS		DATE
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DRAWN:	BLJ	06/01/03
CHK'D:		
APPR'D:		
SCALE: AS NOTED		

DRAWING NO.	REV.
02074-G-02	C

CHELM WASTE TO ENERGY PROJECT
CHELM, POLAND
RDF BUILDING SECTIONS

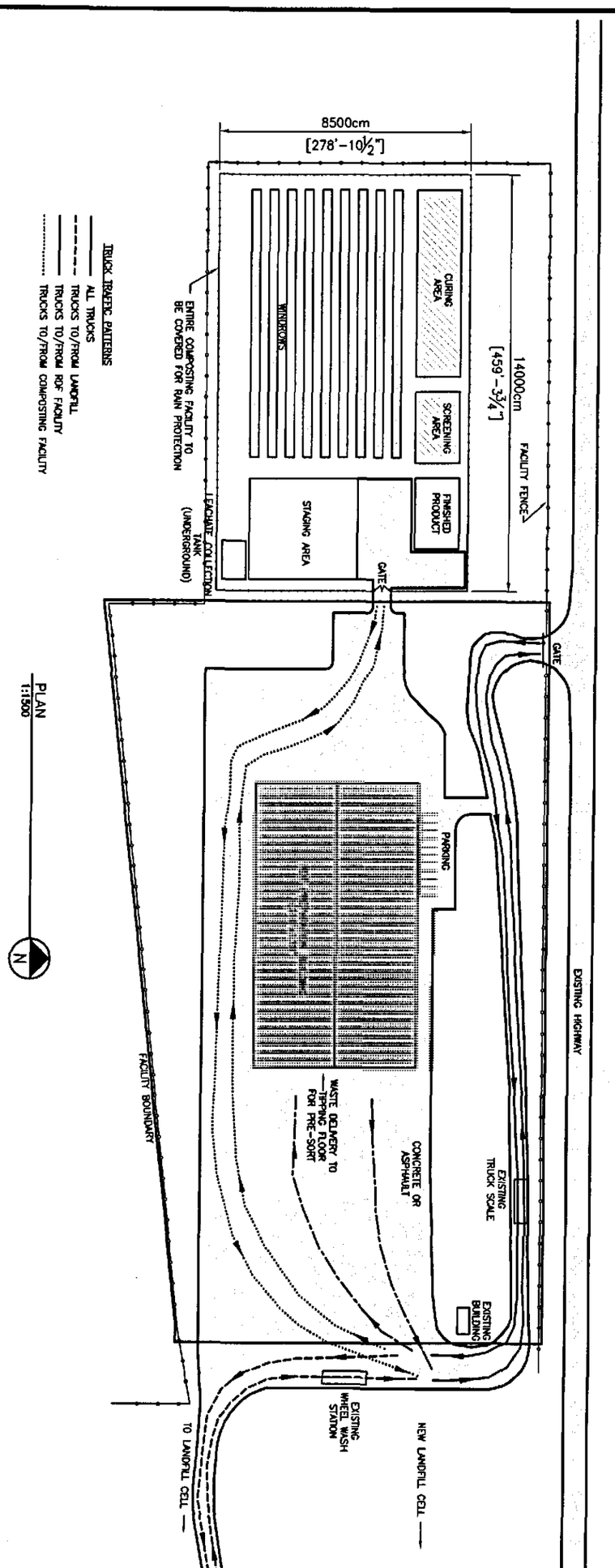
Chelm Projekt Energetycznej Utylizacji Odpadów
Chelm, Polska

Miasto Chełm

PCI Energy International, Inc.
Schaumburg, IL

REV	DESCRIPTION	DATE

FILE NAME: Bldg-Layout-M082803.dwg
PLOT DATE: 08/26/03



INITIALS		DATE
DESIGN:	BLJ	05/28/03
DRAWN:	BLJ	06/01/03
CHK'D:		
APPR'D:		
SCALE:	AS NOTED	

DRAWING NO.	REV.
02074-G-03	C

CHELM WASTE TO ENERGY PROJECT
CHELM, POLAND
RDF FACILITY SITE PLAN

Chelm Projekt Energetycznej Utylizacji Odpadóow
Chelm, Polska
Plan Terenu Urzadzenia

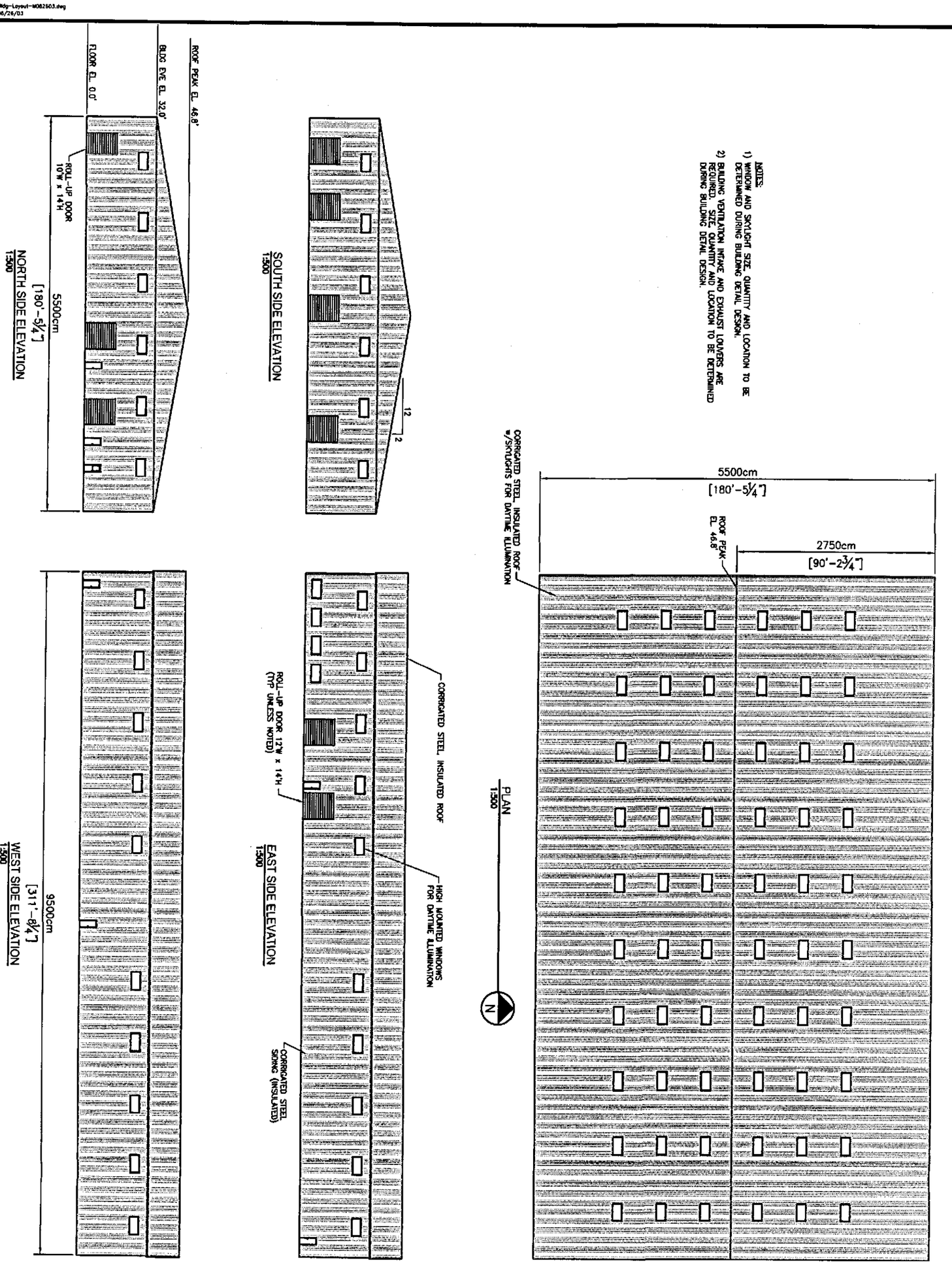
Miasto Chełm

PCI Energy International, Inc.
Schaumburg, IL

REV	DESCRIPTION	DATE

FILE NAME: Bldg-Layout-M062503.dwg
PLOT DATE: 06/26/03

NOTES:
1) WINDOW AND SKYLIGHT SIZE, QUANTITY AND LOCATION TO BE DETERMINED DURING BUILDING DETAIL DESIGN.
2) BUILDING VENTILATION INTAKE AND EXHAUST LOUVERS ARE REQUIRED. SIZE, QUANTITY AND LOCATION TO BE DETERMINED DURING BUILDING DETAIL DESIGN.



INITIALS		DATE
DESIGN:	BLJ	05/28/03
DRAWN:	BLJ	06/01/03
CHK'D:		
APPR'D:		
SCALE:	AS NOTED	

DRAWING NO.	REV.
02074-G-04	C

CHELM WASTE TO ENERGY PROJECT
CHELM, POLAND
RDF BUILDING ARCHITECTURAL VIEWS
Chelm Projekt Energetycznej Utylizacji Odpadóow
Chelm, Polska

Miasto Chełm

PCI Energy International, Inc.
Schaumburg IL

REV	DESCRIPTION	DATE

Appendix IV

◆

Major Equipment Descriptions

MAJOR EQUIPMENT DESCRIPTIONS
CHEŁM REFUSE DERIVED FUEL FACILITY
COMPOSTING CONFIGURATION

ITEM 1: Infeed Conveyor (Steel Belt)

Style:	- Steel Belt HIH configuration
Chain	- 23 cm pitch chain with 10 cm flanged rollers.
Belt:	- Heavy-duty steel belt with 7.6 cm bolt-on cleats
Width:	- 152 cm Wide
Length:	- 1830 cm
Frame:	- Structural steel members
Side walls:	- 76 cm High. Manufactured from formed 7 gauge steel
Motor:	- 7.46 kw, 380v/50hz/3 phase, TEFC

ITEM 2: Vibrating Sizing Screen

Style:	- Heavy-duty Vibrating Sizing Screen
Length	- 10670 cm
Width	- 183 cm
Depth	- 198 cm
Contact Surfaces	- 1.27 cm Thick Steel, A. R. Steel (400 BHN)
Weight	- 40,823 kg
Motor:	- 30 kw 380v/50hz/3 phase
Controls	- Included in Control Panel

ITEM 3: "Overs" Take Away Conveyor

Quantity	- One
Type	- Slider Bed
Length	- 1220 cm End to End
Width	- 152 cm
B.F.	- 158 cm" Between frame width
Belting	- PVC-200# C X FS black belt
Frame	- 4.55 mm. side frames.
Deck	- 4.55 mm sheet metal.
Drive	- 2.23 kw. Motor 380v/50hz/3 phase shaft mounted gear reducer
Belt Speed	- 356 mm/s.
End Take-up	- Screw type for 305 mm belt adjustment.
Supports	- Heavy-duty adjustable structural channel type.

ITEM 4: "Unders" Transfer to Sort Conveyor

Quantity	- One
Type	- Troughed Slider Bed
Length	- 915 cm End to End
Width	- 152 cm
B.F.	- 158 cm" Between frame width
Belting	- PVC-200# C X FS black belt
Frame	- 4.55 mm. side frames.
Deck	- 4.55 mm sheet metal.
Drive	- 2.23 kw motor 380v/50hz/3 phase shaft mounted gear reducer
Belt Speed	- 150 – 300 mm/s Varible Frequency Drive
End Take-up	- Screw type for 305 mm belt adjustment.
Supports	- Heavy-duty adjustable structural channel type.

ITEM 5: *Sort Conveyor*

Quantity	- One
Type	- Troughed Slider Bed
Length	- 2010 cm End to End
Width	- 152 cm
B.F.	- 178 cm Between frame width
Belting	- PVC-200# C X FS black belt
Frame	- 4.55 mm side frames.
Deck	- 4.55 sheet metal.
Drive	- 3.73 kw. motor 380v/50hz/3 phase shaft mounted gear reducer
Belt Speed	- 150 – 300 mm/s Varible Frequency Drive
End Take-up	- Screw type for 305 mm belt adjustment.
Supports	- Heavy-duty adjustable structural channel type.

ITEM 6: MEZZANINE

Quantity	- One
Bunkers	- 6
Bunker Walls	- Concrete
Main Frame	- 15 cm Wide flange beams
Supports	- 10 cm Wide flange beams
Deck	- 4.55 mm steel
Stairs	- OSHA approved
Ladders	- OSHA approved
Rails	- 4 cm x 4 cm Square tubing
Legs	- 15 cm Wide flange beams
Bracing	- Mild steel channel

ITEM 7: Overbelt Electro Magnet

Style:	- Electro Severe Duty
Design:	- 4 Pulley Design 152 cm Belt Width
Motor:	- 7.46 kw, 380v/50hz/3 phase, TEFC (Totally Enclosed Fan Cooled
Belt:	- Heavy-duty armored clad self-cleaning belt
Belt Speed:	- 3048 mm/s

ITEM 8: Eddy Current Separator

Frame:	20 cm HD Channel
Rotor Shell:	Patented Kevlar/Ceramic tile surfaced with Devcon ceramic renewable coating
Rotor Drive:	11.2 kw 380v/50hz/3 phase, TEFC
Conveyor Motor:	2.2 kw 380v/50hz/3 phase, TEFC
Belting	Urethane with 3.8 cm Corrugated Sidewalls
Pan Feeder	Urethane Liner
Motor	1.5 kw 380v/50hz/3 phase, TEFC
Controls:	Soft Start Motor Starters, Logic and NEMA 12 Enclosures

ITEM 9: Non-Ferrous Metals Take Away Conveyor

Quantity	- One
Type	- Troughed Slider Bed
Length	- 762 cm End to End
Width	- 46
B.F.	- 51cm Between frame width
Belting	- PVC-200# C X FS black belt
Frame	- 4.55 mm side frames.
Deck	- 4.55 mm sheet metal.
Drive	- 2.2 kw H.P. motor 380v/50hz/3 phase, TEFC Shaft-mounted gear reducer
Belt Speed	- 381 mm/s
Supports	- Heavy-duty adjustable structural channel type.

ITEM 10: Sort Conveyor Take Away Conveyor to Inerts Separator

Quantity	- One
Type	- Troughed Slider Bed
Length	- 1220 cm End to End
Width	- 92 cm
B.F.	- 96 cm Between frame width

Belting	- PVC-200# C X FS black belt
Frame	- 4.55 mm. side frames.
Deck	- 4.55 mm. sheet metal.
Drive	- 2.23 kw. motor 380v/50hz/3 phase shaft mounted gear reducer
Belt Speed	- 228 mm/s
End Take-up	- Screw type for 305 mm belt adjustment.
Supports	- Heavy-duty adjustable structural channel type.

ITEM 11: Inerts Separator

Type:	- Classifier
Length:	- 520 cm
Width:	- 122 cm
Weight:	- 4105 kg
Blower:	- 680 kg
Motor:	- 3.73 kw 380v/50hz/3 phase
Blower Motor:	- 22.3 kw 380v/50hz/3 phase
Blower CFM:	- 4.25 cu meter/s

ITEM 12: "Heavies" In-Organic Take Away Conveyor

Quantity	- One
Type	- Troughed Slider Bed
Length	- 762 cm End to End
Width	- 46 cm
B.F.	- 20" Between frame width
Belting	- PVC-200# C X FS black belt
Frame	- 4.55 mm side frames.
Deck	- 4.55 mm sheet metal.
Drive	- 2.23 kw. motor 380v/50hz/3 phase shaft mounted gear reducer
Belt Speed	- 381 mm/s
End Take-up	- Screw type for 305 mm belt adjustment.
Supports	- Heavy-duty adjustable structural channel type.

ITEM 13: "Lights" Organic Take Away Conveyor To Slow Speed Shredder

Quantity	- One
Type	- Troughed Slider Bed
Length	- 762 cm End to End
Width	- 46 cm
B.F.	- 50 cm Between frame width
Belting	- PVC-200# C X FS black belt
Frame	- 4.55 mm. side frames.
Deck	- 4.55 mm sheet metal.

Drive	- 2.23 kw. motor 380v/50hz/3 phase shaft mounted gear reducer
Belt Speed	- 381 mm/s
End Take-up	- Screw type for 305 mm belt adjustment.
Supports	- Heavy-duty adjustable structural channel type.

ITEM 14: Slow Speed Shredder

1 Norcon Model MS-6040 Stationary Shredder with the following accessories/features:

- 186 kw direct electric drive system
- Heavy duty 152 cm x 100 cm cutting chamber constructed of 8.25 cm carbon steel plate; welded construction and bolted-on side members for easy maintenance
- Patented cushion drive system to reduce destructive shock loads in system
- Hexagonal high alloy heat-treated drive shafts; 16 cm across flats.
- Split end chamber plate for easy knife change out and maintenance (Avg. time for complete knife change: 4 hours. This provides maximum operation time and minimum down time for producing revenue.)
- Dodge Shaft Mount Gear Reducer (or equal) for maximum power
- Knife group to be Programmed Group for maximum knife life at minimal costs
- Structural support base with maintenance platform
- Patented torque arm dampening system for negating system shock loading

SPECIFICATIONS

A. CUTTING CHAMBER ASSEMBLY:

1. Frame: 8.25 cm mild steel plate, welded construction with heavy-duty, bolted-on side members.
2. Shafts: One pair of 16 cm hexagonal, counter-rotating shafts, heat-treated.
3. Bearings: Tapered roller bearings in head, 21 cm bore; spherical roller bearings in tail, 15 cm bore. Both bearing assemblies sealed against contamination.
4. Chamber Openings: Both feed and discharge chamber openings are 152 cm x 100 cm.

B. CUTTING GROUP:

1. Knives: 56 cm diameter, 5 cm thickness, hex bore, machined and precision-ground from heat-treated alloy steel.
2. Spacers: heavy, casehardened steel; hex bore.

3. End Plate: Split for quick removal and easy access to shaft-mounted knives and spacers.

C. **DRIVE ASSEMBLY (ELECTRIC):**
1. 186 kw forward and reversing motor 380v/50hz/3phase, TEFC.
2. Twelve heavy-duty V-belts.
3. Reducer: Shaft mounted reducer at cutting chamber.

D. **OVERLOAD PROTECTION:**
1. **Torque Arm:** This patented cushioned arm distributes potentially destructive energy peaks of shock loads over an expanded time base and negates their effects.
2. **Impulse Limit Switch:** Located by the torque arm, this switch disengages the air clutch when a high overload condition exists. The overload compresses the torque arm springs, causing a bolt attached to torque arm bracket to trip the limit switch.
3. **Auto-Reverse:** In the event the electrical system senses an electrical overload due to a material jam in the cutting chamber, the unit will stop automatically, reverse, and engage in the forward motion again to release the jam. If the jam persists, the unit will attempt three reversals and automatically shut down to prevent damage to the shredder.

E. **ELECTRICAL CONTROLS:**
1. Electrical equipment suitable for operation with 380/600-volt, 50/60-hertz, three-phase electrical system.
2. All wiring in accordance with the National Electric Code (NEC).
3. All electrical components are UL approved.
4. Control circuit is grounded (120 volts) unless otherwise specified.
5. All wiring fused; NEMA 4 water-resistant enclosure.
6. All wiring numbered.
7. Push-button start.

F. **BASE:**
1. Heavy structural steel I-beam, channel-welded.

G. **SERVICE PLATFORM:**
1. Check plate, steel platform with guardrails and steel stairs to provide access to shredder chamber and system components.

ITEM 15: Shredder Take-Away Conveyor with covers

Quantity:	-One
Type:	-Trough slider-bed with covers
Length:	-762 cm long
Width:	-122 cm wide

Drive:	-2.23 kw, 380/v/50hz/3 phase
B.F.	-127 cm between the frames
Belting:	-PVC-200PIW, C x FS
Speed:	-381 mm/s
Construction:	-Heavy-duty structural steel and 4.55 mm plate
Paint:	-(1) coat Industrial DTM, "Norcon Blue"

ITEM 16: Infeed Conveyor to Vertical Mill with covers

Quantity:	-One
Type:	-Trough slider-bed with covers
Length:	-1680 cm long
Width:	-122cm wide
Drive:	-3.73 kw, shaft mount gear-motor, 380v/50hz/3 phase
B.F.:	-1270 mm between the frames
Belting:	-PVC-200PIW, C x FS
Speed:	-381 mm/s
Construction:	-Heavy-duty structural steel and 7 gauge plate
Paint:	-(1) coat Industrial DTM, "Norcon Blue"

ITEM 17: Vertical Mill Shredder Hoods

(1) Each infeed hood made from 0.63 cm plate, seam welded
(1) Each discharge hood made from 0.63 cm plate seam welded

ITEM 18: Vertical Mill Shredder

The single shaft turns at 840 RPM generating a rotor-plate speed of 354 kms/hr. The four rotor-plates attached to the single shaft incorporate adjustable impellers.

The adjustable impellers are installed to create an angle of attack similar to an aircraft propeller. The design incorporates a 11149 sq cms input opening and a 2090 sq cm output opening. Once the mill is in operation the roto-sections, comprised of both impellers and rotor-plates, draw in air through the input opening. The restriction caused by the smaller output opening creates several atmospheres of pressure inside the shredder. This pressure, along with impeller rotation, creates a "tornado" like effect inside the shredder. Introducing solid waste and garbage into the this tornado pulverizes and shreds the waste into fluff, ideal for RDF.

The Shredder reduces the weight of the incoming MSW by 12% to 23% by removing moisture.

SPECIFICATIONS

MSG Model #	3000
Motor	223 kw
Voltage	380/600v/50Hz
Shaft RPM	840.00
Throughput	18 Ton/Hour (metric)
CFM Output	0-13,000
Weight	11340 kg.
Total Height	3353 mm
Diameter	1329 mm"
Total Width	2590 mm"
Base Dimensions	1981 mm x 1981 mm
*Nominal Measurements	

ITEM 19: Vertical Mill Take Away Conveyor with covers

Quantity:	-One
Type:	-Trough slider-bed with covers
Length:	-1830 cm long
Width:	-122cm wide
Drive:	-3.73 kw shaft mount, 380v/50hz/3 phase
B.F.:	-127 cm between the frames
Belting:	-PVC-200PIW, C x FS
Speed:	-381 mm/s
Construction:	-Heavy-duty structural steel and 4.55 mm plate
Paint:	-(1) coat Industrial DTM, "Norcon Blue"

ITEM 20: Cyclone

Cyclone is sized to process 5.7 – 9.5 cubic meters/second of air.

ITEM 21: Radial Stacking Conveyor

Quantity:	-One
Type:	-Troughing Conveyor
Length:	-1220 cm long
Width:	-122 cm wide
Height:	-610 cm" discharge height
Drive:	-5 hp, 380v/50hz/3 phase
Belting:	-PVC-200PIW, C x FS
Speed:	-508 mm/s
Construction:	-Heavy-duty structural steel
Paint:	-(1) coat Industrial DTM, "Norcon Blue"

ITEM 22: Electrical Controls

All enclosures to be NEMA 12 rated. All pieces of equipment will be integrated through PLCs in sub-systems then integrated in the complete system. All components to be UL approved and all wiring to be in accordance with the NEC. Individual lockable disconnects will be provided for each piece of equipment.

Appendix V

Report:
Applicable Environmental Regulations

PCI Waste to Energy Project

Applicable Environmental Regulations

CHEŁM, POLAND

DRAFT FOR COMMENT

CONFIDENTIAL AND PRIVILEGED

December 2002

This report has been prepared by WS Atkins Polska Sp. z.o.o with all reasonable skill, care and diligence within the terms of the Contract with the Client and taking into account the information made available by the client and the manpower and resources devoted to it by agreement with the client.

WS Atkins Polska Sp. z.o.o disclaims any responsibility to the client and others in respect of any matters outside the scope of the above Contract.

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Client:	PCI Energy
Project:	Chelm Waste to Energy
Title:	Environmental Regulations Review
	Draft for Comment
Job No:	RR 56xx *Copy No:* 1
Document Reference:	RR 56xx /G/DO/001

Document Issue:

0 Master

1 XX

2 XX

3 XX

4 WSA Project File

JOB NUMBER: RR 56xx			DOCUMENT REF: Final Draft			
	Draft	P. Poborski				18.12.2002
	Final Draft		R.Adamczyk	J.Ronikier	CJMoore	30.12.2002
		Originated	Checked	Reviewed	Authorised	Date
Revision	Purpose Description	ATKINS				

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Annexes:

Annex 1: List of selected environmental laws

Annex II: EIA and Permitting scheme – Plus memo on Site development

Annex III: EU Directives: LCP, Waste Incineration…

EXECUTIVE SUMMARY

Atkins Polska was commissioned by PCI Energy to review Polish Environmental Regulations and identify possible emission limit values for a proposed waste to energy scheme being considered for the city of Chelm, in south eastern Poland. The report is as part of a pre-feasibility study and does not provide definitive legal advice. Given that the technology options have not been chosen or fully characterized, the report provide mainly initial guidance in terms of environmental issues to considered when selecting the various options.

To date there are very few waste to energy plants operating in Poland, the main project to date is an Italian based plant which operates in Warsaw (the project has been controversial). Consequently the Polish environmental regulators have little experience in dealing with these issues.

Based on our review of regulations, it is our understanding that Municipal Solid Waste (MSW) incineration is covered by the same environmental regulation despite of method of incineration, age of installation and its complicity. Poland has transposed a number of EU directives as part of the EU accession process, and this will be an ongoing process. Below are some key EU acts which have been or will be transposed by Poland:

- The Large Combustion Plant (LCP) Directive (88/609/EEC) and is expected to transpose and implement fully new LCP Directive 2001/80/EC (a draft ordinance benign prepared at present) and waste incineration Directive (2000/76/EC) automatically when it comes in force.

- Transposition and implementation with no derogation Council Directives on preventing air pollution by existing and new MSW incineration plants (89/429/EEC, 89/369/EEC).

- Transposition and implementation of Council Directive 96/61/EC concerning integrated pollution prevention and control (IPPC). Consequently Best Available Techniques (BATs) should be applied for combustion of fuels and waste incineration or co-incineration. Integrated permit is needed to operate waste incineration of co-incineration installation. Under Polish regulations new pants need integrated permits already whilst existing plants are to apply for such permits by 2004 (possible derogations periods till 2005-7 for some existing plants)

No exclusions are provided for RDFs either solid, liquid or gaseous (the latter, when received in pyrolytic process). This could be partly due to the lack of experience with such projects. It appears their could be longer term scope for helping to shape the regulations, notably with respect to Integrated permits, for instance for a cement plant (however, the onus would be on the operator to show the impacts and effects).

According to LCP Draft BREF document the minimum requirement for emission of all the technological options is determined by new LCP Directive and waste incineration directive.

Poland is expected to transpose and implement the 2000/76/EC Directive on waste incineration. Member States shall bring into force the laws, regulations and administrative provisions necessary to comply with this Directive not later than 28 December 2002. It can be assumed that Poland will comply with this regulation by the time of EU accession (i.e. 1 May 2004) , hence the project needs to be in compliance with these directives. As operational permits (in this case "integrated permit") will be issued after 28 December 2002, the plant should fulfil requirements set by Directive 2000/76/EC for "new" plants. For waste incineration and co-incineration of unsorted MSW emission air limit values are set by Annex V to the Directive, Limit Values for discharge of waste waster from cleaning of exhaust gases by Annex IV to the Directive (see Annex III to the Report).

Given that the city will need to apply for integrated permit for its landfill as well as CHP (plus the neighbouring cement plant), it may be useful to consider ensuring the various waste management practices are included within these permits at an early stage to ensure that depending on the final feasibility study options exist to incorporate them without changing the permits.

1 INTRODUCTION

BACKGROUND

1.1 WS Atknis Polska Sp. z o o. was commissioned by PCI Energy to develop a desktop review of environmental regulations applicable to the Waste-to –Energy Project, notably in terms of obtaining permits and what issues to consider in the process. Moreover, the aim was to outline environmental standards that will apply to this project to allow these to be used in the pre-feasibility study, notably in terms of choosing various technological options.

1.2 The review at this stage is not an environmental impact assessment nor provides definitive legal advice.

PROPOSED PROJECT

1.3 Chelm city, a medium sized town in south eastern Poland has retained PCI to provide assistance with respect to the waste management for the town and region. One of the options begin considered is a waste to energy scheme which would utilise either existing facilities or require new plant to be constructed to allow for a waste to energy project to take place. Irrespective of the technological option chosen their will be a need for upgrade of existing facilities using modern technologies and techniques/or construction of a new plant.

1.4 Generally, the potential production/activity pattern would consist of:

- Waste incineration
- RDF composing
- Gasification
- Composting

- Heat generation
- Electricity generation
- Waste (secondary) utilization

1.5 The most favoured option is that the scheme will revolve around the existing facilities of Chełm City Power Plant (Miejskie Przedsiębiorstwo Energetyki Cieplnej w Chełmie. (MPEC Chełm).

1.6 MPEC Chełm operates two heat plants: Centralna and Szczytowa (Peak) and heat distribution system (hot water piping).

1.7 Szczytowa Heat Plant is equipped with 4 boilers of rated thermal output of 34.88 MWt. Facility was constructed in years 1975-1981.

1.8 Centralna Heat Plant was constructed in the years 1983-1994 and is equipped with 4 boilers with total rated thermal output of 117.77 MWt

1.9 Heating system consisting of these two heat plants produces circa 1 mln GJ of thermal energy in form of hot water and distributes it through 52 597 m of piping system. Produced power varies seasonally from 92 MWt in winter to about 10 MWt in summer.

TECHNOLOGY OPTIONS

1.10 Waste-To-energy technologies defined by PCI Energy International are:

- Incineration of waste either as mass burn or refuse derived fuel (RDF) in a new combustion facility at the Chelm central heating plant (CHP).
- Incineration of waste in RDF form as supplemental fuel in the existing CHP boilers and/or the local cement plant.
- Gasification of the waste for supplemental fuel in the existing CHP boilers.
- Composting – probable limited to sewage treatment sludge and selected organics (food stuffs) in conjunction with RDF preparation.

1.11 As an alternative it is being considered to use RDF as a fuel for the nearby cement kiln.

STRUCTURE OF ENVIRONMENTAL REGULATIONS IN POLAND

1.12 Structure of Polish environmental regulations is vague; regulations are dispersed in many acts and numerous decrees. Poland agreed to harmonise environmental legislation with that of the EU but harmonisation process is performed under time pressure and the actual legislation is in half-the way between command-and-control system developed under central planned regime and more flexible system in marked driven economy. Structure of Polish Environmental regulations does not reflex that of EU; horizontal law is included in Act on Environmental Law, the framework character of asic regulations: Environmental Law, Waste Law, Water Law is not fully preserved. Some changes are introduced by acts formally addressing different areas like Act on Legal authorisation of some bodies.." and so on.

1.13 Formally the environmental protection law in Poland is based on the Constitution of Republic of Poland but in practice EU harmonisation caused that the actual basis is common EU legislation based on the Treaty establishing the European Community and particular Article 175(1) thereof and accession agreement with protocols.

1.14 Poland asked for derogation from some EU regulations what resulted in numerous transitional arrangements. Also attempts to implement agreed EU legislation caused number of transitional arrangements of temporary character.

1.15 Waste management legislation is based on Waste management act but also on number of codes, statutes and acts.

1.16 Secondary waste management legislation is issued by several ministers but mainly by Ministry of Environment and Ministry of Economy.

1.17 List of major Polish environmental laws is given in Annex 1.

2 PLANNING AND PERMITTING

PLANNING

2.1 Construction, modernisation and operating power plant requires permits which should be in agreement with appropriate plans. The waste to energy scheme has to be in compliance with the regional waste management plan which needs to be developed by each region.

2.2 On the central level there are developed inter alia the following documents: National Policy on Environmental Protection, National Environmental Protection Strategy and National Waste Management Plan

2.3 Adequate Regional plans are:

- Regional Waste Management Plan (regional/voivodship level),
- County Waste Management Plan
- Air Quality Plan (voivodship level)
- Noise maps (county)

2.4 On the Municipal level there are developed:

- Municipality Environmental Protection Plan
- Municipality Waste Management Plan
- Development plan of the City
- Noise Protection Plan
- City Plan (Physical)
- City Energy Plan (including heat, electric power, fuels etc)

2.5 Additionally, the Voivodship and county authorities are responsible for air (voivodship) soil contamination (county) and noise monitoring (county)

2.6 Self Governmental Authority of Voivodship level (Marshal) is responsible for developing Regional Waste Report (MoE Decree of 11 Dec. 2001 on principles of developing voivodship Report , Dz.U. 2001.152.1739).

2.7 There is a need thus to check with the local development plans as well as with the specific environmental management plans such as the regional waste management plan.

PERMITTING

2.8 Prior to undertaking an investment there is a need to obtain a number of permits, associated with site location and then construction followed by operational permits. A brief review of the process is given in the appendix. Given below is a summary of the key issues to consider.

2.9 Firstly the local development plan needs to be reviewed to ensure that the given activity is allowed. This should be reviewed during the due diligence.

2.10 The next stage is the obtaining a planning permit, - Polish acronym wzizt. This is necessary for any new development, although some modernisation can be exempt. Depending on the size of the project an environmental impact assessment (EIA) may be required.:

- EIA Phase1 procedure involving developing EIA Report and public participation is required for all planned activities which are or potentially could be harmful to human health and/or environment

2.11 Following obtaining a planning permit, there is a need to obtain a construction permit. This needs to include the detailed design etc. again depending on the size of the project an EIA may be required.

- EIA, Phase 2 procedure is continuation of EIA phase I

2.12 Prior to commencing activity there is a need to obtain a site works completion certificate as well as operational permits. In the case of the proposed project this will require an integrated permit. Some authorities like to obtain operational permits as part of the construction permit.

2.13 Scheme of permitting system is presented in Annex II

2.14 Operation of installations above a certain threshold require an integrated permit. The need to obtain this type of permit is regulated by IPPC classification which determines installation type and capacity (threshold values)

2.15 Types of installations and production capacity thresholds for relevant activities are:

- Combustion installations with a rated thermal input exceeding 50 MW
- Cement clinker production in rotary furnace: over 500tons/day
- Thermal utilization of MSW; capacity over 3 tons/hour
- Utilization of wastes other than hazardous, capacity over 50 tons/day

2.16 Before starting operation of installation covered by IPPC it is necessary to obtain legally binding integrated permit.

2.17 Other permits associated with energy or technical conditions need to be applied for example according to the Energy Law separate concessions are required for :

- Electric energy production
- Heat energy production
- Energy distribution

2.18 Municipal Waste collection and processing requires concession according to recent regulation approved by Parliament (waits in Senate for approval, Dec. 2002)

2.19 Special permit of Voivode is required for transportation and management of hazardous wastes.

TIMING:

2.20 The timeframe for obtaining the various permits is fairly subjective and site specific and discussed in the attached memo in appendix II. Nevertheless it can be briefly summaries as:

2.21 Planning permit – 2-3 months preparation (mainly EIS – environmental Impact Statement – if this is not required then time needed to ill in some standard forms) plus 2-3 months to obtain a permit (includes a 21 day public consultation period/document made available for review/, review process, and then the permit coming into force). It should be noted that this is subject to havening all of the documents in place and no protests are encountered. There is a strong NGO presence in Poland that is often involved in protesting against various developments such as hyper markets and is likely to approach such a project with the same vigour.

2.22 Building permit. Upon obtaining a planning permit, it is necessary to prepare a building permit application. This is a more detailed document consisting of various design document and agreements of the local service providers and authorities (such as fire and sanitary inspectors etc.). Moreover a second EIS document needs to be prepared which address whether the detailed design solution meet those specifications given in the first EIA. To prepare the documentation their is a need of a minimum of 6 months (for instance need for a geotechnical investigation to be submitted etc.). Normally the process can last around one year to prepare all of the design etc for a major new project (construction of say a new plant). Modernisation or upgrade the time-lag can be shortened considerably.

3 ENVIRONMENTAL LIMITS

GENERAL

AIR EMISSION

3.1 Environmental regulations are given by

- Act of 27 April 2001 "Environmental Law" (Dz.U. 2001.62.627. as amended)
- Act of 27 April 2001 on wastes (Dz.U. 2001.62.628)
- Act of 27 July 2001 on introducing Environmental Law, waste Law and changing some other regulation (Dz.U.2001.100.1085)

3.2 In Poland air quality is regulated by controlling air emission on two basic ways:

- Planning and permitting some activities in given location
- Limiting air emission from active industries by permitting and enforcement

3.3 Planning and Permitting activities are based on series of acts and regulations on:

- development plans and other local and regional plans
- physical planning,
- location permit
- construction permit
- operation permit (not always applicable)

3.4 All the plans should be based on detailed studies, i.a. physiographical study, demographic study, waste management study ect.

3.5 Permitting air emission is based on two principles:

- controlling air emission by direct permitting of emission from specific installations
- monitoring air quality and using these data for planning and emission permitting

3.6 Thus, two sets of data applicable for given area are thought to secure proper air quality:

- air emission limit values set for some industrial processes (more or less industry/technology specific). This values have priority before values obtained indirectly basing on air quality benchmarks.
- air quality benchmarks allowing for assessing indirectly (usually by mathematical modelling) limiting factors for industrial emissions and generally - activities in the area.

DIRECT REGULATION OF AIR EMISSION FROM INDUSTRIAL INSTALLATION

3.7 Direct regulation of air emission from a facility in a little bit vague: it is regulated by Decree of Ministry of Environment of 30 June 2001 on discharging to the air of polluting substances originating from technological processes and technical operations. (Dz.U.2001.87.957 of 24 Aug 2001 r.). This decree is based and refers to the "old" act on environmental protection and management of 31 Jan. 1980 though in April 2001 the new act Environmental Law was accepted (Dz.U.2001.62.627 z dnia 20 czerwca 2001 r.); this act replaces "old" one. Polish Parliament accepted Act introducing Environmental Law, waste Law and changing some other regulation (Dz.U.01.100.1085 of 18 Sept 2001 r.) Three days earlier (27 July 21) then the MoE issued discussed Decree, This ambiguous situation resulted of willingness to transpose as much as possible of Common EU legislation but logics and structure of legal regulation was not preserved.

3.8 According to the introductory Act (Dz.U.01.100.1085 of 18 Sept 2001 r.) the MoE **Decree will expire on 30 Jun 2003.** It is not know what will be limit values or emission benchmarks after this date as a new decree is in early state of development.

3.9 It is worth to stress, that in some Polish regulation understanding of some terms and thereby the practical implementation of some regulation sometimes differs from that in Western Countries and in common EU law. One of this differences in meaning of the term "source" of emission. § 7 and § 8 of Decree of MoE Ministry of 30 June 2001 on discharging to the air of polluting substances originating from technological processes and technical operations. (Dz.U.2001.87.957 of 24 Aug 2001) says:

- §7 . „Till 31 Dec 2002, the permissible amount of pollutants born in burning processes from which the exhaust/flue gases are lead through single emitter and for which the construction permit has been issued after 6 Oct. 1998, is the permissible amount of polluting substances [...] appropriate for total thermal power of the sources.
- For all the sources constructed after 30 Jun 1987 the rule will come in force on 01 Jan 2003.
- The same applies for the sources extended by 50 MW or more after 30 Jun 1987

3.10 The above rules do not apply for multi-fuel sources (ie. Burning simultaneously 2 or more fuels); basis for determining emission limits in this case is average of limit values weighted by thermal input power created by burning these fuels.

3.11 Burning residues from natural oil procession, as one of multi-fuels, is regulated separately.

3.12 Fuel burning for energetic purposes can be split to several cases, according to time of construction and fuel, but not all the categories are regulated. Table 3.1. shows regulation applicability to various combustion process.

Table 3.1. Air emission regulation for energetic and waste incineration installations

	Existing installation **"old" - (CP - construction permit)** ***CP before 1 July 1987***	**New installation** **CP after 3o June 1987 and before 7 Oct.1998**	**New-new installation** **CP after 6 Oct 1998**
Natural fuels			
Hard coal	Y	Y	Y
Brown coal/lignite	Y	Y	Y
Natural gas	Y	Y	Y
Industrial fuels			
BOF gas	N	N	N
Coke gas	N	N	N
Other			
Mixed/multi fuels	Y	Y	Y
Waste to energy			
Industrial	N/Y	N/Y	N/Y
Toxic	Y	Y	Y
Municipal	Y	Y	Y
RDFs	N	N	N

3.13 If the existing source of pollution is to be closed down before 31 Dec 2010, the limit values for the time between 1.Jan 2005 and 31 Dec 2010 is the same as for as for the time before 1 Jan 2002.

3.14 Limit values for air emission from specific installations/activities are given in annex 1 to Decree of MoE Ministry of 30 June 2001 on discharging to the air of polluting substances originating from technological processes and technical operations. (Dz.U.2001.87.957 of 24 Aug 2001).

3.15 Limit values for air emission from combustion of municipal wastes is given in annex 4 to Decree of MoE Ministry of 30 June 2001. It is important to remember that this regulation will expire on 30 June 2003 and a new regulation is being prepared which will be based on the current EU LCP Directive. It is not clear to which extend municipal wastes or RDFs can be regarded as a fuels in understanding of the Decree when mixed/multi-fuels are regarded and there is not clear if emission from co-firing fuels (coal, oil, gas) with municipal wastes is covered by the regulation, but interpretation by MoE and definition of waste incineratior given by § 22 of the Decree suggest that all the installations burning wastes in any form are regarded as waste incinerators.

3.16 Emission concentrations are given in mg/Nm^3 i.e. for standard conditions:. 273 K and 101.2 kPa

3.17 Major limit values for burning fuels are different for:

- sources which have got construction permit after 6 Oct. 1998.
- sources which started operation after 28 March 1990
- sources which started operation before 29 March 1990
- Existing" sources for which construction permit was issued after 30 June 1987.

3.18 Any modernisation, for which construction permit is required causes that the installation is to be regarded as a new one

3.19 Staring 1 Jan 2003 all the municipal waste incinerators should comply with the same standards despite of date when construction permit was issued.

3.20 Principles and details of issuing air permits are given in MoE Decree of 18 Sept. 1998 (Dz.U.98.124.819)

3.21 The new LCP Directive (2001/80/EC) covers three categories of plants,

- **existing plants**, licensed before 1 July 1987,
- **old - new plants**, licensed after 1 July 1987 and before 27 Nov. 2002 (providing that the plant is put into operation no later that 27 Nov. 2003)

- **new new plants**, licensed on or later than 27 November 2002 .

3.22 It can be seen that the dates delimiting existing plants and old-new plants are different from that set in Polish legislation what rises some interpretation problems in Poland

3.23 Poland asked for derogations from the EU LCP Directive (2001/80/EC (LCP)), notably in respect to SO2 and Nox emissions and for dust emission from smaller district heating plants and CHPs. New LCP directive is to be transposed to Polish Environmental Legislation and a draft is being prepared. Poland obtained some derogations to the LCP but only with respect to existing facilities and emissions limits from these. There are no such derogation for new facilities and new ones will need to reflect the conductions specified in the LCP Directive.

MONITORING

3.24 For the MSW incineration (capacity more than 1tonne of wastes/hour) it is obligatory to:

- continuously monitor: dust, CO, HCl
- periodically, at least twice a year: heavy metals, HF, SO_2, organic compounds (as TOC), dioxins and furans.

3.25 Obligation to monitor Dioxins and Furans can be withdrawn when emission of these substance is lower than 10% of limit values (method of proving this fact is however not defined)

Table 3.2 Permissible air emissions from burning hard coal in sources which started operation after 6.10,1998 (valid till 30 June 2003)

Rated Thermal Input	SO_2	NOx	Dust	CO	Rated Thermal Input
<5	1500	400	630	2500	<5
≥5 and <10	1300		400		≥5 and <10
≥10 and <50				1000	≥10 and <50
≥50 and<100	850	460	50	350	≥50 and<100
≥100 and <150	Linear change from 850 to 400				≥100 and <150
≥150 and <300				200	≥150 and <300
≥300 and < 500					≥300 and < 500
≥500	400				≥500

[mg/Nm^3 in standard conditions and 6% of oxygen in exhaust gases)

Table 3.3. Permissible air emission from municipal waste incineration;

(valid till 30 June 2003)

Compound	**Permissible emission (dry gas, standard conditions, concentration of O_2 =11%)**			
Total rated capacity	tons/hour	**<1**	**1<Q<3**	**Q>3**
Particulate	mg/m^3	200	100	30
TOC	mg/m^3	20	20	20
HCl	mg/m^3	250	100	50
HF	mg/m^3	-	4	2
SO_2	mg/m^3	-	300	300
CO (one hour average)	mg/m^3	100	100	100
Heavy metals and its compounds expressed as a metal				
Pb+Cr+Cu+Mn	mg/m^3	-	5	5
Ni+As	mg/m^3	-	1	1
Cd+Hg	mg/m^3	-	0.2	0.2
Dioxins and Furans (Sum of equivalents)	ng/m^3	0.1	0.1	0.1

INDIRECT REGULATION OF AIR EMISSION BASED ON AMBIENT AIR QUALITY

3.26 Determining permissible emission levels is based on concept that emission should be limited to such extend that the concentration in the ambient air will never exceeds concentrations safe for human health and ecosystem stability. There are some presumptions and number of simplifications in this concept: some of them are:

- Industrial air emission influences ambient air quality
- Dispersion of air pollutants is in first order in the vicinity of the source of emission
- Controlling air emission can allow for achieving appropriate air quality

3.27 It is evident that the above presumptions are partly or completely false for many of air pollutants installations and emission conditions (eg. SO_2 or NOx emitted from majority of energy sources is a subject of a long range transport and does not follow the applied pattern) however, this approach is justified as the tradition of environmental legislation in Poland is based on command-end-control system and low level competence of permitting authority does not allow for more sophisticated and closer to reality approach.

3.28 Ministry of Environment (MoE) by his decree of 6 June 2002 (Dz.U. 2002.87.796) regulated allowable levels (concentrations) of some substances in ambient air, alarm levels and tolerance levels. Values are valid for entire territory of Poland with exception of health resorts and National Parks for which more strict levels are set.

3.29 MoE determined also assessment methods of ambient air quality (Decree of 6 June 2002 on assessing substance level (concentration) in ambient air, Dz.U. 2002.87.798)

3.30 MoE by his Decree of 18 Sept. 1998 (Dz.U. 98.124.819) on detailed principles of determining discharging to the air permissible kinds and amounts of polluting substances as well as requirements regarding documents which are necessary to be submitted in aim to issue permit on permissible kinds and amounts of polluting substances discharged to the air.

3.31 Moe Decree of 3 Sept 1998 on computing level of air pollution caused by existing and planned sources of pollution (Dz. U. 98.122.805) is thought as a minimum requirement but the practice shows, that is regarded as an only legally binding method.

3.32 Both above mentioned decrees from 1998 will expire by the 30 June 2003 and are expected to be replaced by the new regulation; proposed MoE Decree on reference values of some substances in the air covers both, the calculation model and methodology as well as reference concentrations of 169 substances polluting ambient air.(Draft document of 6 Aug.2002) This regulation replaces also MoE Decree of 28 April 1998 on permissible concentrations of air polluting substances in ambient air (Dz.U. 98.55.355). Decree sets also limits for deposition of Cadmium, Lead and total particulate.

4 WASTE WATER DISCHARGE

LEGISLATION

4.1 Water protection legislation is contained within two framework acts: Water Law Act, Environmental Protection Act and several executive orders (regulations) issued by various ministers. Note that as result of harmonisation with EU regulations Polish regulations change very dynamically and not all executive regulations which are envisaged in the framework acts have been issued as yet.

4.2 Generally, water regulation follows common EU legislation, ie Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy, and all daughter directives. Surface waters are classified due to possible water use: drinking water, bathing water, water for fishes ect The maximum concentrations of major pollutants are specified for each class

4.3 Basic secondary legislation comprises of two MoE Decrees (issued up to now) and Decree of Ministry of Infrastructure.

4.4 Note that all discharges are subject to regulation: industrial waste waters, sanitary waste waters, storm water run-off and cooling waters

DISCHARGES TO SURFACE WATERS AND GROUND

4.5 Discharging untreated waste water directly to the ground ar surface water is generally prohibited (some exclusions exist). Discharge of treated waste water to surface water and soils are regulated by MoE Decree of 29 Nov.2002 (Dz.U.2002.212.1799) and came in force on 1 Jan 2003.

4.6 Regulation also defines priority substances which are to be eliminated and those which should be controlled.

4.7 The emission limit values for treated industrial waste water are set for priority substances and other potentially harmful substances and depending on the technology in which waste water was generated as well as averaging time. Limit values are presented 11 Annexes. Separate limit values are set for waste water form cleaning exhaust gases from thermal waste treatment which will come in force on 28 Dec. 2005.

4.8 Separate MoE regulation covers quality standards of fresh water being environment for living of fishes in natural conditions (Dz.U. 2002.176,1455)

4.9 Discharging wastewater to the surface waters or to the ground requires a Water Permit. Note that conditions more stringent than in regulation may be set in the Water Permit if the water course crosses protected or recreation areas or if the proportion of waste waters discharged is more than 10% of the water flow in the water course.

4.10 The water permit is issued upon application by the unit wishing to obtain such permit. A study on the impact of the proposed discharge on the watercourse or ground is a mandatory attachment to the application. A part of the application review procedure is a hearing for all parties involved, called a (Water Law Hearing) involving all parties using a given water and that may be affected by the proposed discharge. The water permit may contain conditions (such as participation in the costs of water course maintenance) and is issues for a limited time only.

DISCHARGES TO THE SEWER NETWORK

4.11 Industrial wastewater discharge to the municipal sewer network is regulated by the Ministry of Infrastructure Decree of 20 August 2002 (Dz.U.2002.129.1108) as a secondary regulation to Act of 7 June 2001 on collective water supply and waste water collection (Dz.U. 2002.72.747 and 2002.113.984). Regulation determines also analytical methods. Separate limits are set for gases and vapours concentrations in sewage system air.

4.12 Limit values for industrial waste water discharged to sewage systems are presented in table 4.1.

Table 4.1. Limit values for pollutants in industrial waste water discharged to sewage systems.

#.	Pollutant	Unit	Value	Recommended analytical method
1	Temperature	°C	35	In situ measurement
2	PH	1	6,5-9,5 8 - 101)	Electrometric (*in situ*)
3	Easily sedimenting suspended matter	ml/l	10	Imhoff sedimentation funnel, 0,5h
4	Total suspended matter	mg/l	2)	0,45 µm membrane filtration, drying in 105°C ± 1°C and weighting
5	COD_{Cr}	mgO2/l	2)	Potassium dichromate titration
6	BOD_5	mgO2/l	2)	Oxygen determination after 5 days incubation in 20°C ±1°C
7	TOC	mgC/l	2)	Catalytical digestion to CO2 and infrared spectrometry
8	Ammonia Nitrogen	mgNNH4/l	1003) 2004)	Indophenol spectrophotometric
9	Nitrite Nitrogen	mgNNo2/l	10	UV-VIS or IC-HPLC
10	Total Phosphorous	mgP/l	2)	UV-VIS
11	Chlorides	mgCl/l	1.000	Argentometric after Mohr or IC-HPLC
12	Sulphates	mgSO4/l	500	UV-VIS or IC-HPLC
13	Sulphites	mgSO3/l	10	Iodomentic titration IC-HPLC
14	Total Iron	mgFe/l	5)	AAS or ICP OES
15	Aluminium	mgAl/l	5)	AAS or ICP OES
16	Antymon	mgSb/l	0,5	AAS or ICP OES
17	Arsenic	mgAs/l	0,5	AAS or ICP OES

18	Barium	mgBa/l	5	AAS or ICP OES
19	Beryllium	mgBe/l	1	AAS or ICP OES
20	Boron	mgB/l	10	AAS or ICP OES
21	Zinc	mgZn/l	5	AAS or ICP OES
22	Tin	mgSn/l	2	AAS or ICP OES
23	Cr+6	mgCr+6/l	0,2	AAS or ICP OES
24	Total Cr	mgCr/l	1	AAS or ICP OES
25	Cadmium	mgCd/l	0,4	AAS or ICP OES
26	Cobalt	mgCo/l	1	AAS or ICP OES
27	Cooper	mgCu/l	1	AAS or ICP OES
28	Molybdenum	mgMo/l	1	AAS or ICP OES
29	Nickel	mgNi/l	1	AAS or ICP OES
30	Lead	mgPb/l	1	AAS or ICP OES
31	Mercury	mgHg/l	0,1	Cold vapour AAS
32	Selenium	mgSe/l	1	AAS or ICP OES
33	Silver	mgAg/l	0,5	AAS or ICP OES
34	Thallium	mgTl/l	1	AAS
35	Titanium	mgTi/l	2	AAS or ICP OES
36	Vanadium	mgV/l	2	AAS or ICP OES
37	Chlorine free	mgCl2/l	1	Titration , UV-VIS
38	Total Chlorine	mgCl2/l	4	Titration, UV-VIS
39	Cyanides bound	mgCN/l	5	UV-VIS

40	Cyanides free	mgCN/l	0,5	UV-VIS
41	Fluorides	mgF/l	20	Ion selective electrode IC-HPLC
42	Sulfides	mgS/l	1	Colorimetric with tiofluorosceine or ion selective electrode
43	Rodanate	mgSCN/l	30	Colorimetric with fluorosceine
44	Volatile Phenols (phenol index)	mg/l	15	UV-VIS
45	Oils	mg/l	15	IR
46	Ethyl eter extract	mg/l	100	By weight, extraction
47	HCH	mgHCH/l	4	solvent extraction, GC ECD,
48	CCl_4	mgCCl4/l	3	solvent extraction, GC ECD,
49	PCP	mgPCP/l	1,5	solvent extraction, GC ECD,
50	Aldrins, djeldrins, endrins, izodrins	mg/l	0,05	solvent extraction, GC ECD,
51	HCB	mgHCB/l	2	solvent extraction, GC ECD,
52	HCBD	mgHCBD/l	1,5	solvent extraction, GC ECD,
53	Chloroform (CHCl3)	mgCHCl3/l	1,5	solvent extraction, GC ECD,
54	EDC	mgEDC/l	2	solvent extraction, GC ECD,
55	Trichoroethylene	mgTRI/l	0,5	solvent extraction, GC ECD,
56	PER	mgPER/l	0,5	solvent extraction, GC ECD,
57	TCB	mgTCB/l	1	solvent extraction, GC ECD,
58	Phosphor-organic pesticides	mg/l	0,1	Gas chromatography NPD , solvent extraction
59	VOX	mgCl/l	1,5	Activated Carbon Extraction , microculometry

60	AOX	mgCl/l	1	Activated Carbon Extraction , microculometry
61	BTX	mg/l	1	GC FID
62	Anionic surfactants	mg/l	15	Colorimetry with methylene blue
63	Non-ionic surfactants	mg/l	20	UV-VIS

1) for waste water containing cyanides

2) values should be determined basing on permissible load for WWTP

3) WWTP for equivalent number of inhabitants < 5.000.

4) WWTP for equivalent number of inhabitants □ 5.000.

5) Pollutant level limited by the limit: readily sedimenting suspended matter

FEES AND FINES

4.13 Government Regulation of 27.12.93 on Payments covers fees for the abstraction of water and for discharge to water for Water Usage.

4.14 Fines for violation of the limits set for excessive load of pollutants in waste water discharges are regulated by Governmental Regulation of 11^{h} December 2001 (Dz.U. 2001 no.146, item 1640).

MONITORING

4.15 Sanitary Inspector of an appropriate level is responsible for monitoring quality of potable water (including drinking water supply systems).

4.16 Regional Environmental Protection Inspectorate is responsible for monitoring surface water.

4.17 Sanitary Inspectorate, Environmental Protection Inspectorate and Environmental Protection Department of the local authority are entitled at all times to take samples in order to monitor compliance with conditions of water permit.

5 SOIL AND GROUNDWATER POLLUTION

5.1 Pursuant to Art. 102.1 of Environmental Protection Act, the holder of the land is liable for its remediation. Minister of Environment set limit values for pollutant concentration levels what allows for classifying some land as "contaminated" (MoE Decree of September 2002 on Soil Quality Standards , Dz.U. The regulation does not apply to underground water and no underground water standards were established.

5.2 According to MoE Decree of 9 Sept. 2002 on soil and ground quality standards the limit values are set for three categories of lad use:

- "A" – water protection areas and nature protection areas
- "B" – agricultural land, forests, residential areas
- "C" industrial areas, communication terrains, mining areas.

5.3 According to the Environmental Protection Act and transition Act, there are several cases when former owner or polluter is liable for contamination. In some special cases, when the land was polluted by third party before the Act enter in force (1 Oct.2001) and pollution was registered by appropriate county, the liability can be cancelled. Also, if it is possible to proof, that land was polluted before 1 Sept. 1981, the scope of required reclamation can be limited to action securing no threat to human health and no dispersion in environment.

6 WASTE MANAGEMENT

GENERAL LEGISLATION

6.1 A number of acts and secondary legislation regulates waste management: major acts are:

- The Act of 27 April 2001 on wastes
- The Act "Packaging and packaging waste" of 22 July 2001 r.
- The Act on implementation Environmental Law and Waste Law of 27 July 2001
- The Act on Maintaining Cleanliness and Order in Communities as amended.

6.2 Poland transposed waste legislation of the EU and signed waste transportation treaties, thus waste management legislation in Poland is similar to that in EU Member States. (including waste classification, register and so on).

6.3 General rules of waste management are: prevention, recycling and environmental friendly neutralisation. The priorities are: minimising generation, recycling and minimising lanfilling

6.4 Important part of waste management is planning: Waste amnagement Plans are to be developed on National, Regional (Voivodship) county and municipality level

6.5 The enterprise which generates wastes in its installations should:

(i) Obtain permit for generating more than 1 tonne/a of hazardous wastes and 5 k tonns of oter wastes

(ii) Obtain administrative decision approving way of waste management when generates more than 1 tonne of hazardous wastes per year

(iii) Submit information on wastes and waste management if generates 5-5000 tonnes of wastes other than hazardous.

6.6 The entity generating wastes can transfer obligation of waste management to another entity, providing that receiver is in possession of proper permit.

6.7 Services in waste recycling or neutralisation require permit issued by:

(i) Appropriate voivode, for projects which can specially harmful to the environment

(ii) Appropriate Starosta (County Manager) for other project.

6.8 The above mentioned permit is not required when installation requires integrated permit under IPPC regime or for municipal wastes.

6.9 Services in waste collection or transportation require the permit issued by starosta after receiving opinions of city Mayor and county-level Inspector of environmental protection. Proper starost is that appropriate for site of waste collection and that appropriate for residence of firm (according to firms register) – for waste transportation.

6.10 Permit for waste collection or transportation determines:

- Type of wastes
- Area of activity
- Place and methods of waste storage
- Transportation ways and facilities
- Technical and logistical possibilities
- Additional/special terms when required

- Date of expiry.

6.11 Permit for waste collection and/or transportation can be cancelled when the terms are not fulfilled.

6.12 The financial deposit can be required for compensation of potential liabilities for environmental damage if the project can potentially cause large scale damage to environment.

6.13 Separate regulations cover some types of wastes like PCB and PCB containing wastes , asbestos, waste oil, batteries and accumulators.

6.14 Special set of regulations address thermal utilization of wastes, the relevant are:

(i) It is allowed to thermally process wastes in other installations than dedicated incinerators, with exclusion of hazardous wastes. Ministry of Economy will determine conditions

(ii) Operator of waste incinerator (with exclusion of hazardous wastes incineration) before receiving it t is obliged to:

- determine amount of waste
- verify data in waste-transfer documents (not applicable for waste incineration in installations other than dedicated waste incinerators)

6.15 Installations which do not fulfil requirements can be stopped by Environmental Protection Inspector.

6.16 Separate set of regulations determines construction and operation of landfills, international transportation and trade of wastes.

ADDITIONAL CONDITIONS REGARDING OPERATION OF WASTE INCINERATOR

6.17 Basing of provisions of article 47 of Act on Wastes, Ministry of Economy set terms of thermal processing of wastes (Dz.U.2002.37.339).

6.18 Technical conditions of waste incineration are need to guarantee:

- 1100°C for waste containing more than 1% organo -chlorinec compounds recalculated to Chlorine
- 850° for wastes containing less than I % of organo-chlorine compounds re-calculated to chlorine
- exhaust gases should be maintained in burning chamber by minimum 2 secondsand at min. 6% of oxygene.
- Maksimal concentration of non-oxydised organic compounds expressed as TOC in slag and ashes should not exceed 3%
- Contents of burnable compounds in burning residues should be less than 5%.

6.19 All the incinerators should be equipped with:

- at least one automatically ignited burner supporting burning process to secure required temperature of burning process, and used during start-up.
- All the incinerators should be equipped with automatic supply system allowing for stopping supply in case of problems with maintaining proper temperature in combustion chamber or exceeding emission limits. (obligatory starting date of entry to EU)
- Exhausted gas emission control devices which guarantee compliance with emission standards
- Technical measures to secure ground and soil, groundwater and surface water protection

- Technical facilities for storage of dry burning residues.

6.20 Obligatory monitoring comprise of:

- Continuous temperature monitoring in combustion chamber; sensor located close to the outer wall of the chamber with elimination of thermal radiation of the flame.

- Continuous monitoring of oxygen contents in exhausted gas

- Continuous pressure monitoring of exhausted gas

- Continuous monitoring of the time of residence of exhaust gases in combustion chamber

- (water vapour contents when gas is not dried out before analysis)

6.21 Special attention is paid to disposal or treatment of burning residuals (secondary wastes): it can be mixed with concrete providing heavy metals water leachability less than 10 mg/l for sum of metals.

7 IPPC AND BAT RELATED VALUES

7.1 Poland has transposed Integrated Pollution Prevention and Control Directive 96/61/EC (IPPC) by incorporating it to the Environmental Protection Act. IPPC is becoming one of the main approaches to environmental control in Europe (based on the UK system) and is currently being implemented throughout the region. More information on IPPC can be obtained on the following web pages: http://europa.eu.int/comm/environment/ippc/index.htm

7.2 Poland has no derogation for implementation of the IPPC directive (apart from a few specified plants) and the installations covered by the Annex I to the Directive should comply with BAT by the year 2007.

7.3 Annex I to the IPPC Directive has been transposed in its entirety in the form of the Minister of the Environment Decree of 26 July 2002 on Installations Causing Significant Pollution to Specific Components of the Environment or to the Environment as a Whole and lists the industrial activities falling under the IPPC regime. The IPPC regulations specify which installations fall under the integrated permit requirement.

7.4 Pursuant to Article 19 of the Transitional Act the operator of an Existing Installation will be obliged to obtain an integrated permit by 1 January 2004. "Existing Installations" have been defined in the Transitional Act as those for which a building permit was obtained before the effective date of the EPA (1 October 2001) and which commence their operation before 30 June 2003. However, the Minister of the Environment may delay this deadline in respect of specific sectors of industry until 30 October 2007 (i.e. until the deadline contained in the IPPC Directive). The Minister has not, to date, issued any regulation delaying the deadline and therefore, at this stage, all operators of Existing Installations are obliged to comply with the 1 January 2004 deadline. The definition of "Existing Installation" used in the Transitional Act does not reflect the terms of the IPPC Directive and is therefore subject to change.

7.5 Any installation which either obtained a building permit after 1 October 2001 or commences operations after 30 June 2003 (i.e. which is not an Existing Installation) is required to obtain an integrated permit immediately.

7.6 To obtain integrated permit it is needed to demonstrate compliance of operated installations with Best Available Techniques (BAT) – of not present a scheduled to ensure this is met. For the sectors for which BAT reference Documents (BREF) have been developed it is necessary to regard appropriate BREF when considering compliance with BAT. BREFs are developed in complex negotiation process by sector working groups accredited in Sevilla (Spain). BREFs are not legal acts but a reference material only which must be regarded when assessing BAT requirement for installation of interest. The Directive allows for temporary deviation form BAT driven emission limits, when corrective plan is approved and gives guarantee to comply with BAT requirements within 6 months.

7.7 If the installation does not fulfil all the IPPC requirements, the application for obtaining integrated permit should be rejected... With no legally binding integrated permit no construction permit will be issued for new installations and operation will be stopped (for "existing" installations).

7.8 The IPPC Directive is broad and apart from energy plants also encompasses for instance cement and lime, plants, waste incineration, chemical, steel, municipal landfills etc...

7.9 BREFs documents are in various stage of development and adoption by international process; for waste incineration

(i) Draft Reference Document on Best Available Techniques for Large Combustion Plants (Draft dated March 2001)

(ii) Waste Incineration (the BREF is benign prepared and not yet published)

Other BREFs applicable to the Project are:

(i) The first draft BREF on Emissions from Storage

(ii) The third draft document on Monitoring

(iii) Reference Document on the application of Best Available Techniques to Industrial Cooling Systems (adopted Dec 2001)

(iv) BREF Note on Waste Treatment (under preparation not yet published)

7.10 All these BREFs should be regarded when developing IPPC compliance study and preparing application for integrated permit due to IPPC regulation.

7.11 IPPC related requirements can be classified into three categories:

- emission control equipment of end-of- the-pipe type;
- technology changes/requirements (including material imput/output and facilities balances, energy efficiency and emission)
- environmental monitoring

7.12 Pre-condition for LCP BAT compliance is fulfilling of all legal requirements: in this case provisions of new LPC directive.

7.13 Chapter 8 of LCP BREF addresses co-combustion of waste and recovered fuel. Draft status and incompleteness of some chapters disables practical use of this document.

7.14 It is evident that at least following environmental aspects should be regarded

- air emission
- waste water emission
- water abstraction
- noise
- soil and groundwater pollution
- monitoring
- energy efficiency
- waste use/ minimisation

7.15 Please note that for waste incineration their will be a need to review and study a number of the BREF notes depending on the technology chosen. For instance if RDF

is to be used in say a cement plant there is a need to review and take on board the Cement and Lime Sector BREF Note. The fuel type and source would need to be part of the Cement plants permit application (which is to be obtained next year). The cement plant would need to apply for the option once it is undertaking this action next year. Without this it will be difficult to add the new fuel to the plant. It may thus be appropriate for the project team to discuss this option with the management of the cement plant.

8 ENVIRONMENTAL NOISE

8.1 Poland has tradition of regulating environmental noise whilst the EU legislation address exclusively noise generation by facilities and equipment. It can be observed some convergence of those two ideas: environmental noise regulation is discussed in EU and EU legislation regarding noise generation has been transposed to Polish legal system.

8.2 Environmental noise levels are regulated by MoE Decree of 13 May 1998. Similary like other regulations referring to "old" act on environmental protection, this regulation will expire on 30 June 2003. Draft document developed in regime set by "new" Environmental Protection Act (2001) will probably use the same limit values.

8.3 Noise limits in dB(A) are set for certain time of the day, land use and one of to categories of noise sources (general groups). Regulation address separately noise generated by energetic lines and take- off, landing and trespassing of aircrafts.

8.4 Limit values for the areas, excluding noise generated by energetic lines and take- off, landing and trespassing of aircrafts are presented in table 8.1.

Table 8.1. Environmental noise limit values excluding noise generated by energetic lines and take- off, landing and trespassing of aircrafts

Land use	Permissible noise level in dBA			
	Roads and railways		Other objects and groups of noise sources	
	Daytime (6AM-10PM)	Night time (10PM-6AM)	Daytime, the 8 "worst" hours	Night time, the "worst" 1 hour
Health resorts Hospitals out of the city	50	40	40	35
Recreation areas out of the city Single housing area Area of permanent stay of children and youngsters Social care houses Hospitals in the city	55	45	45	40
Multi-family houses Residential areas with services	60	50	50	40
Centers of the cities with population more than 100 000, including administrative, commercial and services infrastructure	65	55	55	45

9 ENVIRONMENTAL FEES

9.1 According to Official Announcement of MoE dated 15 Nov. 2002 on environmental fees (for "use" of environment) in the year 2003 (Monitor Polski No. 49, 715) the unit environmental fees are set for:

- gases and particulates emitted too the atmosphere
- pollutants discharged to surface/running water or soils
- cooling water
- deposition of wastes in landfill
- extraction of fresh water from surface intakes or groundwater wells
- polluted rainwater or water from melting snow.

9.2 Unit Fees are updated annually by official announcement of MoE issued before 31 Oct each year and valid for the next fiscal/calendar year.

10 LIMIT VALUES FOR TECHNOLOGY OPTIONS

10.1 Polish Environmental legislation does not distinguish between mass burn of wastes and RDFs. Under current philosophy the issue would need to be address in an integrated permit. It is thus possible for a cement plant to include this but would necessitates a number of studies and a permit application (assumed cost 30-60 K USD for a cement plant – encompassing this and normal issues).

10.2 According to §22 of MoE Decree of 30 July 2001 (Dz.u. 2001.87.957) burning products of MSW gasification (pyrolysis) is regarded as burning wastes.

10.3 According to §22 of MoE Decree of 30 July 2001 (Dz.u. 2001.87.957) and interpretation of MoE every "technical facility used for MSW incineration" is regarded as "Municipal Waste Incinerator".

10.4 Technological options:

(i) construction of new municipal waste incineration plant

(ii) modernisation of exiting boilers in CHP to burn MSW of RDFs

(iii) combustion in CHP of gas obtained in pyrolytic process

(iv) combustion of wastes in local cement plant

10.5 These do not differ in emission limit values or other rules. After 1 Jan 2003 also the date of construction permit does not matter for emission limit values when MSW are incinerated.

10.6 According to knowledge of consultants gained in other projects gas obtained in composting process of MSW could be eventually regarded as a fuel by local and

regional authorities as this type of gas generation is not mentioned in the legal regulations on waste incineration (but not official interpretation by MoE is available)

10.7 All the technology options are covered by IPPC regulations either as MSW incinerators with the capacity of more than 3 tonnes/hour or as a thermal sources of rated thermal input capacity of more that 50 MWt. and the same BREFs are applicable.

10.8 Poland transposed the Large Combustion Plant (LCP) Directive (88/609/EEC) and is expected to transpose and implement fully new LCP Directive 2001/80/EC and waste incineration Directive (2000/76/EC) automatically when it comes in force, and with no derogations.

10.9 Poland transposed and implemented with no derogation Council Directives on preventing air pollution by existing and new MSW incineration plants (89/429/EEC, 89/369/EEC). **It is worth to remember that these Directives are to be repealed 28 Dec 2005 for existing plants and 28 Dec 2002 for new plants.**

10.10 Poland transposed and implemented the Council Directive 96/61/EC concerning integrated pollution prevention and control (IPPC) and Best Available Techniques (BATs) should be applied for combustion of fuels and waste incineration or co-incineration. Integrated permit is needed to operate waste incineration of co-incineration installation.

10.11 No exclusions are done for RDFs either solid, liquid or gaseous (the latter, when received in pyrolitic process).

10.12 According to LCP Draft BREF document the minimum requirement for emission of all the technological options discussed is determined by new LCP Directive and waste incineration directive (after 2005)

10.13 Cement and Lime Manufacturing Industries BREF pays a little attention to use of waste as fuel (chapter 2, page 10). It is pointed out that when wastes are fed through the main burner, will be decomposed in the primary burning zone at temperatures up to 2000 C, while tat fed to a secondary burner, preheater or preacalciner will be burnt at lower temperatures, which not always is enough to decompose halogenated organic substances. Volatile compounds in material that is fed at the upper end of the kiln or as lump fuel can evaporate; i.e. will not pass through primary burning zone

and might be not decomposed. Thus, use of waste containing VOCs, mercury thallium should can increase emission. Generally wastes to be used in cement kiln should be properly prepared and composed with original fuel; unsorted municipal wastes are not suitable for this purpose.

10.14 Concluding, no single technological option is preferable from environmental emission point of view as long Polish environmental law in force is regarded. The chosen option will need to meet the EU Directives as a minimum and only detailed modelling may provide more specific guidance which would need to be done at the planning permit stage once a favoured technical option is chosen (could model the impact of two variants for instance).

10.15 As mentioned in 10.7 Poland is expected to transpose and implement the 2000/76/EC Directive on waste incineration. Member States shall bring into force the laws, regulations and administrative provisions necessary to comply with this Directive not later than 28 December 2002. It can be supposed that Poland will be obliged to comply with this regulation latest in moment of EU accession (i.e. 1 May 2004) Starting this time the Project should comply with provisions of the Directive.

10.16 As the operation permit (in this case "integrated permit") will be issued after 28 December 2002, the plant should fulfil requirements set by Directive 2000/76/EC for "new" plants. For waste incineration and co-incineration of unsorted MSW emission air limit values are set by Annex V to the Directive, Limit Values for discharge of waste waster from cleaning of exhaust gases by Annex IV to the Directive. This limit values are thought to be obligatory in Poland after 1 May 2004.

10.17 Both the CHP and the Cement plant will require to obtain integrated permits with applications being done next year. The costs of each is substantial and it may be an option to combine the project details with the facilities permit application process as to ensure that say RDF or other options are considered and could be incorporated with slight modification to any permit in the future. If an integrated permit is obtained (optimally valid for 5-10 year) without such an option introducing new fuel types would mean a material chance og the permit and hence need for substantial modification of the permit which would be in the 30-60 K USD ball park.

ANNEX 1

LIST OF SELECTED
ENVIRONMENTAL LAWS

Annex I. List of selected environmental laws

SPECIFICATION OF LEGAL REGULATIONS AND OTHER REQUIREMENTS

(Status for December 2002)

No	Legislative	Publication
(1)	(2)	(3)
	KEY BASIC LEGAL ACTS ON ENVIRONMENT PROTECTION IN POLAND	
1.	**The Constitution of Republic of Poland**	1997
2.	**The Environment Protection Act of 20 June 2001**	The Journal of Legal Acts 2001 No 69, entry 627
3.	**The Act on Wastes of 20 June 2001**	The Journal of Legal Acts 2001 No 96, entry628
4.	**The Act on implementation Environment Law and Waste Law of 27 July 2001**	The Journal of Legal Acts 2001 No 100, entry 1084
5.	**The Act "Water Law" as amended**	The Journal of Legal Acts 1974, No 38, entry 230,
6.	**The Act "Water Law"**	The Journal of Legal Acts 2001, No 115, entry 1229
7.	**The Act "Packaging and packaging waste" of 22 July 2001 r.**	The Journal of Legal Acts 2001 63, entry 638
8.	**The Act "Construction Law" as amended**	The Journal of Legal Acts 1994, No: 89 entry 414
9.	**The Act on Maintaining Cleanliness and Order in Communities as amended**	The Journal of Legal Acts 1996, No 132, entry 622
10.	**The Act on Nature Conservation as amended**	The Journal of Legal Acts 1991, No 114, entry 492
11.	**The Act on Toxic Substances as amended**	The Journal of Legal Acts 1963, No 22, entry 116
12.	**The Act on substances and chemicals**	The Journal of Legal Acts 2001, No 11, entry 84
13.	**The Act on Prohibition of Use Materials with Asbestos as amended**	The Journal of Legal Acts 1997, No 101, entry 628
14.	**The Act of Spatial Planning (Land Development Act)**	The Journal of Legal Acts 1999, No 15, entry 139
15.	**Amending the Act on Land Development**	The Journal of Legal Acts No 114, entry 124
16.	**The Act on Managing Substances Damaging Ozone Layer**	The Journal of Legal Acts 2001 No 52, entry 537
17.	**The "Nuclear Law" Act**	The Journal of Legal Acts 2001, No 3, entry 18
18.	**The Act of Changing of Act on implementation Environment Law and Waste Law and others acts**	The Journal of Legal Acts 2002, No 143, entry 1196
19.	**The Act of Changing of Act on animals protection**	The Journal of Legal Acts 2002, No 153, entry 1141
20.	**The Act of Changing of Act "Water law"**	The Journal of Legal Acts 2001, No 153, entry 1803

No	Legislative	Publication
(1)	(2)	(3)
21.		The Journal of Legal Acts 2001, No 3, entry 18
	GENERAL REGULATIONS THE ENVIRONMENT LAW REFERS TO:	
22.	**The Act "Civil Code" as amended**	The Journal of Legal Acts 1974, No 24, entry 141
23.	**The Act Administrative Code**	The Journal of Legal Acts 2000, No 98, entry 1071
24.	**The Act of 6 June 1997 "Penal Code"**	The Journal of Legal Acts 1997, No 88, entry553
25.	**The Act "Petty Offences Code" as amended**	The Journal of Legal Acts 1971, No 12, entry 114
26.	**The Act of Administrative Law Change bearing the reform of state regime system as amended**	The Journal of Legal Acts 1998, No 106, entry 668
27.	**The Act "Construction Law" as amended**	The Journal of Legal Acts 1994, No 89, entry 414
28.	**The Act on Maintaining Cleanliness and Order in Communities as amended**	The Journal of Legal Acts 1996, No 132, entry 622
29.	**The Act on Transportation as amended**	The Journal of Legal Acts 1995, No 119, entry 575
30.	**The Road Traffic as amended**	The Journal of Legal Acts 1995, No 98, entry 602
31.	**The Act o Road Transportation of hazardous substances**	The Journal of legal Acts 2002, No 199, pos1671
32.	**The Act changing Act "Building Law"**	The Journal of legal Acts 2001, No 129, pos1439
33.	**The Act changing Act on City Planning**	The Journal of legal Acts 2001, No 154, pos1804
	ENVIRONMENT MANAGEMENT	
34.	**The Environment Protection Act of 20 June 2001**	The Journal of Legal Acts 2001 No 69, entry 627
35.	**The Act on implementation Environment Law and Waste Law of 27 July 2001**	The Journal of Legal Acts 2001 No 100, entry 1084
36.	**Council of Ministers Decree of 30 September 1998 on setting rules of co-operation of local units of state administration with other institutions and organisation**	The Journal of Legal Acts 1980, No 24, entry 98
37.	**Council of Ministers Decree of 22 December 1987 on fines for violation the requirements of Environment protection and on register of these fines**	The Journal of Legal Acts 1998, No 162, entry 1138
38.	**Council of Ministers Decree of 28 December 2000 amending regulation on charges for emissions to the air and for cutting trees**	The Journal of Legal Acts 2000, No 120, entry 1288
39.	**Council of Ministers Decree of 22 December 1998 on fines for exceeding Environment permits**	The Journal of Legal Acts 1998, No 162, entry 1138

No	Legislative	Publication
(1)	(2)	(3)
40.	**Council of Ministers Decree of 27 December 1993 on fees for economic use of the environment**	The Journal of Legal Acts 1993, No 133, entry 638
41.	**Ministry of Environment Decree of14 November 2002 on detailed requirements regarding Environment impact prognosis for projected city plans**	The Journal of Legal Acts 2002, No 115, entry 1229
42.	**Ministry of Environment Decree of 8November 2002 on requirement on emergency plans**	The Journal of Legal Acts 2002, No 194, entry 1632
43.	**Ministry of Environment Decree of 4 November 2002 on registration fees for integrated permits**	The Journal of Legal Acts 2002, No 190, entry 1591
44.	**Ministry of Environment Decree of 24 September 2002 on determining the types of projects potentially harmful to the environment and setting detailed criteria on qualification of the projects to EIA procedures.**	The Journal of Legal Acts 2002, No 179, entry 1490
45.	**Ministry of Environment Decree of 1 October 2002 on ways of making available Environment information**	The Journal of Legal Acts 2002, No 176, entry 1453
46.	**Ministry of Environment Decree of 9 October 2002 on the way of informing regional governor on kind, amount, and location of substances especially harmful to the environment.**	The Journal of Legal Acts 2002, No 175, entry 1439
47.	**Ministry of Environment Decree of 10 September 2002 on ammending regulation on Environment fees**	The Journal of Legal Acts 2002, No 161, entry 1335
48.	**Ministry of Environment Decree of 9 September 2002 on eco-physigraphical studies**	The Journal of Legal Acts 2002, No 155, entry 1298
49.	**Ministry of Environment Decree of 26 July 2002 on types of installations potentially heavilly polluting elements of the Nature or entire environment (IPPC related)**	The Journal of Legal Acts 2002, No 122, entry 1055
50.	**Ministry of Environment Decree of 26 June 2002 on Environment information register and public access**	The Journal of Legal Acts 2002, No 100, entry 920
51.	**Ministry of Environment Decree of20 June 2002 on fees for cutting prematured trees**	The Journal of Legal Acts 2002, No 99, entry 905
52.	**Ministry of Environment Decree of 24 June 2002 on use and**	The Journal of Legal Acts 2002, No 96, entry 860

No	Legislative	Publication
(1)	(2)	(3)
	transportation of hazardous substances.	
53.	Ministry of Environment Decree of 9 April 2002 on kind andf amount of substance which causes accounting the enterprise to high or enhanced risk of industrial accident	The Journal of Legal Acts 2002, No 58, entry 535
54.	Ministry of Environment Decree of 22 December 2002 on products containing asbestos and used for production or introduction to Polish Market	The Journal of Legal Acts 2001, No 1, entry 11
55.	Ministry of Environment Decree of 28 December 2001 on temporary ban on international trading substances depleting ozone layer and products containing these substances.	The Journal of Legal Acts 2001, No 157, entry 1841
56.	Ministry of Environment Decree of 20 December 2001 on automatic registration of trade and transportation of substances depleting ozone layer	The Journal of Legal Acts 2001, No 157, entry 1844
57.	Ministry of Environment Decree of 20 November 2001 on rodzaju instalacji ktorych instalacja wymaga zgloszenia	The Journal of Legal Acts 2001, No 140, entry 1585
58.		
	AIR PROTECTION	
59.	The Environment Protection Act of 20 June 2001	The Journal of Legal Acts 2001 No 69, entry 627
60.	The Act on implementation Environment Protection Law and Waste Law of 27 July 2001	The Journal of Legal Acts 2001 No 197, entry 1667
61.	The Ministry of Environment Decree on 30 July 2001 on admitting of contaminants into air (those coming from technological processes and technical operations)	Journal of Legal Acts 2001, No 87, entry957
62.	Ministry of Environment Decree of 28 April 1998 on permissible ambient air pollution levels	The Journal of Legal Acts 1998, No 55, entry 355
63.	The ordinance of the Council of Ministries of 5 August 1998 on recording and specifying of contaminants admitted into air.	Journal of Legal Acts 1998 No 102, entry 647
64.	Council of Ministers Decree of 28 December 2000 amending regulation on charges for emissions to the air and for cutting trees	The Journal of Legal Acts 2000, No 120, entry 1288
65.	Ministry of Environment Decree of 18 September 1998 on	The Journal of Legal Acts 1998, No 124, entry 819

No	Legislative	Publication
(1)	(2)	(3)
	principles of setting air emission limits and required documentation	
66.	**Ministry of Environment Decree of 3 September 1998 on air pollution calculations methods for existing and planned sources of Pollution**	The Journal of Legal Acts, No 122, entry 805
67.	**Council of Ministers Decree of 22 December 1998 on fines for exceeding Environment permits**	The Journal of Legal Acts 1998, No 162, entry 1138
68.	**Council of Ministers Decree of 27 December 1993 on fees for economic use of the environment (The Journal of Enactment No133, entry 638)**	The Journal of Legal Acts 1993, No133, entry 638
69.	**The ordinance of the Council of Ministries of 30 December 1997 on imposing charges for introducing contaminants into air and for removing trees and bushes.**	Journal of Legal Acts 1997 No 162, entry 1117, amended: 1998 No 162, entry 1129; 1999 No 110, entry 1261; 2000 No 120, entry 1288
70.	**The ordinance of Environment Ministry of26 November on the scope and way of dissemination of information on air pollution**	The Journal of Legal Acts 2002, No204, entry 1727
71.	**The ordinance of Environment Ministry of 5 July 2002 on detailed requirements regarding air protection programmes**	The Journal of Legal Acts 2002, No115, entry 1003
72.	**The ordinance of Environment Ministry of 6 June 2002 on permissible levels of some substances in the air, alarm levels and tolerance margins for permissible levels of some substances**	The Journal of Legal Acts 2002, No87, entry 796
73.	**The ordinance of Environment Ministry of 6 June 2002 on assessment of some substances levels in the air**	The Journal of Legal Acts 2002, No87, entry 798
	WASTE DISPOSAL	
74.	**The Environment Protection Act of 20 June 2001**	The Journal of Legal Acts 2001 No 69, entry 627
75.	**The Act on Wastes of 20 June 2001**	The Journal of Legal Acts 2001 No 96, entry628
76.	**The Act on implementation Environment Law and Waste Law of 27 July 2001**	The Journal of Legal Acts 2001 No 100, entry 1084
77.	**The Act on Maintaining Cleanliness and Order in Communities as amended**	The Journal of Legal Acts 1996, No 132, entry 622
78.	**The act of 15 Sept. 2000 amending act on ban to use of products containing asbestos**	The Journal of Legal Acts 2000, No 58, entry 986

No	Legislative	Publication
(1)	(2)	(3)
79.	**The act of 11 May 200 Waste management obligations for industries and product and deposit fees.**	The Journal of Legal Acts 2001, No 63, entry639
80.	**European Agreement on Road Transportation of Dangerous substances ADR with annex A and B**	The Journal of Legal Acts 1999, No 30, entry 287
81.	**Ministry of Finance Decree of 7 January 1998 r. on waste types which utilization entitles to tax relaxation and assessing values of wastes used in production processes (The Journal of Enactment No 8, entry 29).**	The Journal of Legal Acts 1998, No 8, entry 29
82.	**The Ministry of Environment Decree of 24 December 1997 on waste classification.**	The Journal of Legal Acts. 1997 No 162, entry 1135; 2001 No 17, entry 204
83.	**Council of Ministers Decree of 22 Dec.1998 on fees for land filling wastes.**	Journal of Legal Acts 1998 No 162, entry 1128 amended: 1999 No 110 entry 1263; 2000 No 120, entry 1284
84.	**Ministry of Environment Decree of 13 Feb. 1998. on labeling packages**	The Journal of Legal Acts1998, No 25, entry 138
85.	**Ministry of Environment Decree of 6 April 1998 r. setting the list of wastes which import requires no permit of National Environment Protection**	The Journal of Legal Acts 1998, No 47, entry 299 The Journal of Legal Acts 2000, No 20, entry 251
86.	**Ministry of Environment Decree of 12 September 1998 on patterns of documentation forms to be used for registration of wastes and distribution of information pertaining kinds and quantities of wastes placed at a waste yard as well as period of time of their storage.**	Journal of Legal Acts 1998 No 121, entry 794
87.	**Ministry of Economy Decree of 2 July 1998 on wastes which should be reused for industrial purposes and conditions of this use.**	The Journal of Legal Acts 1998, No 90, entry 573, The Journal of Legal Acts 2000, No 100, entry 1078
88.	**Council of Ministry Decree of 30 June 2001 on annual level of recycling waste packaging**	The Journal of Legal Acts 2001, No 69, entry719
89.	**Ministry of Economy Decree of 21 October 1998 on specific principles of toxic wastes removal , use and disposal**	The Journal of Legal Acts 1998, No 145, entry 942 The Journal of Legal Acts 2001, No 22, entry 251
90.	**Ministry of Environment Decree of 14 June 2000.on the list of wastes which the generating entity can transfer to individuals to**	The Journal of Legal Acts 2000, No 51, entry 620

No	Legislative	Publication
(1)	(2)	(3)
	bc reused	
91.	Ministry of Economy Decree of 19 July 1999r. on forms (layouts) used in international exchange of wastes	The Journal of Legal Acts 1999, No 69, entry 768
92.	Ministry of Environment Decree of 11 August 1999 on terms to be fulfilled when using sewage sludge for non-industrial purposes	The Journal of Legal Acts 1999, No 72, entry 813
93.	Ministry of Economy Decree of 14 Aug. 1998 on safe use and removal of products containing asbestos	The Journal of Legal Acts 1998, No 138, entry 895
94.	Ministry of Economy Decree of 14 February 2000 admitting production and import of some asbestos containing products	The Journal of Legal Acts 2000, No 15, entry 188
95.	Ministry of Transportation and Marine Economy Decree of 15 June 1999 on road transportation of dangerous materials	The Journal of Legal Acts 1999, No 57, entry 608
96.	Ministry of Transportation and Marine Economy Decree of 15 June 1999 on training courses for drivers transporting dangerous materials (The Journal of Enactment No 57, entry 609, 1999	The Journal of Legal Acts 1999, No 57, entry 609
97.	Ministry of Transportation and Marine Economy Decree of 30 May 1999 on temporary limitation of some car	The Journal of Legal Acts 1999, No 50, entry 598
98.	Ministry of Transportation and Marine Economy and Ministry of Internal Affairs and Administration Decree of 21 June 1999 on road signs and	The Journal of Legal Acts 1999, No 58, entry 622
99.	The ordinance of the Ministry of Environment Protection, Natural Resources and Forestry of 12 September 1998 on patterns of documentation forms to be used for registration of wastes and distribution of information pertaining kinds and quantities of wastes placed at a waste yard as well as period of time of their storage.	Journal of Legal Acts 1998 No 121, entry 794
100.	The ordinance of Economy Ministry of 30 October 2002 on types of waste which can be lanfilled with no selection	The Journal of Legal Acts 2002, No 191, entry 1595
101.	The ordinance of Economy Ministry of 28 Octobre 2002 on types of wastes which collection and transportation does not require permit for thesuch an activity and setting requirements regarding collection and transport.	The Journal of Legal Acts 2002, No 188, entry 1575

No	Legislative	Publication
(1)	(2)	(3)
102.	**The ordinance of Environment Ministry of 21 October 2002 on wastes generated in Tithanium dioxide production and processing of wastes which can not be neutralised by means of landfilling.**	The Journal of Legal Acts 2002, No 179, pos 1513
103.	**The ordinance of Environment Ministry of 8 October 2002 on on landfills and storage sites of wastes from Titanium dioxide production and processing**	The Journal of Legal Acts 2002 No 175, entry 1456
104.	**The ordinance of Environment Ministry of 1 August 2002 on municipal sludge wastes**	The Journal of Legal Acts 2002 No 134, entry 1140
105.	**The ordinance of Environment Ministry of 12 July on forms for annual reporting of mass of wastes imported or exported from abroad**	The Journal of Legal Acts 2002 No 122 entry 1053
106.	**The ordinance of Environment Ministry of 12 July on regional (voivodship) reports on packaging wastes**	The Journal of Legal Acts 2002 No 122, entry 1054
107.	**The ordinance of Environment Ministry of 28 May 2002 on the list of wastes which the owner can transfer to individuals or entities which are not enterprises – to be utilised for their own needs.**	The Journal of Legal Acts 2002 No 74, entry 686
108.	**The ordinance of Environment Ministry of 5 March 2002 on determining form used in international exchange of wastes**	The Journal of Legal Acts 2002 No 56, entry 511
109.	**The ordinance of Environment Ministry of 5 March 2002 on list of wastes other than hazardous which import from abroad does not require permit issued by GIOS**	The Journal of Legal Acts 2002 No 56, entry 512
110.	**The ordinance of Environment Ministry of 8May 2002 on request for import or export of wastes**	The Journal of Legal Acts 2002 No 56, entry 513
111.	**The ordinance of Economy Ministry of 21 March 2002 on requirements regarding thermal processing of waste**	The Journal of Legal Acts 2002 No 37, entry 339
112.	**The ordinance of Economy Ministry of 29 January 2002 on waste types other than hazardous and kinds of installations and**	The Journal of Legal Acts 2002 No 18, entry 176

No	Legislative	Publication
(1)	(2)	(3)
	facilities with which thermal waste processing is allowable.	
113.	The ordinance of Environment Ministry of 6 Fabruary 2002 on types of toxic wases which are allowed to be imported from abroad.	The Journal of Legal Acts 2002 No 15, entry 146
114.	The ordinance of Environment Ministry of 6 February 2002 introducing obligation to obtain permits for exportation wastes to some countries	The Journal of Legal Acts 2002 No 15, entry 147
115.	The ordinance of Environment Ministry of 6 February 2002 on template for permit register for international turnover of wastes.	The Journal of Legal Acts 2002 No 15 , entry 148
116.	The ordinance of Environment Ministry of 7 December 2001 on template for report on amount of introduced to the country market of packagings and products and reached levels of re-use, recycling packaging wastes and on incomes from product fees.	The Journal of Legal Acts 2002 No 2 , entry 26
117.	Ministry of Environment Decree of11 Decembre 2001 on the scope of information fequired durinfg registration and given by the waste owners who are not obliged to register or obtain the permit.	The Journal of Legal Acts 2001, No 151 entry 1734
118.	Ministry of Environment Decree of 11 December 2001 on types or quantity of wastes for which there is no obligation to keep recorsand categories pf small and medium firms which can keep simplified waste register.	The Journal of Legal Acts 2001, No 151, entry 1735
119.	Ministry of Environment Decree of 11 December on templates of documents used for waste evidence	The Journal of Legal Acts 2001, No 151, entry 1736
120.	Ministry of Environment Decree of 11 December 2001 on terms and scope of access to voivodship data base on generation and management of wastes.	The Journal of Legal Acts 2001, No 151, entry 1738
121.	Ministry of Environment Decree ofw 11 December 2001 on minimal scope of information covered by the obligation to be collected , processed and on the rules of managing voivodship and central data bases on generation and management of wastes.	The Journal of Legal Acts 2001, No 151, entry 1740

No	Legislative	Publication
(1)	(2)	(3)
122.	**9 November 2001 on qualification requirements in waste management**	The Journal of Legal Acts 2001, No 140, entry 1584
123.		
	WATER PROTECTION	
124.	**The Environment Protection Act of 20 June 2001**	The Journal of Legal Acts 2001 No 69, entry 627
125.	**The Act on implementation Environment Law and Waste Law of 27 July 2001**	The Journal of Legal Acts 2001 No 100, entry 1084
126.	**The Act of 24 October 1974 Water Law**	Journal of Legal Acts. 1974 No 38, entry 230, amended: 1975 No 17,entry 94; 1980 No 3, entry 6; 1983 No 44, entry 201; 1989 No 26, entry 139, No 35, entry 192; 1990 No 34, entry 198, No 39, entry 222; 1991 No 32, entry 131, No 77, entry 335; 1993 No 40, entry 183; 1994 No 27, entry 96; 1995 No 47, entry 243, No 141, entry 692; 1996 No 106, entry 496; 1997 No 47, entry 299, No 133, entry 885, No 88, entry 554; 1998 No 106, entry 668; 2000 No 12,entry 136, No 109, entry 1157, No 120, entry 1268, 2001 No 5, entry 43
127.	**The Act "Water Law"**	The Journal of Legal Acts 2001, No 115, entry 1229
128.	**The Act amending the Act "Water Law"**	The Journal of Legal Acts 2002, No 154 entry 1803
129.	**Council of Ministries Decree of 19 May 1999 on conditions to be met while disposing of wastes into sewage system**	Journal of Legal Acts 1999 No 50, entry 501
130.	**Ministry of Agriculture Order of 26 January1976 on requirements concerning water permit documentation**	M.P. No 6, entry 32
131.	**Council of Ministers Decree of 3 June 1977 on supervision and control of water management**	The Journal of Legal Acts 1977, No 19, entry 78
132.	**Council of Ministers Decree of 11 March 1985 on kind of particular usage of water and water facilities**	The Journal of Legal Acts 1985, No 13, entry 55
133.	**Council of Ministers Decree of 2 November 1985 on rules and procedures on setting fines for exceeding limits of water collection**	The Journal of Legal Acts 1985, No 52, entry 271
134.	**Council of Ministers Decree of 18 December 1996 on water and sewage fees**	The Journal of Legal Acts 1996, No 151, entry 716

No	Legislative	Publication
(1)	(2)	(3)
135.	**Council of Ministers Decree of 28 December 2000 on changing regulation on water and sewage fees**	The Journal of Legal Acts 2000, No 120, entry 1288
136.	**Ministry of Environment Decree of 5 November 1991 on delimitation of protected zone for water supply well**	The Journal of Legal Acts 1991, No 116, entry 504
137.	**Ministry of Environment Order of 7 July 1986 r. on agriculture use of waste water**	M.P. No 23, entry 170
138.	**Ministry of Environment Decree of 5 November 1991 on water quality and requirements of waste water discharged into water and ground**	The Journal of Legal Acts 1991, No 116, entry 503
139.	**Council of Ministers Decree of 20 June 1995 on penalties for violation of requirement for waste water discharge into water or ground**	The Journal of Legal Acts 1995 No 79, entry 400
140.	**Minister of Health protection and Social Care Decree of 4 September 2000. on the conditions to be fulfilled by the drinking water, household water, bathing water and rules of water quality control by Sanitary Inspection units**	The Journal of Legal Acts 2000, No 82, entry 937
141.	**Ministry of Environment Decree of 27 November 2002 on quality requirements regarding surface waters utilised for drinking purposes.**	The Journal of Legal Acts 2002, No 204, entry 1728
142.	**Ministry of Environment Decree of 6 November 2002 on reference methods for assessing degree of bio-degradation of surfactants used in products, which utilisation could impact water quality.**	The Journal of Legal Acts 2002, No 196, entry 1658
143.	**Ministry of Environment Decree of 20 July 2002 on way of implementing obligation of industrial waste water suppliers and terms of discharging industrial waste water to the sewage system.**	The Journal of Legal Acts 2001, No 129, entry 1108
144.	**Ministry of Environment Decree of 11 december 2001 on the unit penalties for exceeding terms (limits) of discharging waste water to surface water or soil.**	The Journal of Legal Acts 2001, No 129, entry 1108
145.	**Ministry of Environment Decree of 4 October 2002 on quality**	The Journal of Legal Acts 2002 No 176, entry 1455

No	Legislative	Publication
(1)	(2)	(3)
	requirement of fresh water being living environment for fishes	
146.	Ministry of Environment Decree of 29 November 2002 on terms to be fulfilled for discharging waste water to surface waters or soils as well on priority polluting substances for water environment	The Journal of Legal Acts 2002 No 212, entry 1799
147.	Ministry of Infrastructure Decree of 20 July 2002 on the ways of fulfilling obligations of waste water suppliers and on conditions of introducing waste water to municipal sewage system.	The Journal of Legal Acts 2002 No 129, entry 1108
	LAND and soil PROTECTION	
148.	The Environment Protection Act of 20 June 2001	The Journal of Legal Acts 2001 No 69, entry 627
149.	The Act on implementation Environment Law and Waste Law of 27 July 2001	The Journal of Legal Acts 2001 No 100, entry 1084
150.	The Act on Nature Conservation	The Journal of Legal Acts 1991, No 114, entry 492
151.	The Act on the Protection of Agricultural and Forests Land as amended	The Journal of Legal Acts 1995, No 16, entry 78
152.	Council of Ministers Decree of 23 January 1987 on detailed principles of land protection	The Journal of Legal Acts 1987, No 87, entry 23
153.	Council of Ministers Decree of 3 February 1995 on protection of agricultural and forest soils amended by administrative regulation on public administration	The Journal of Legal Acts 1995, No 16, entry 78 The Journal of Legal Acts 2000, No 12, entry 136
154.	Ministry of Economy of 20 September 2000 on technical standards of filling stations, fuel bases and mains for long range transportation for oil its products	The Journal of Legal Acts 2000, No 98, entry 1068
155.	Ministry of Environment Decree of 9 September 2002 on quality standards of soil and ground quality standards.	The Journal of Legal Acts 2002, No 165, entry 1359
	GEOLOGICAL AND MINING LAW	
156.	The Act of Geological and Mining Law as amended	The Journal of Legal Acts 1994, No 27, entry 96
157.	Ministry of Environment Decree of 23 August 1994 on the cases when is needed preparation of documentation other than geological documentation of the sediment, hydro-geologic and geologic-engineering	The Journal of Legal Acts 1994, No 93, entry 443

No	Legislative	Publication
(1)	(2)	(3)
158.	**Ministry of Environment Decree of 23 August 1994 on the detailed requirements regarding hydro-geological and geological-engineering documentation**	The Journal of Legal Acts 1994, No 93, entry 444
159.	**Ministry of Environment Decree of 18 August 1994 on collecting information and samples obtained in geological works and the management of samples and geological documentation**	The Journal of Legal Acts 1994, No 91, entry 425
160.	**Ministry of Environment Decree of 18 August 1994 on plan of geological works**	The Journal of Legal Acts 1994, No 91, entry 426
	NOISY AND WIBRATION	
161.	**The Ordinance of the Ministry of Environment of 1998**	The Journal of Legal Acts 1998, No 66, entry436
162.	**Ministry of Environment Decree of 14 October 2002 on particular requirements regarding environmental protection plans against noise**	The Journal of Legal Acts 2002, No 179, entry 1498
163.	**Ministry of Environment Decree of 26 March 2002 on regarding basic requirements for devices used outdoor – regarding environmental noise emission**	The Journal of Legal Acts 2002, No 60, entry 546
164.	**Ministry of Environment Decree of 9 January 2002 on noise level limit values**	The Journal of Legal Acts 2001, No 8, entry 81
165.	**Ministry of Environment Decree of 29 september 2001 on unit values of fines for exceeding noise limit values.**	The Journal of Legal Acts 2001, No 129, entry 1285
	INDUSTRIAL ACCIDENTS CAUSED BY CHEMICAL SUBSTANCES	
166.	**The Act of 21 May 1963 – "Toxic substances" as amended**	The Journal of Legal Acts 1963 No 22, entry116, amended.: 1983 No 6, entry 35; 1996 No 24, entry 110; 1997 No 88, entry 554; 1998 No 106, entry 668
167.	**The Act of 11 January 2001 on Substances and Chemicals**	The Journal of Legal Acts 2001 No 11, entry 84
168.	**The Act on administration of international exchange of goods and services and on special exchange**	The Journal of Legal Acts 1997, No 157, entry 1026
169.	**The Ministry of Industry and Trade Decree of 30 November 1994 on requirements set to products regarding human health and**	The Journal of Legal Acts 1996, No 133, entry 690 The Journal of Legal Acts 1998, No 122, entry 801

No	Legislative	Publication
(1)	(2)	(3)
	Environment protection	
170.	**The Council of Ministers Decree of 19 December 1997 on setting ban on international exchange of substances damaging ozone layer and wares containing these substances**	The Journal of Legal Acts 1997, No 160, entry 1088 The Journal of Legal Acts 1999, No 29, entry 271
171.	**The Ministry of Health and Social Care of 28 December 1963 on the list of toxic substances and harmful materials.**	The Journal of Legal Acts 1964 r. , No 2 entry 9
172.	**The Ministry of Health and Social Care of 1 July 1996 on introducing a ban on application, turnover and transport for some of dangerous chemical substances.**	The Journal of Legal Acts 1996 No 86, entry393
173.	**The Ministry of Health and Social Care of 21 August 1997 on chemical substances making a threat to life or health**	The Journal of Legal Acts 1997 No 105, entry 671; 1999 No 26, entry 241
174.	**The Ministry of Economy of 16 August 2001 on external rescue plan for industrial accident**	The Journal of Legal Acts 2001, No 97, entry 1056
175.	**The Ministry of Economy of 16 August 2001 on internal rescue plan for industrial accident**	The Journal of Legal Acts 2001, No 97, entry 1057
176.	**The Ministry of Economy of 16 August 2001 on industrial safety rapport**	The Journal of Legal Acts 2001, No 97, entry 1058
	WORKING ENVIRONMENT	
177.	**The Act of 26 June 1974 – Labour Code**	Journal of Legal Acts 1997 No 88, entry553, amended: No 128, entry 840; 1999 No 64, entry 729; 2001 No 52, entry 538
178.	**Ministry of Health and Social Care of 28 May 1996 on kinds of work which demand particular mental and psychical fitness.**	Journal of Law 1996, No. 62, entry287
179.	**Ministry of Health and Social Care of 12[1]July 1996 on specification of units authorised to conduct research works on materials and technological processes in order to establish degree of their harmfulness to health and range of such research.**	Journal of Legal Acts 1996 No 101, entry473
180.	**Ministry of Health and Social Care of 17 January 1998 *amended* 2 January 2001**	Journal of Legal Acts 1998, No 79, entry 513 Journal of Legal Acts 2001, No 4, entry 36
181.	**Ministry of Health and Social Care of 1 July 1996 on introducing a ban on application, turnover and transport for some of**	Journal of Legal Acts 1996 No 86, entry393

No	Legislative	Publication
(1)	(2)	(3)
	dangerous chemical substances.	
182.	**Ministry of Health and Social Care of 21 August 1997 on chemical substances making a threat to life or health**	Journal of Legal Acts 1997 No 105, entry 671; 1999 No 26, entry 241
183.	**Ministry of Health and Social Care of 11[t]September 1996 on carcinogenic factors in work environment and supervision over health of employees who are exposed to such factors**	Journal of Legal Acts 1996 No 121, entry 571
184.	**Ministry of Labour and Social Policy of 28 May 1996 on kinds of work which should be performed by at least two persons.**	Journal of Legal Acts 1996 No 62, entry 288
185.	**Ministry of Health and Social Care of 9 July 1996 on testing and taking measurements of factors harmful to health in work environment**	Journal of Legal Acts 1996 No 86, entry 394
186.	**Ministry of Health and Social Care of 30 May 1996 on conducting obligatory medical check-up for employees, the range of preventive health care over employees and medical opinions issued for the purposes resulting from the Labour Code**	Journal of Legal Acts 1996 No 69, entry 332; 1997 No 60, entry 375; 1998 No 159*, entry 1057; 2001 No 37, entry 451
187.	**The Ministry of Health and Social Care of 28 July 1998 on establishing circumstances and reasons for accidents at work and the manner of their registering and the range of information to be placed in registry of accidents at work**	Journal of Legal Acts 1998 No 115, entry744
188.	**The Ministry of Labour and Social Policy of 5 June 2000 on establishing a pattern of the accident statistical sheet for accidents at work.**	Journal of Legal Acts 2000 No 51, entry 612
189.	**The Ministry of Work and Social Care of 26 September 1997 on ogólnych warunków Health and Safety**	Journal of Legal Acts 1997 No 129, entry 844
190.	**The Ministry of Health and Social Care of 1 December 1998 on obligatory use of Polish Standards concerning Occupational Safety and Health, including:** **PN-N-01307:1994,** **PN-86/N-01338,** **PN-77/C-94136,** **PN-EN 136:1993,**	Journal of Legal Acts 1998 No 148 entry 974

No	Legislative	Publication
(1)	(2)	(3)
	PN-EN 136-10:1998, PN-EN 137:1996, PN-EN 138:1997, PN-EN 139:1997, PN-EN 140:1993, PN-EN 141:1995, PN-EN 142:1996, PN-EN 143:1996, PN-EN 145:1994, PN-EN 146:1997, PN-EN 147:1997, PN-EN 149:1996, PN-EN 166:1998, PN-EN 169:1996, PN-EN 170:1994, PN-EN 171:1994, PN-EN 271:1998, PN-EN 340:1996, PN-EN 344:1996, PN-EN 345:1996, PN-EN 346:1996, PN-EN 347:1996, PN-EN 348:1994, PN-EN 352-1:1996, PN-EN 352-2:1996, PN-EN 353-1:1996, PN-EN 353-2:1996, PN-EN 354:1997, PN-EN 355:1997, PN-EN 360:1996, PN-EN 361:1997,	

No	Legislative	Publication
(1)	(2)	(3)
	PN-EN 362:1997, PN-EN 363:1997, PN-EN 371:1996, PN-EN 372:1996, PN-EN 374-1:1998, PN-EN 388:1997, PN-EN 397:1997, PN-EN 403:1996, PN-EN 407:1997, PN-EN 412:1997, PN-EN 420:1996, PN-EN 466:1998, PN-EN 467:1998, PN-EN 471:1997, PN-EN 510:1996, PN-EN 511:1998, PN-IEC 895:1994, PN-ISO 4643:1994, PN-ISO 5423:1994, PN-ISO 6110:1993, PN-ISO 6112:1993, PN-ISO 6910:1993, PN-76/M-69160, PN-86/N-01309/05, PN-78/O-91031, PN-78/O-91036, PN-88/O-91037, PN-90/O-91038, PN-0-91042:1996, PN-0-91043:1996, PN-92/O-91060,	

No	Legislative	Publication
(1)	(2)	(3)
	PN-92/O-91061, **PN-0-91064:1995,** **PN-89/P-84505/68,** **PN-89/P-84505/02,** **PN-89/P-84505/03,** **PN-89/P-84505/04,** **PN-89/P-84505/05,** **PN-P-84525:1998,** **PN-92/P-84672,** **PN-90/P-84675,** **PN-92/P-84681,** **PN-92/P-84682,** **PN-92/P-84683,** **PN-92/P-84684,** **PN-P-84688:1998,** **PN-P-84690:1998,** **PN-88/Z-08054,** **PN-EN 294:1994,** **PN-EN 457:1998,** **PN-EN 45014:1993,** **PN-80/M-49060,** **PN-93/N-01256/03**	
191.	**Council of Ministers Regulatory of 2 September 1997 on occupational health and safety staff**	Journal of Legal Acts 1997 No 109, entry 704
192.	**The Act of the Ministry of Health and Social Care of 12 June 1975 on financial service for accidents and occupational diseases**	Journal of Legal Acts 1983 No 30, entry 144 Compensation rates for work accidents are published in the ordinance of Ministry of Health and Social Care every quarter
193.	**The ordinance of the Ministry of Health and Social Care of 28 April 1951 on protection of work environment at machine treatment of metals**	Journal of Legal Acts 1951 No 25, entry 192

No	Legislative	Publication
(1)	(2)	(3)
194.	**The ordinance of the Ministry of Health and Social Care of 3 October 1951 on protection of work environment at spray metal plating**	Journal of Legal Acts 1951 No 53, entry 374
195.	**The Ministry of Building and Building Materials of 28 March 1972 on protection of work environment at construction and demolition works.**	Journal of Legal Acts 1972 No 13, entry 93
196.	**The Ministry of Health and Social Care of 19 March 1954 on protection of work environment at conveyor operations**	The Journal of Legal Acts 1954 No 13, entry 51
197.	**The Ministry of Health and Social Care of 24 September 1953 on protection of work environment at fast metal scraping operations**	The Journal of Legal Acts 1953 No 46, entry 229
198.	**The Ministry of Economy and Social Care of 27 April 2000 on protection of work environment at welding operations**	The Journal of Legal Acts 2000 No 40, entry 470
199.	**The Ministry of Health and Social Care of 13 April on protection of work environment at air compressors**	The Journal of Legal Acts 1951No 22, entry 174
200.	**The Ministry of Health and Social Care, Industry, Miners, Energy etc, of 4 April 1950 on protection of work environment at electric cranes operations**	The Journal of Legal Acts 1950 No 25, entry 223, The Journal of Legal Acts 1950 No 39, entry 361
201.	**The Ministry of Health and Social Care of 14 March 2000 on health an safety of work at manual transporting works**	The Journal of Legal Acts 2000 No 26, entry 313
202.	**The Ministry of Industry of 2 November 1978 on protection of work environment at power bogies exploitation**	The Journal of Legal Acts 1978 No 27, entry 119
203.	**The Ministry of Economy of 17 September 1999 on protection of work environment at electric devices and installations operations**	The Journal of Legal Acts 1999 No 80, entry 912
204.	**The Ministry of Economy of 19 February 1977 on protection of work environment at devices generating electromagnetic field of 1 MHz to 300 MHz**	The Journal of Legal Acts 1977 No 8, entry 33 as amended
205.	**The Ministry Agriculture of 14 February 1995 on protection of work environment at service on maintenance of ammonia cooling systems**	The Journal of Legal Acts 1995 NO 19, entry97
206.	**Council of Ministry Regulatory of 10 September 1996 on list of works prohibited for woman**	The Journal of Legal Acts 1996 No 114, entry 545

No	Legislative	Publication
(1)	(2)	(3)
207.	**The Ministry of Health and Social Care of 28 May 1996 on detailed rules of occupational health and safety training**	The Journal of Legal Acts 1996 No 62, entry 285
208.	**The Ministry Economy of 16 March 1998 on personal occupational qualifications for operators**	The Journal of Legal Acts 1998 No 59, entry 377 with amendments
209.	**Council of Ministry Regulatoryof 28 May 1996 on preventive meals and beverages**	The Journal of Legal Acts
210.	**The Ministry of Health and Social Care of 28 December 1963 on the list of toxic substances and harmful materials.**	The Journal of Legal Acts 1964 r. , No 2 entry 9
211.	**The Ministry of Health and Social Care of 17 June 1998 on limits of concentration of harmful factors in working environment.**	The Journal of Legal Acts 1998 No 79, entry 513
212.	**The Ministry of Labour of 26 September 1997 on Work Safety regulations**	The Journal of Legal Acts 1997 No 129, entry 844
213.	**The Council of Ministries of 30 September 1980 on protection of work environment against excessive noise and vibration.**	The Journal of Legal Acts 1980 No 24 entry 90
214.	**The Act of 24 August 1991 on fire protection**	The Journal of Legal Acts 1991 No 81, entry 351, amended: 1997 No 111 entry 725
215.	**The Ministry of Health and Social Care of 4 November 1985 on running Sanitary Control Diary.**	The Journal of Legal Acts 1985 No 56, entry 289
216.	**The Council of Ministries of 27 December 1993 on imposing charges for commercial utilization of environment.**	The Journal of Legal Acts 1993 No 133 entry 638, 51 entry203, 1994 No 140 entry 772, 1995 No 153 entry 775 amended 1996 No 154 entry 747
217.	**The Ministry of Health and Social Care of 12 July 1996 on specification of units authorised to conduct research works on materials and technological processes in order to establish degree of their harmfulness to health and range of such research.**	The Journal of Legal Acts 1996 No 101, entry473
218.	**The Ministry of Health and Social Care of 1 July 1996 on introducing a ban on application, turnover and transport for some of dangerous chemical substances.**	The Journal of Legal Acts 1996 No 86, entry393
219.	**The Ministry of Health and Social Care of 21 August 1997 on chemical substances making a threat to life or health**	The Journal of Legal Acts 1997 No 105, entry 671; 1999 No 26, entry 241
220.	**The Ministry of Health and Social Care of 11'September 1996 on**	The Journal of Legal Acts 1996 No 121, entry 571

No	Legislative	Publication
(1)	(2)	(3)
	carcinogenic factors in work environment and supervision over health of employees who are exposed to such factors	
221.	**The Ministry of Labour and Social Policy of 28 May 1996 on kinds of work which should be performed by at least two persons.**	The Journal of Legal Acts 1996 No 62, entry 288
222.	**The Ministry of Health and Social Care of 9 July 1996 on testing and taking measurements of factors harmful to health in work environment**	The Journal of Legal Acts 1996 No 86, entry 394
223.	**The Ministry of Health and Social Care of 30 May 1996 on conducting obligatory medical check-up for employees, the range of preventive health care over employees and medical opinions issued for the purposes resulting from the Labour Code**	The Journal of Legal Acts 1996 No 69, entry 332; 1997 No 60, entry 375; 1998 No 159*, entry 1057; 2001 No 37, entry 451
224.	**The Ministry of Health and Social Care of 28 July 1998 on establishing circumstances and reasons for accidents at work and the manner of their registering and the range of information to be placed in registry of accidents at work**	The Journal of Legal Acts 1998 No 115, entry744
225.	**The Ministry of Labour and Social Policy of 31 December 1996 on establishing a pattern of the accident statistical sheet for accidents at work.**	The Journal of Legal Acts 2000 No 51, entry 612
226.	**The Act of 21 May 1963 – Toxic substances.**	The Journal of Legal Acts 1963 No 22, entry116, amended.: 1983 No 6, entry 35; 1996 No 24, entry 110; 1997 No 88, entry 554; 1998 No 106, entry 668
227.	**The Ministry of Health and Social Care of 28 December 1963 on the list of toxic substances and harmful materials.**	The Journal of Legal Acts 1964 r. , No 2 entry 9
228.	**The Ministry of Health and Social Care of 17 June 1998 on limits of concentration of harmful factors in working environment.**	The Journal of Legal Acts 1998 No 79, entry 513
229.	**The Ministry of Labour of 26 September 1997 on Work Safety regulations**	The Journal of Legal Acts 1997 No 129, entry 844
230.	**The Act of 11 January 2001 about chemical substances and preparations**	The Journal of Legal Acts 2001 No 1 entry 84
231.	**Council of Ministries Regulatory of 30 September 1980 on**	The Journal of Legal Acts 1980 No 24 entry 90

No	Legislative	Publication
(1)	(2)	(3)
	protection of work environment against excessive noise and vibration.	
232.	**The Ministry of Health and Social Care of 4 November 1985 on running Sanitary Control Diary.**	The Journal of Legal Acts 1985 No 56, entry 289
233.	**The Council of Ministries of 27 December 1993 on imposing charges for commercial utilization of environment.**	The Journal of Legal Acts 1993 No 133 entry 638, 51 entry203, 1994 No 140 entry 772, 1995 No 153 entry 775 amended 1996 No 154 entry 747
234.	**Rady Ministrów Decree of 5 November 2002 on protection against ionising radiation of external workers exposed to radiation during their work in controlled area**	The Journal of Legal Acts 2001, No 201, entry 1693
	OTHER	
235.	**The Bill of 7 July 1994 on Territorial Development.**	The Journal of Legal Acts 1999 No 15, entry 139 (uniform text) amended: 1999 No 41, entry 412; No 82, entry 928; No 111, entry 1279; 2000 No 12, entry 136; No 109, entry 1157; No 120, entry 1268; 2001 No 14, entry 124.
236.	**The Bill of 7 July 1994 – Building Law**	The Journal of Legal Acts 1994 No 89, entry 414, amended 1995 No.141, entry692, 1996 No.100, entry465, No.146, entry680, No 106, entry496, 1997 No 111, entry726, No 88, entry554, 1998 No 22, entry118 (correction), No106, entry668, No62, entry682, 2000 No.12, entry136, No.29, entry354
237.	**The Bill of 10 April 1997 on Energy.**	The Journal of Legal Acts 1997 No 54, entry 348, amended: 1997 No 158, entry 1042: 1998 No 94, entry 594; no 106, entry 668, No 162, entry 1126; 1999 No 88, entry 980; 2000 No 48, entry 555
238.	**Corporate Standard 500B0574 – Environment Policy.**	
239.	**Corporate Standard 500B0654 – Environment Management System.**	
240.	**Corporate Standard 500B0734 – Environment reporting. The consumption of raw materials.**	

No	Legislative	Publication
(1)	(2)	(3)
241.	Corporate Standard 500B0751 – Negative list for substances and materials.	
242.	Corporate Standard 500B0806 – Corporate Environment reporting. The uniform statement.	
243.	Resolution of the Town Council of Grodzisk Mazowiecki. No. 61/99 of 27 January on settling charges for disposal of housing and industrial water wastes.	
244.	Decision WOŚR & GW – 760/24/01 determining admissible amount of gaseous and dust contaminants introduced into air and parameters of emitters.	
245.	Decision of OSRiOP-IX-7637/4698 allowing for running business activity resulting in appearance of waste, specification of which is enclosed as annexe 1 to the Decision	
246.	Decision No. 179/98 granting permission for disposal previously purified liquid waste and drain water from Danfoss Sp. z o.o. to Rokicianka river .	

ANNEX II

EIA AND PERMITTING
SCHEME – PLUS MEMO
ON SITE DEVELOPMENT

ATKINS

Memorandum

www.wsatkins.com.pl

Memo to:

From:	Robert Adamczyk	**Email:**	adamczyk@wsatkins.com.pl
Telephone:	+ 22 529 02 40 ext 28	**Date:**	09 2002
Ref:			
CC:			

Message: List of documents and arrangements for new projects in Poland

Set out is a list of documents and permits required to obtain an operational permit for a new development in Poland. This is not exhaustive and is informative, as there is scope for discussions with regulators. The aim is to outline the general principals and procedure required to obtain a construction permit in Poland. Attached in the appendix are two flow diagrams showing the time scope and procedure. The enclosed information is for information only as is not definitive legal advice, specialist legal advice is recommended from qualified planning and environmental attorneys in Poland.

I. Stage of Change of Local Spatial Plan

Required if the investment is not compatible with Local Spatial Plan.

Documents:

1. Study on conditions and directions of spatial development for planned change including the issues of: present landuse, protected areas, environment, agriculture, land ownership, quality of life and regional public needs .
2. The prognosis of the impact of the change of local spatial plan on the environment .

Preparation of the above mentioned documents may require all documents listed in Location permit Section.

Decisions to be obtained:

3. City Council Resolution approving the change in Local Spatial Plan (hence zoning). This includes a map of the area.

Time Frame:

This varies, as apart from preparing the studies (min 1 month – normally 2 months) there is a need to obtain a city resolution, public consultation, hence council meeting etc. This could take anything

upto 6 months or longer depending if this is high on the agenda or not (also dependant on lobbying).

II. Obtaining a Location Permit (WZiZT) or often referred to as initial planning permission

The wzizt is often the first stage of any development, as without this no major development can take place. It is important to note that a planning permit can be obtained for land to which one does not have legal title, hence often this is undertaken before a transaction is completed or a transaction is subject to obtaining a planning permit (for e.g. Sometimes used with respect to retail developments.)

Given below are some of the documents needs to be included with an application. The application is generally a few pages description plus and Environmental Impact Statement (EIS) report (for those developments falling under Environmental Impact Assessment requirements – Please note theta EIA is the whole process and EIS is just the report). A permit is granted following the EIA procedure which includes public consultations. Please note that there are specific regulations dealing with EIA process including scope, consultation requirements etc.

The EIS is a public document hence can be referred and called on in the future during inspection etc. (this is a change from past practices). Consequently, the content of the EIS should be reviewed.

Please note that infrastructure such as higher power lines, gas lines, water and wastewater networks etc, are separate and need separate permits as appropriate. Often it is the infrastructure connection which are the most problematic and having these identified early on reduced risks considerably.

Documents:

1. Up-to-date extract from local spatial plan (map of area with appropriate zoning).

2. Complete location permit application including whole scope of investment (technology (general outlines 1-3 pages), production building (shape of building visual presentation), parkings, changes in road configuration, new infrastructure etc.). This needs also to include an outline of decommissioning if relevant:

    - Description of investment plans,
    - Geodesy maps with indicated investment site boundary,
    - Ownership maps,
    - Ground register extract,
    - Environmental Impact Statement repot,
    - Design Drawings describing the investment (initial site plan, roads, infrastructure),
    - List of the parties involved in administrative process

Other documents at Location Permit Stage (not always required):

Please note that if you do not include some of these in the planning permit, then they are not considered and new obligations could be issues at a latter stage, which could increase construction or operational costs and time. It is therefore recommended to include this in the early process to reduce future risk and abnormal costs.

1. Initial geotechnical (chemical) investigation at investment site including:

   - ground conditions (type, bearing capacity),
   - hydrogeological conditions,
   - ground contamination,
   - recommendations related to planned buildings foundation.

2. Inventory of trees and bushes at the site identifying:

   - number,
   - species
   - trunk circumference
   - health judgement
   - trees management recommendations indicating the trees to be relocated or cut out without paying fees,
   - the fee required for trees and bushes cut out.
   - old review of the area including flooding risk
   - any mining activity in the area

3. Measurements of traffic volume on adjacent roads

4. Investigation of adjacent roads condition:

   - road surface deformations and spring deflections,
   - road profile,
   - road width etc.
   - proposed reinforcements.

5. Inventory of objects at investment site

   - technical description of buildings (used materials, types of construction itp.),
   - list of surfaces and volumes,
   - initial recommendations related to demolitions.

Decisions to be obtained:

1. **Location Permit Decisions** (WZiZT) for all investment elements and all relevant resolutions approving the investment location (Sanitary Inspectorate, Environmental Protection Administration, Road Administration, Nature Conservation Administration etc.), Building site and infrastructure usually separate.

Additionally the investor should apply for:

1. Technical conditions for infrastructure connections (electricity, heat, natural gas, water, sewer, storm water system, telecommunication),
2. Technical conditions for planned redevelopment of existing infrastructure due to collision with designed site plan, roads, infrastructure etc.
3. Agreement of investment roads development conception design with relevant road administration.

TIME FRAME:

The time frame various and please refer to the attached appendix and flow diagrams. Nevertheless, a period of 3 months for preparation of the EIA, etc is often required. Notably as minimum 1 month is needed for the administrative process. The EIA will depend on the complexity of the project and 1 –2 months should be required.

III. Construction Permit Stage

Documents:

1. **Construction design** and execution design including:

   a) **site plan** indicating: site borders, location of existing and planned buildings, infrastructure, waste water collection and treatment, roads configurations, green areas planning, description of amounts required and connection method to external networks (electricity, water, heat, gas, sewer system, telecommunication, roads),

   b) **architecture and construction design** describing: function, form and structure of buildings, its energy use and environmental characteristics, proposed technical and material solutions, geo-technical conditions.

2. **Construction designs of infrastructure** including execution designs and reconfiguration designs in case of any collisions with external networks. Can be separate

3. **Construction design** and execution design of **roads redevelopment or modernization** prepared in accordance with approved conception design of roads configuration Can be separate.

4. **Environmental Impact Study** for investment and all elements associated with investment (independent from location stage EIA), Note separate ones from separate issues (e.g new gas reduction station would require it own EIA etc,).

5. Other **documents**, required by the statements included into issued Location Permit (WZiZT) for investment site, infrastructure, roads, infrastructure redevelopments.

6. **Geodesy** maps (so called *sytuacyjno-wysokościowe*), **ownership maps** (so called *ewidencyjne*) and **extracts from the land register** for the construction purposes covering the area of the site, the area of rebuilding or modernisation of the roads scheme and incoming services, as well as relocation / realignment of the service's network clashing with the incoming services.

Decision to be obtained:

Construction Permit Decision issued by Starosta.

The investor should make additionally the following agreements:

1. agree the construction designs of the site, of the incoming services, of relocation / realignment of the service's network clashing with the incoming services and rebuilding or modernisation of the roads scheme with the Technical Arrangements Agency (so called *ZUD – Zakład Uzgodnień Technicznych*),

2. agree the construction designs and EIA with the Environmental Protection Administration,

3. obtain a positive opinion of the appropriate inspector of the State Sanitary Inspection (in order to give such an opinion the sanitary inspection applies for the opinion within the scope of the compliance with the veterinary conditions to the appropriate veterinary surgeon),

4. obtain a positive opinion of the appropriate inspector of the State Labour Inspection or of the licensed expert for the safety and hygiene of work,

5. obtain a positive opinion of the fire prevention licensed expert or the appropriate firemaster of the Voivode State Fire Department,

6. obtain a positive opinion of the appropriate authority (*starosta*) with respect to the location of the planned infrastructure network, on the basis of the presented project of the land armament network location (art. 27 of the Geodesic and Cartographic Law),

7. obtain the approval of the appropriate authority (*starosta*) of the project of geological and hydrogeological works and the approval of the geological documentation on the geological and hydrogeological survey,

8. obtain a decision – water permit issued by the appropriate authority (*starosta*) for the water consumption and sewage disposal at the construction stage, which shall be preceded by the preparation of the water survey and by the arrangements with the environmental protection authorities (provided that this is required by the applied technical solutions), Please note that water permit, notably strom-water and wastewater drainage are major issue and early agreement of this is recommended and often these go through 3rd party planed and can be subject to additional costs of buying land out etc..

9. obtain permits and arrangements for production and waste management at the construction stage,

10. agree the construction designs with the appropriate civil defence inspector,

11. prepare the project of the traffic organisation for the construction period, agreed and approved by the appropriate authorities,

12. lodge a motion and obtain a permit for the removal of trees and bushes or its relocation in other place,

13. obtain a decision on exclusion of the site from the agricultural or forest production, in case when the real property is classified in the land register as the agricultural or forest land,

TIMEFRAME:

The time frame depends on the details of design. This needs to be certified by Polish licensed engineering etc, and in practice minimum 6 months is required to prepare all the documentation. To this we need to add the administrative process.

IV. Stage of occupancy permit of the building structure

Documents and arrangements:

Prior to applying for the occupancy permit, the investor shall prepare following documents and shall perform following actions, including in particular:

- Integrated Permit for the use of Environment (in case of project, which has a significant influence on Environment, in other cases separate permits for use of air, water, waste management are required). The permits set the levels of permitted emissions to environment. This is a bulky study which will need to look at BAT (best available Techniques etc. in line with EU IPPC requirements). All new investments need it and existing entities form 2004. Please note that in certain area the local authorities require environmental permits to be include with the building permit!. The time necessary to undertake the IPPC application can very depending on the site, but 2 months is seen as fairly pragmatic.

- Post – closing Geodesic Cataloguing including the localization of the building structure on the land and post – closing geodesic survey together with a clause confirming that the investment was performed in compliance with the land development project approved by ZUD (Art. 43 of the Construction Law and § 17 of the Order of the Ministry for Spatial Layout and Construction concerning manner and scope of the geodesic and cartographic surveys and geodesic actions binding in the construction).

- Survey of the structure's initial state, if the construction design provides for the periodical survey of the premises and deformation of that structure (§ 18 of the Order of the Ministry for Spatial Layout and Construction concerning manner and scope of the geodesic and cartographic surveys and geodesic actions binding in the construction).

- Informing the appropriate voivodship environmental protection inspector of the completion of the construction works and intention to commence the occupancy of the building structure (Art. 56 of the Construction Law).

- Informing the appropriate district sanitary inspector of the completion of the construction works and intention to commence the occupancy of the building structure (Art. 56 of the Construction Law).

- Informing the appropriate regional labour inspector of the completion of the construction works and intention to commence the occupancy of building structure (Art. 56 of the Construction Law).

- Informing the appropriate district (municipal) firemaster of the State Fire Department of the completion of the construction works and intention to commence the occupancy of building structure (Art. 56 of the Construction Law)

- Submission of the original construction log book to the appropriate architectural department (Art. 57 of the Construction Law).

- Submission of the declaration of the site manager on compliance of the building structure's performance with the construction design, with the conditions of the building permit, with the provisions of law and binding Polish Norms and on tiding up and restoring to the due state the construction site as well as (in case of use) street, the neighbouring real property, building or premises (Art. 57 of the Construction Law).

- Submission of the declaration of the investor concerning the appropriate development of the adjacent site, if the exploitation of the built structure depends on the appropriate development of this site (Art. 57 of the Construction Law).

- Copies of drawings included in the approved construction design, with all changes introduced and (if necessary) the supplementary description – in case of making changes which do not diverge significantly from the approved project and the conditions of the construction design (Art. 57 of the Construction Law). In such case, declaration mentioned in point 8 above shall be confirmed by the designer and the inspector of the investment supervision.

- Protocols of testing and checks (Art. 57 of the Construction Law), which may include in particular:

  - protocol of compliance with approved design of chimney stacks by local chimney authorities,
  - protocol of compliance with approved design of ventilation installation and adjustment if necessary,
  - protocol of verification and testing of electrical installation and equipment,
  - testing of hydrological parameters of fire protection water supply system,
  - testing of fire hydrants,
  - laboratory testing of water quality in water supply main,
  - laboratory testing of tap water quality,
  - protocol of initiating of sprinkler pump,
  - protocol of watertightness of sprinkler system,
  - protocols of connecting on-site water and sewage systems to off-site systems,
  - protocol of watertightness testing of sewage system beneath the building floor,
  - protocol of watertightness testing of stormwater system,
  - protocol of initiating and adjustment of the heat exchange point,

- protocol of watertightness testing of cooling water system
- protocol of corrosion and insulation testing of cooling water system,
- protocol of filling the cooling system,
- protocol of watertightness testing of heating system,
- protocol of corrosion and insulation testing of heating system,
- protocol of initiating and adjustment of the heating system,
- protocol of assembly and completion of the sewage system,
- protocol of watertightness testing of technological installation of the heat exchange point,
- protocol of corrosion and insulation testing of heat exchange point,
- protocol of watertightness testing of pre-insulated heating pipes,
- protocol of acceptance of pre-insulated heating system,
- protocol of acceptance of power supply line,
- protocol of technical acceptance of connections to the main power supply line,
- protocol of technical acceptance of construction of power supply line,
- protocol of noise level testing within ventilated areas.

- Protocols prepared by the appropriate voivodship environmental protection inspector, the district sanitary inspector, the regional labour inspector and the district (municipal) firemaster of the State Fire Department or declaration of the investor on the lack of remarks or objections from the aforementioned authorities.

- Approval Certificate of Technical Supervisory Authority (UDT) for operation of Turbine, high pressure feed heating, Water feed tank, operation of Boiler, High pressure parts, operation of Elevators, operation of Cranes, operation of Hoists (electro.), flammable substances tanks.

- Power / Heat Generation License, possibly preceded by a promise (promesa) for generation of heat/ electricity isuued by the President of the Energy Regulatory Authority

- Tariff approval bu the President of the Energy Regulatory Authority for trading in heat / electricity (if required)

Documents to be obtained:

Occupancy Permit Decision issued by Starosta.

Fig. 1.1. Permitting procedure for investment classified as a potentially severely harmful to the environment (EIA obligatory)

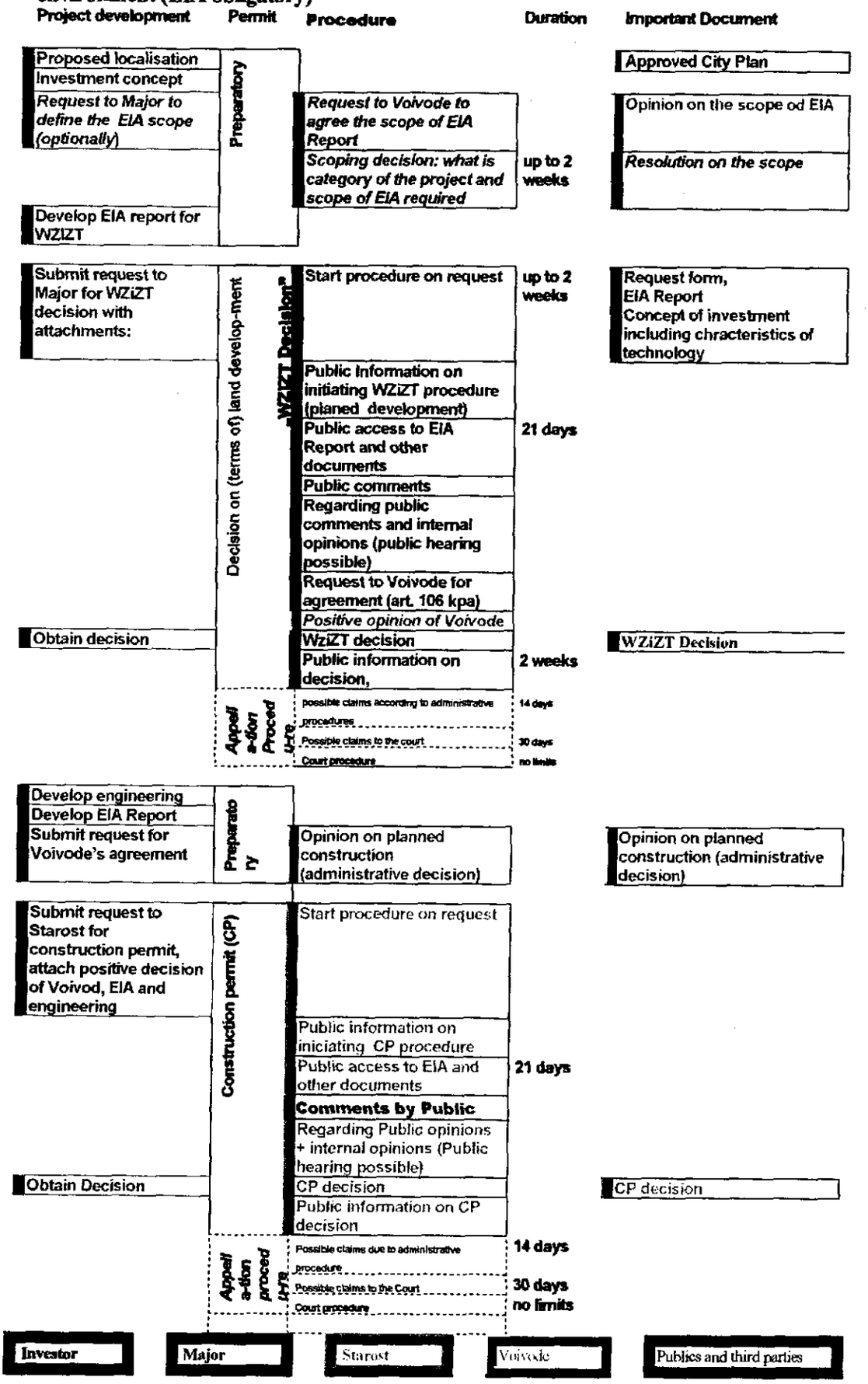
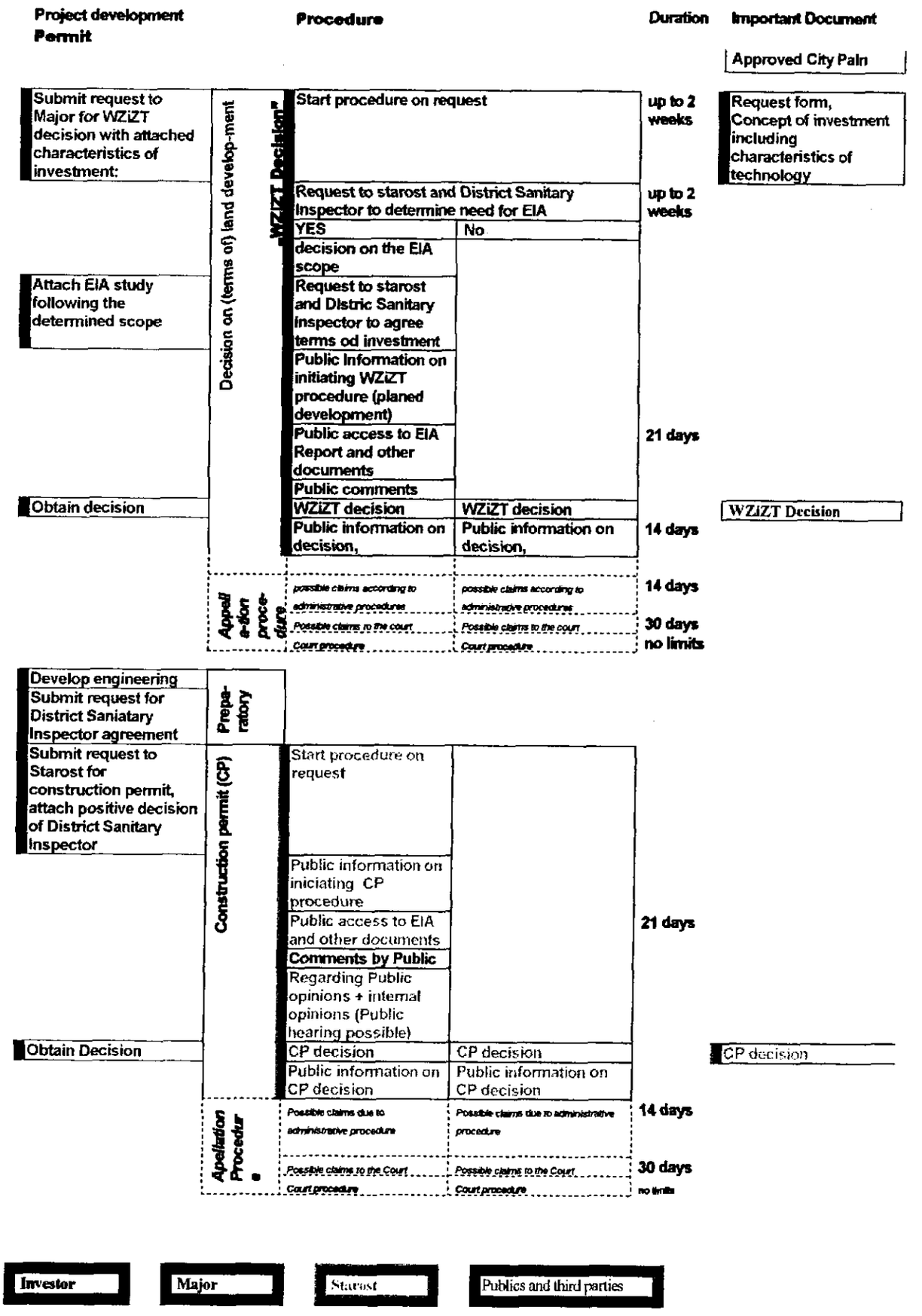
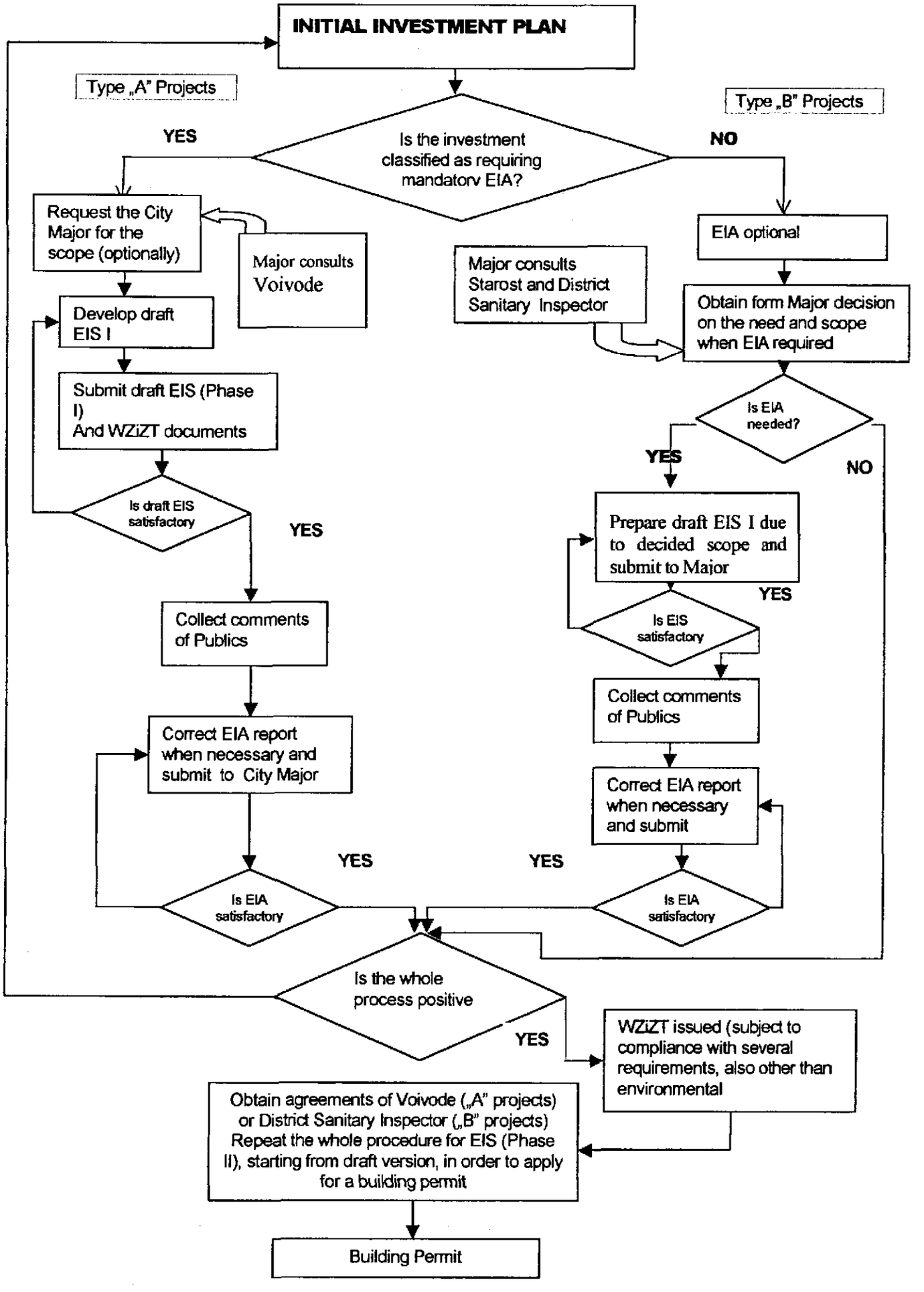


Fig.1.2. Permitting procedure for investment classified as a potentially harmful to the environment (EIA optional)




INITIAL INVESTMENT PLAN
Type „A" Projects
Type „B" Projects
YES
Is the investment classified as requiring mandatory EIA?
NO
Request the City Major for the scope (optionally)
Major consults Voivode
EIA optional
Major consults Starost and District Sanitary Inspector
Develop draft EIS I
Obtain form Major decision on the need and scope when EIA required
Submit draft EIS (Phase I) And WZiZT documents
Is EIA needed?
YES
NO
Is draft EIS satisfactory
YES
Prepare draft EIS I due to decided scope and submit to Major
YES
Is EIS satisfactory
Collect comments of Publics
Collect comments of Publics
Correct EIA report when necessary and submit to City Major
Correct EIA report when necessary and submit
YES
YES
Is EIA satisfactory
Is EIA satisfactory
Is the whole process positive
YES
WZiZT issued (subject to compliance with several requirements, also other than environmental
Obtain agreements of Voivode („A" projects) or District Sanitary Inspector („B" projects) Repeat the whole procedure for EIS (Phase II), starting from draft version, in order to apply for a building permit
Building Permit

ANNEX III

EU DIRECTIVES: LPC,
WASTE INCINERATION

Annex III

Emission Limit values for new incineration plant. Annexes IV and V to the Directive 2000/76/EC

ANNEX IV

Emission limit values for discharges of waste water from the cleaning of exhaust gases

Polluting substances	Emission limit values expressed in mass concentrations for unfiltered samples	
1. Total suspended solids as defined by Directive 91/271/EEC	95 % 30 mg/l	100 % 45 mg/l
2. Mercury and its compounds, expressed as mercury (Hg)		0,03 mg/l
3. Cadmium and its compounds, expressed as cadmium (Cd)		0,05 mg/l
4. Thallium and its compounds, expressed as thallium (Tl)		0,05 mg/l
5. Arsenic and its compounds, expressed as arsenic (As)		0,15 mg/l
6. Lead and its compounds, expressed as lead (Pb)		0,2 mg/l
7. Chromium and its compounds, expressed as chromium (Cr)		0,5 mg/l
8. Copper and its compounds, expressed as copper (Cu)		0,5 mg/l
9. Nickel and its compounds, expressed as nickel (Ni)		0,5 mg/l
10. Zinc and its compounds, expressed as zinc (Zn)		1,5 mg/l
11. Dioxins and furans, defined as the sum of the individual dioxins and furans evaluated in accordance with Annex I to the Directive		0,3 mg/l

ANNEX V (extract)

AIR EMISSION LIMIT VALUES FOR NEW PLANTS

(a) **Daily average values**

Total dust	10 mg/m3
Gaseous and vaporous organic substances, expressed as total organic carbon	10 mg/m3
Hydrogen chloride (HCl)	10 mg/m3
Hydrogen fluoride (HF)	1 mg/m3
Sulphur dioxide (SO2)	50 mg/m3
Nitrogen monoxide (NO) and nitrogen dioxide (NO2) expressed as nitrogen dioxide for existing incineration plants with a nominal capacity exceeding 6 tonnes per hour or new incineration plants	200 mg/m3 (*)

(*) Until 1 January 2007 and without prejudice to relevant (Community) legislation the emission limit value for NOx does not apply to plants only incinerating hazardous waste.

(b) **Half-hourly average values**

	(100 %) A	(97 %) B
Total dust	30 mg/m3	10 mg/m3
Gaseous and vaporous organic substances, expressed as total organic carbon	20 mg/m3	10 mg/m3
Hydrogen chloride (HCl)	60 mg/m3	10 mg/m3
Hydrogen fluoride (HF)	4 mg/m3	2 mg/m3
Sulphur dioxide (SO2)	200 mg/m3	50 mg/m3
Nitrogen monoxide (NO) and nitrogen dioxide (NO2), expressed as nitrogen dixoide for r new incineration plants (*)	400 mg/m3 (*)	200 mg/m3

(*) Until 1 January 2007 and without prejudice to relevant Community legislation the emission limit value for NOx does not apply to plants only incinerating hazardous waste.
EN Official Journal of the European Communities 28.12.2000 L 332/110

(c) **All average values over the sample period of a minimum of 30 minutes and a maximum of 8 hours**

Cadmium and its compounds, expressed as cadmium (Cd) Thallium and its compounds, expressed as thallium (Tl)	total 0,05 mg/m3
Mercury and its compounds, expressed as mercury (Hg)	0,05 mg/m3
Antimony and its compounds, expressed as antimony (Sb) Arsenic and its compounds, expressed as arsenic (As) Lead and its compounds, expressed as lead (Pb) Chromium and its compounds, expressed as chromium (Cr) Cobalt and its compounds, expressed as cobalt (Co) Copper and its compounds, expressed as copper (Cu) Manganese and its compounds, expressed as manganese (Mn) Nickel and its compounds, expressed as nickel (Ni) Vanadium and its compounds, expressed as vanadium (V)	total 0,5 mg/m3 total

These average values cover also gaseous and the vapour forms of the relevant heavy metal emissions as well as their compounds.

(d) **Average values shall be measured over a sample period of a minimum of 6 hours and a maximum of 8 hours. The emission limit value refers to the total concentration of dioxins and furans calculated using the concept of toxic equivalence in accordance with Annex I.**

Dioxins and furans 0,1 ng/m3

(e) **The following emission limit values of carbon monoxide (CO) concentrations shall not be exceeded in thecombustion gases (excluding the start-up and shut-down phase):**
— 50 milligrams/m3 of combustion gas determined as daily average value;
— 150 milligrams/m3 of combustion gas of at least 95 % of all measurements determined as 10-minute average values or 100 mg/m3 of combustion gas of all measurements determined as half-hourly average values taken in any 24-hour period.
Exemptions may be authorised by the competent authority for incineration plants using fluidised bed technology, provided that the permit foresees an emission limit value for carbon monoxide (CO) of not more than 100 g/m3 as an hourly average value.

DIRECTIVE 2000/76/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL
of 4 December 2000
on the incineration of waste

THE EUROPEAN PARLIAMENT AND THE COUNCIL OF THE EUROPEAN UNION,

Having regard to the Treaty establishing the European Community, and in particular Article 175(1) thereof,

Having regard to the proposal from the Commission [1],

Having regard to the Opinion of the Economic and Social Committee [2],

Having regard to the Opinion of the Committee of the Regions [3],

Acting in accordance with the procedure laid down in Article 251 of the Treaty [4], and in the light of the joint text approved by the Conciliation Committee on 11 October 2000,

Whereas:

(1) The fifth Environment Action Programme: Towards sustainability — A European Community programme of policy and action in relation to the environment and sustainable development, supplemented by Decision No 2179/98/EC on its review [5], sets as an objective that critical loads and levels of certain pollutants such as nitrogen oxides (NO_x), sulphur dioxide (SO_2), heavy metals and dioxins should not be exceeded, while in terms of air quality the objective is that all people should be effectively protected against recognised health risks from air pollution. That Programme further sets as an objective a 90 % reduction of dioxin emissions of identified sources by 2005 (1985 level) and at least 70 % reduction from all pathways of cadmium (Cd), mercury (Hg) and lead (Pb) emissions in 1995.

(2) The Protocol on persistent organic pollutants signed by the Community within the framework of the United Nations Economic Commission for Europe (UN-ECE) Convention on long-range transboundary air pollution sets legally binding limit values for the emission of dioxins and furans of 0,1 ng/m; TE (Toxicity Equivalents) for installations burning more than 3 tonnes per hour of municipal solid waste, 0,5 ng/m; TE for installations burning more than 1 tonne per hour of medical waste, and 0,2 ng/m; TE for installations burning more than 1 tonne per hour of hazardous waste.

(3) The Protocol on Heavy Metals signed by the Community within the framework of the UN-ECE Convention on long-range transboundary air pollution sets legally binding limit values for the emission of particulate of 10 mg/m³ for hazardous and medical waste incineration and for the emission of mercury of 0,05 mg/m³ for hazardous waste incineration and 0,08 mg/m³ for municipal waste incineration.

(4) The International Agency for Research on Cancer and the World Health Organisation indicate that some polycyclic aromatic hydrocarbons (PAHs) are carcinogenic. Therefore, Member States may set emission limit values for PAHs among other pollutants.

(5) In accordance with the principles of subsidiarity and proportionality as set out in Article 5 of the Treaty, there is a need to take action at the level of the Community. The precautionary principle provides the basis for further measures. This Directive confines itself to minimum requirements for incineration and co-incineration plants.

(6) Further, Article 174 provides that Community policy on the environment is to contribute to protecting human health.

(7) Therefore, a high level of environmental protection and human health protection requires the setting and maintaining of stringent operational conditions, technical requirements and emission limit values for plants incinerating or co-incinerating waste within the Community. The limit values set should prevent or limit as far as practicable negative effects on the environment and the resulting risks to human health.

(8) The Communication from the Commission on the review of the Community Strategy for waste management assigns prevention of waste the first priority, followed by reuse and recovery and finally by safe disposal of waste; in its Resolution of 24 February 1997 on a Community Strategy for waste management [6], the Council reiterated its conviction that waste prevention should be the first priority of any rational waste policy in relation to minimising waste production and the hazardous properties of waste.

[1] OJ C 13, 17.1.1998, p. 6 and OJ C 372, 2.12.1998, p. 11.
[2] OJ C 116, 28.4.1999, p. 40.
[3] OJ C 198, 14.7.1999, p. 37.
[4] Opinion of the European Parliament of 14 April 1999 (OJ C 219, 30.7.1999, p. 249), Council Common Position of 25 November 1999 (OJ C 25, 28.1.2000, p. 17) and Decision of the European Parliament of 15 March 2000 (not yet published in the Official Journal). Decision of the European Parliament of 16 November 2000 and Decision of the Council of 20 November 2000.
[5] OJ C 138, 17.5.1993, p. 1 and OJ L 275, 10.10.1998, p. 1.
[6] OJ C 76, 11.3.1997, p. 1.

(9) In its Resolution of 24 February 1997 the Council also underlines the importance of Community criteria concerning the use of waste, the need for appropriate emission standards to apply to incineration facilities, the need for monitoring measures to be envisaged for existing incineration plants, and the need for the Commission to consider amending Community legislation in relation to the incineration of waste with energy recovery in order to avoid large-scale movements of waste for incineration or co-incineration in the Community.

(10) It is necessary to set strict rules for all plants incinerating or co-incinerating waste in order to avoid transboundary movements to plants operating at lower costs due to less stringent environmental standards.

(11) The Communication from the Commission/energy for the future: renewable sources of energy/White paper for a Community strategy and action plan takes into consideration in particular the use of biomass for energy purposes.

(12) Council Directive 96/61/EC [1] sets out an integrated approach to pollution prevention and control in which all the aspects of an installations environmental performance are considered in an integrated manner. Installations for the incineration of municipal waste with a capacity exceeding 3 tonnes per hour and installations for the disposal or recovery of hazardous waste with a capacity exceeding 10 tonnes per day are included within the scope of the said Directive.

(13) Compliance with the emission limit values laid down by this Directive should be regarded as a necessary but not sufficient condition for compliance with the requirements of Directive 96/61/EC. Such compliance may involve more stringent emissions limit values for the pollutants envisaged by this Directive, emission limit values for other substances and other media, and other appropriate conditions.

(14) Industrial experience in the implementation of techniques for the reduction of polluting emissions from incineration plants has been acquired over a period of ten years.

(15) Council Directives 89/369/EEC [2] and 89/429/EEC [3] on the prevention and reduction of air pollution from municipal waste incineration plants have contributed to the reduction and control of atmospheric emissions from incineration plants. More stringent rules should now be adopted and those Directives should accordingly be repealed.

(16) The distinction between hazardous and non-hazardous waste is based principally on the properties of waste prior to incineration or co-incineration but not on differences in emissions. The same emission limit values should apply to the incineration or co-incineration of hazardous and non-hazardous waste but different techniques and conditions of incineration or co-incineration and different monitoring measures upon reception of waste should be retained.

(17) Member States should take into account Council Directive 1999/30/EC of 22 April 1999 relating to limit values for sulphur dioxide, nitrogen dioxide and oxides of nitrogen, particulate matter and lead in ambient air [4] when implementing this Directive.

(18) The incineration of hazardous waste with a content of more than 1 % of halogenated organic substances, expressed as chlorine, has to comply with certain operational conditions in order to destroy as many organic pollutants such as dioxins as possible.

(19) The incineration of waste which contains chlorine generates flue gas residues. Such residues should be managed in a way that minimises their amount and harmfulness.

(20) There may be grounds to provide for specified exemptions to the emission limit values for some pollutants during a specified time limit and subject to specific conditions.

(21) Criteria for certain sorted combustible fraction of non-hazardous waste not suitable for recycling, should be developed in order to allow the authorisation of the reduction of the frequency of periodical measurements.

(22) A single text on the incineration of waste will improve legal clarity and enforceability. There should be a single directive for the incineration and co-incineration of hazardous and non-hazardous waste taking fully into account the substance and structure of Council Directive 94/67/EC of 16 December 1994 on the incineration of hazardous waste [5]. Therefore Directive 94/67/EC should also be repealed.

(23) Article 4 of Council Directive 75/442/EEC of 15 July 1975 on waste [6] requires Member States to take the necessary measures to ensure that waste is recovered or disposed of without endangering human health and without harming the environment. To this end, Articles 9 and 10 of that Directive provide that any plant or undertaking treating waste must obtain a permit from the competent authorities relating, *inter alia*, to the precautions to be taken.

(1) OJ L 257, 10.10.1996, p. 26.
(2) OJ L 163, 14.6.1989, p. 32. Directive as last amended by the Accession Act of 1994.
(3) OJ L 203, 15.7.1989, p. 50. Directive as last amended by the Accession Act of 1994.
(4) OJ L 163, 29.6.1999, p. 41.
(5) OJ L 365, 31.12.1994, p. 34.
(6) OJ L 194, 25.7.1975, p. 39. Directive as last amended by Commission Decision 350/96/EC (OJ L 135, 6.6.1996, p. 32).

(24) The requirements for recovering the heat generated by the incineration or co-incineration process and for minimising and recycling residues resulting from the operation of incineration or co-incineration plants will assist in meeting the objectives of Article 3 on the waste hierarchy of Directive 75/442/EEC.

(25) Incineration and co-incineration plants treating only animal waste regulated by Directive 90/667/EEC [1] are excluded from the scope of this Directive. The Commission intends to propose a revision to the requirements of Directive 90/667 with a view to providing for high environmental standards for the incineration and co-incineration of animal waste.

(26) The permit for an incineration or co-incineration plant shall also comply with any applicable requirements laid down in Directives 91/271/EEC [2], 96/61/EC, 96/62/EC [3], 76/464/EEC [4], and 1999/31/EC [5].

(27) The co-incineration of waste in plants not primarily intended to incinerate waste should not be allowed to cause higher emissions of polluting substances in that part of the exhaust gas volume resulting from such co-incineration than those permitted for dedicated incineration plants and should therefore be subject to appropriate limitations.

(28) High-standard measurement techniques are required to monitor emissions to ensure compliance with the emission limit values for the pollutants.

(29) The introduction of emission limit values for the discharge of waste water from the cleaning of exhaust gases from incineration and co-incineration plants will limit a transfer of pollutants from the air into water.

(30) Provisions should be laid down for cases where the emission limit values are exceeded as well as for technically unavoidable stoppages, disturbances or failures of the purification devices or the measurement devices.

(31) In order to ensure transparency of the permitting process throughout the Community the public should have access to information with a view to allowing it to be involved in decisions to be taken following applications for new permits and their subsequent updates. The public should have access to reports on the functioning and monitoring of the plants burning more than three tonnes per hour in order to be informed of their potential effects on the environment and human health.

(32) The Commission should present a report both to the European Parliament and the Council based on the experience of applying this Directive, the new scientific knowledge gained, the development of the state of technology, the progress achieved in emission control techniques, and on the experience made in waste management and operation of the plants and on the development of environmental requirements, with a view to proposing, as appropriate, to adapt the related provisions of this Directive.

(33) The measures necessary for the implementation of this Directive are to be adopted in accordance with Council Decision 1999/468/EC of 28 June 1999 laying down the procedures for the exercise of implementing powers conferred on the Commission [6].

(34) Member States should lay down rules on penalties applicable to infringements of the provisions of this Directive and ensure that they are implemented; those penalties should be effective, proportionate and dissuasive,

HAVE ADOPTED THIS DIRECTIVE:

Article 1

Objectives

The aim of this Directive is to prevent or to limit as far as practicable negative effects on the environment, in particular pollution by emissions into air, soil, surface water and groundwater, and the resulting risks to human health, from the incineration and co-incineration of waste.

This aim shall be met by means of stringent operational conditions and technical requirements, through setting emission limit values for waste incineration and co-incineration plants within the Community and also through meeting the requirements of Directive 75/442/EEC.

Article 2

Scope

1. This Directive covers incineration and co-incineration plants.

[1] Council Directive 90/667/EEC of 27 November 1990, laying down the veterinary rules for the disposal and processing of animal waste, for its placing on the market and for the prevention of pathogens in feedstuffs of animal or fish origin and amending Directive 90/425/EEC (OJ L 363, 27.12.1990, p. 51). Directive as last amended by the Accession Act of 1994.

[2] Council Directive 91/271/EEC of 21 May 1991 concerning urban waste-water treatment (OJ L 135, 30.5.1991, p. 40). Directive as amended by Directive 98/15/EC (OJ L 67, 7.3.1998, p. 29).

[3] Council Directive 96/62/EC of 27 September 1996 on ambient air quality assessment and management (OJ L 296, 21.11.1996, p. 55).

[4] Council Directive 76/464/EEC of 4 May 1976 on pollution caused by certain dangerous substances discharged into the aquatic environment of the Community (OJ L 129, 18.5.1976, p. 23). Directive as last amended by the Accession Act of 1994.

[5] Directive 1999/31/EC of 26 April 1999 on the landfill of waste (OJ L 182, 16.7.1999, p. 1).

[6] OJ L 184, 17.7.1999, p. 23.

2. The following plants shall however be excluded from the scope of this Directive:

(a) Plants treating only the following wastes:

(i) vegetable waste from agriculture and forestry,

(ii) vegetable waste from the food processing industry, if the heat generated is recovered,

(iii) fibrous vegetable waste from virgin pulp production and from production of paper from pulp, if it is co-incinerated at the place of production and the heat generated is recovered,

(iv) wood waste with the exception of wood waste which may contain halogenated organic compounds or heavy metals as a result of treatment with wood-preservatives or coating, and which includes in particular such wood waste originating from construction and demolition waste,

(v) cork waste,

(vi) radioactive waste,

(vii) animal carcasses as regulated by Directive 90/667/EEC without prejudice to its future amendements,

(viii) waste resulting from the exploration for, and the exploitation of, oil and gas resources from off-shore installations and incinerated on board the installation;

(b) Experimental plants used for research, development and testing in order to improve the incineration process and which treat less than 50 tonnes of waste per year.

Article 3

Definitions

For the purposes of this Directive:

1. 'waste' means any solid or liquid waste as defined in Article 1(a) of Directive 75/442/EEC;

2. 'hazardous waste' means any solid or liquid waste as defined in Article 1(4) of Council Directive 91/689/EEC of 12 December 1991 on hazardous waste [1].

For the following hazardous wastes, the specific requirements for hazardous waste in this Directive shall not apply:

(a) combustible liquid wastes including waste oils as defined in Article 1 of Council Directive 75/439/EEC of 16 June 1975 on the disposal of waste oils [2] provided that they meet the following criteria:

(i) the mass content of polychlorinated aromatic hydrocarbons, e.g. polychlorinated biphenyls (PCB) or pentachlorinated phenol (PCP) amounts to concentrations not higher than those set out in the relevant Community legislation;

(ii) these wastes are not rendered hazardous hy virtue of containing other constituents listed in Annex II to Directive 91/689/EEC in quantities or in concentrations which are inconsistent with the achievement of the objectives set out in Article 4 of Directive 75/442/EEC; and

(iii) the net calorific value amounts to at least 30 MJ per kilogramme,

(b) any combustible liquid wastes which cannot cause, in the flue gas directly resulting from their combustion, emissions other than those from gasoil as defined in Article 1(1) of Directive 93/12/EEC [3] or a higher concentration of emissions than those resulting from the combustion of gasoil as so defined;

3. 'mixed municipal waste' means waste from households as well as commercial, industrial and institutional waste, which because of its nature and composition is similar to waste from households, but excluding fractions indicated in the Annex to Decision 94/3/EC [4] under heading 20 01 that are collected separately at source and excluding the other wastes indicated under heading 20 02 of that Annex;

4. 'incineration plant' means any stationary or mobile technical unit and equipment dedicated to the thermal treatment of wastes with or without recovery of the combustion heat generated. This includes the incineration by oxidation of waste as well as other thermal treatment processes such as pyrolysis, gasification or plasma processes in so far as the substances resulting from the treatment are subsequently incinerated.

This definition covers the site and the entire incineration plant including all incineration lines, waste reception, storage, on site pretreatment facilities, waste-fuel and air-supply systems, boiler, facilities for the treatment of exhaust gases, on-site facilities for treatment or storage of residues and waste water, stack, devices and systems for controlling incineration operations, recording and monitoring incineration conditions;

5. 'co-incineration plant' means any stationary or mobile plant whose main purpose is the generation of energy or production of material products and:

— which uses wastes as a regular or additional fuel; or

— in which waste is thermally treated for the purpose of disposal.

[1] OJ L 377, 31.12.1991, p. 20. Directive as amended by Directive 94/31/EC. (OJ L 168, 2.7.1994, p. 28).

[2] OJ L 194, 25.7.1975, p. 23. Directive as last amended by the Accession Act of 1994.

[3] Council Directive 93/12/EEC of 23 March 1993 relating to the sulphur content of certain liquid fuels (OJ L 74, 27.3.1993, p. 81). Directive as last amended by Directive 1999/32/EC (OJ L 121,11.5.1999, p. 13).

[4] Commission Decision 94/3/EC of 20 December 1993 establishing a list of wastes pursuant to Article 1a of Council Directive 75/442/EEC on waste (OJ L 5, 7.1.1994, p. 15).

If co-incineration takes place in such a way that the main purpose of the plant is not the generation of energy or production of material products but rather the thermal treatment of waste, the plant shall be regarded as an incineration plant within the meaning of point 4.

This definition covers the site and the entire plant including all co-incineration lines, waste reception, storage, on site pretreatment facilities, waste-, fuel- and air-supply systems, boiler, facilities for the treatment of exhaust gases, on-site facilities for treatment or storage of residues and waste water, stack devices and systems for controlling incineration operations, recording and monitoring incineration conditions;

6. 'existing co-incineration or co-incineration plant' means an incineration or co-incineration plant:

(a) which is in operation and has a permit in accordance with existing Community legislation before 28 December 2002, or,

(b) which is authorised or registered for incineration or co-incineration and has a permit issued before 28 December 2002 in accordance with existing Community legislation, provided that the plant is put into operation not later than 28 December 2003, or

(c) which, in the view of the competent authority, is the subject of a full request for a permit, before 28 December 2002, provided that the plant is put into operation not later than 28 December 2004;

7. 'nominal capacity' means the sum of the incineration capacities of the furnaces of which an incineration plant is composed, as specified by the constructor and confirmed by the operator, with due account being taken, in particular, of the calorific value of the waste, expressed as the quantity of waste incinerated per hour;

8. 'emission' means the direct or indirect release of substances, vibrations, heat or noise from individual or diffuse sources in the plant into the air, water or soil;

9. 'emission limit values' means the mass, expressed in terms of certain specific parameters, concentration and/or level of an emission, which may not be exceeded during one or more periods of time;

10. 'dioxins and furans' means all polychlorinated dibenzo-p-dioxins and dibenzofurans listed in Annex I;

11. 'operator' means any natural or legal person who operates or controls the plant or, where this is provided for in national legislation, to whom decisive economic power over the technical functioning of the plant has been delegated;

12. 'permit' means a written decision (or several such decisions) delivered by the competent authority granting authorisation to operate a plant, subject to certain conditions which guarantee that the plant complies with all the requirements of this Directive. A permit may cover one or more plants or parts of a plant on the same site operated by the same operator;

13. 'residue' means any liquid or solid material (including bottom ash and slag, fly ash and boiler dust, solid reaction products from gas treatment, sewage sludge from the treatment of waste waters, spent catalysts and spent activated carbon) defined as waste in Article 1(a) of Directive 75/442/EEC, which is generated by the incineration or co-incineration process, the exhaust gas or waste water treatment or other processes within the incineration or co-incineration plant.

Article 4

Application and permit

1. Without prejudice to Article 11 of Directive 75/442/EEC or to Article 3 of Directive 91/689/EEC, no incineration or co-incineration plant shall operate without a permit to carry out these activities.

2. Without prejudice to Directive 96/61/EC, the application for a permit for an incineration or co-incineration plant to the competent authority shall include a description of the measures which are envisaged to guarantee that:

(a) the plant is designed, equipped and will be operated in such a manner that the requirements of this Directive are taking into account the categories of waste to be incinerated;

(b) the heat generated during the incineration and co-incineration process is recovered as far as practicable e.g. through combined heat and power, the generating of process steam or district heating;

(c) the residues will be minimised in their amount and harmfulness and recycled where appropriate;

(d) the disposal of the residues which cannot be prevented, reduced or recycled will be carried out in conformity with national and Community legislation.

3. The permit shall be granted only if the application shows that the proposed measurement techniques for emissions into the air comply with Annex III and, as regards water, comply with Annex III, paragraphs 1 and 2.

4. The permit granted by the competent authority for an incineration or co-incineration plant shall, in addition to complying with any applicable requirement laid down in Directives 91/271/EEC, 96/61/EC, 96/62/EC, 76/464/EEC and 1999/31/EC:

(a) list explicitly the categories of waste which may be treated. The list shall use at least the categories of waste set up in the European Waste Catalogue (EWC), if possible, and contain information on the quantity of waste, where appropriate;

(b) include the total waste incinerating or co-incinerating capacity of the plant;

(c) specify the sampling and measurement procedures used to satisfy the obligations imposed for periodic measurements of each air and water pollutants.

5. The permit granted by the competent authority to an incineration or co-incineration plant using hazardous waste shall in addition to paragraph 4:

(a) list the quantities of the different categories of hazardous waste which may be treated;

(b) specify the minimum and maximum mass flows of those hazardous wastes, their lowest and maximum calorific values and their maximum contents of pollutants, e.g. PCB, PCP, chlorine, fluorine, sulphur, heavy metals.

6. Without prejudice to the provisions of the Treaty, Member States may list the categories of waste to be mentioned in the permit which can be co-incinerated in defined categories of co-incineration plants.

7. Without prejudice to Directive 96/61/EC, the competent authority shall periodically reconsider and, where necessary, update permit conditions.

8. Where the operator of an incineration or co-incineration plant for non-hazardous waste is envisaging a change of operation which would involve the incineration or co-incineration of hazardous waste, this shall be regarded as a substantial change within the meaning of Article 2(10)(b) of Directive 96/61/EC and Article 12(2) of that Directive shall apply.

9. If an incineration or co-incineration plant does not comply with the conditions of the permit, in particular with the emission limit values for air and water, the competent authority shall take action to enforce compliance.

Article 5

Delivery and reception of waste

1. The operator of the incineration or co-incineration plant shall take all necessary precautions concerning the delivery and reception of waste in order to prevent or to limit as far as practicable negative effects on the environment, in particular the pollution of air, soil, surface water and groundwater as well as odours and noise, and direct risks to human health. These measures shall meet at least the requirements set out in paragraphs 3 and 4.

2. The operator shall determine the mass of each category of waste, if possible according to the EWC, prior to accepting the waste at the incineration or co-incineration plant.

3. Prior to accepting hazardous waste at the incineration or co-incineration plant, the operator shall have available information about the waste for the purpose of verifying, *inter alia*, compliance with the permit requirements specified in Article 4(5). This information shall cover:

(a) all the administrative information on the generating process contained in the documents mentioned in paragraph 4(a);

(b) the physical, and as far as practicable, chemical composition of the waste and all other information necessary to evaluate its suitability for the intended incineration process;

(c) the hazardous characteristics of the waste, the substances with which it cannot be mixed, and the precautions to be taken in handling the waste.

4. Prior to accepting hazardous waste at the incineration or co-incineration plant, at least the following reception procedures shall be carried out by the operator:

(a) the checking of those documents required by Directive 91/689/EEC and, where applicable, those required by Council Regulation (EEC) No 259/93 of 1 February 1993 on the supervision, and control of shipments of waste within, into and out of the European Community [1] and by dangerous-goods transport regulations;

(b) the taking of representative samples, unless inappropriate, e.g. for infectious clinical waste, as far as possible before unloading, to verify conformity with the information provided for in paragraph 3 by carrying out controls and to enable the competent authorities to identify the nature of the wastes treated. These samples shall be kept for at least one month after the incineration.

5. The competent authorities may grant exemptions from paragraphs 2, 3 and 4 for industrial plants and undertakings incinerating or co-incinerating only their own waste at the place of generation of the waste provided that the requirements of this Directive are met.

Article 6

Operating conditions

1. Incineration plants shall be operated in order to achieve a level of incineration such that the slag and bottom ashes Total Organic Carbon (TOC) content is less than 3 % or their loss on ignition is less than 5 % of the dry weight of the material. If necessary appropriate techniques of waste pretreatment shall be used.

[1] OJ L 30, 6.2.1993, p. 1. Regulation as last amended by Commission Regulation (EC) No 2408/98 (OJ L 298, 7.11.1998, p. 19).

Incineration plants shall be designed, equipped, built and operated in such a way that the gas resulting from the process is raised, after the last injection of combustion air, in a controlled and homogeneous fashion and even under the most unfavourable conditions, to a temperature of 850 °C, as measured near the inner wall or at another representative point of the combustion chamber as authorised by the competent authority, for two seconds. If hazardous wastes with a content of more than 1 % of halogenated organic substances, expressed as chlorine, are incinerated, the temperature has to be raised to 1 100 °C for at least two seconds.

Each line of the incineration plant shall be equipped with at least one auxiliary burner. This burner must be switched on automatically when the temperature of the combustion gases after the last injection of combustion air falls below 850 °C or 1 100 °C as the case may be. It shall also be used during plant start-up and shut-down operations in order to ensure that the temperature of 850 °C or 1 100 °C as the case may be is maintained at all times during these operations and as long as unburned waste is in the combustion chamber.

During start-up and shut-down or when the temperature of the combustion gas falls below 850 °C or 1 100 °C as the case may be, the auxiliary burner shall not be fed with fuels which can cause higher emissions than those resulting from the burning of gasoil as defined in Article 1(1) of Council Directive 75/716/EEC, liquefied gas or natural gas.

2. Co-incineration plants shall be designed, equipped, built and operated in such a way that the gas resulting from the co-incineration of waste is raised in a controlled and homogeneous fashion and even under the most unfavourable conditions, to a temperature of 850 °C for two seconds. If hazardous wastes with a content of more than 1 % of halogenated organic substances, expressed as chlorine, are co-incinerated, the temperature has to be raised to 1 100 °C.

3. Incineration and co-incineration plants shall have and operate an automatic system to prevent waste feed:

(a) at start-up, until the temperature of 850 °C or 1 100 °C as the case may be or the temperature specified according to paragraph 4 has been reached;

(b) whenever the temperature of 850 °C or 1 100 °C as the case may be or the temperature specified according to paragraph 4 is not maintained;

(c) whenever the continuous measurements required by this Directive show that any emission limit value is exceeded due to disturbances or failures of the purification devices.

4. Conditions different from those laid down in paragraph 1 and, as regards the temperature, paragraph 3 and specified in the permit for certain categories of waste or for certain thermal processes may be authorised by the competent authority, provided the requirements of this Directive are met. Member States may lay down rules governing these authorisations. The change of the operational conditions shall not cause more residues or residues with a higher content of organic pollutants compared to those residues which could be expected under the conditions laid down in paragraph 1.

Conditions different from those laid down in paragraph 2 and, as regards the temperature, paragraph 3 and specified in the permit for certain categories of waste or for certain thermal processes may be authorised by the competent authority, provided the requirements of this Directive are met. Member States may lay down rules governing these authorisations. Such authorisation shall be conditional upon at least the provisions for emission limit values set out in Annex V for total organic carbon and CO being complied with.

In the case of co-incineration of their own waste at the place of its production in existing bark boilers within the pulp and paper industry, such authorisation shall be conditional upon at least the provisions for emission limit values set out in Annex V for total organic carbon being complied with.

All operating conditions determined under this paragraph and the results of verifications made shall be communicated by the Member State to the Commission as part of the information provided in accordance with the reporting requirements.

5. Incineration and co-incineration plants shall be designed, equipped, built and operated in such a way as to prevent emissions into the air giving rise to significant ground-level air pollution; in particular, exhaust gases shall be discharged in a controlled fashion and in conformity with relevant Community air quality standards by means of a stack the height of which is calculated in such a way as to safeguard human health and the environment.

6. Any heat generated by the incineration or the co-incineration process shall be recovered as far as practicable.

7. Infectious clinical waste should be placed straight in the furnace, without first being mixed with other categories of waste and without direct handling.

8. The management of the incineration or the co-incineration plant shall be in the hands of a natural person who is competent to manage the plant.

Article 7

Air emission limit values

1. Incineration plants shall be designed, equipped, built and operated in such a way that the emission limit values set out in Annex V are not exceeded in the exhaust gas.

2. Co-incineration plants shall be designed, equipped, built and operated in such a way that the emission limit values determined according to or set out in Annex II are not exceeded in the exhaust gas.

If in a co-incineration plant more than 40 % of the resulting heat release comes from hazardous waste, the emission limit values set out in Annex V shall apply.

3. The results of the measurements made to verify compliance with the emission limit values shall be standardised with respect to the conditions laid down in Article 11.

4. In the case of co-incineration of untreated mixed municipal waste, the limit values will be determined according to Annex V, and Annex II will not apply.

5. Without prejudice to the provisions of the Treaty, Member States may set emission limit values for polycyclic aromatic hydrocarbons or other pollutants.

Article 8

Water discharges from the cleaning of exhaust gases

1. Waste water from the cleaning of exhaust gases discharged from an incineration or co-incineration plant shall be subject to a permit granted by the competent authorities.

2. Discharges to the aquatic environment of waste water resulting from the cleaning of exhaust gases shall be limited as far as practicable, at least in accordance with the emission limit values set in Annex IV.

3. Subject to a specific provision in the permit, the waste water from the cleaning of exhaust gases may be discharged to the aquatic environment after separate treatment on condition that:

(a) the requirements of relevant Community, national and local provisions are complied with in the form of emission limit values; and

(b) the mass concentrations of the polluting substances referred to in Annex IV do not exceed the emission limit values laid down therein.

4. The emission limit values shall apply at the point where waste waters from the cleaning of exhaust gases containing the polluting substances referred to in Annex IV are discharged from the incineration or co-incineration plant.

Where the waste water from the cleaning of exhaust gases is treated on site collectively with other on-site sources of waste water, the operator shall take the measurements referred to in Article 11:

(a) on the waste water stream from the exhaust gas cleaning processes prior to its input into the collective waste water treatment plant;

(b) on the other waste water stream or streams prior to its or their input into the collective waste water treatment plant;

(c) at the point of final waste water discharge, after the treatment, from the incineration plant or co-incineration plant.

The operator shall take appropriate mass balance calculations in order to determine the emission levels in the final waste water discharge that can be attributed to the waste water arising from the cleaning of exhaust gases in order to check compliance with the emission limit values set out in Annex IV for the waste water stream from the exhaust gas cleaning process.

Under no circumstances shall dilution of waste water take place for the purpose of complying with the emission limit values set in Annex IV.

5. When waste waters from the cleaning of exhaust gases containing the polluting substances referred to in Annex IV are treated outside the incineration or co-incineration plant at a treatment plant intended only for the treatment of this sort of waste water, the emission limit values of Annex IV are to be applied at the point where the waste waters leave the treatment plant. If this off-site treatment plant is not only dedicated to treat waste water from incineration, the operator shall take the appropriate mass balance calculations, as provided for under paragraph 4(a), (b) and (c), in order to determine the emission levels in the final waste water discharge that can be attributed to the waste water arising from the cleaning of exhaust gases in order to check compliance with the emission limit values set out in Annex IV for the waste water stream from the exhaust gas cleaning process.

Under no circumstances shall dilution of waste water take place for the purpose of complying with the emission limit values set in Annex IV.

6. The permit shall:

(a) establish emission limit values for the polluting substances referred to in Annex IV, in accordance with paragraph 2 and in order to meet the requirements referred to in paragraph 3(a);

(b) set operational control parameters for waste water at least for pH, temperature and flow.

7. Incineration and co-incineration plant sites, including associated storage areas for wastes, shall be designed and in such a way as to prevent the unauthorised and accidental release of any polluting substances into soil, surface water and groundwater in accordance with the provisions provided for in relevant Community legislation. Moreover, storage capacity shall be provided for contaminated rainwater run-off from the incineration or co-incineration plant site or for contaminated water arising from spillage or fire-fighting operations.

The storage capacity shall be adequate to ensure that such waters can be tested and treated before discharge where necessary.

8. Without prejudice to the provisions of the Treaty, Member States may set emission limit values for polycyclic aromatic hydrocarbons or other pollutants.

Article 9

Residues

Residues resulting from the operation of the incineration or co-incineration plant shall be minimised in their amount and harmfulness. Residues shall be recycled, where appropriate, directly in the plant or outside in accordance with relevant Community legislation.

Transport and intermediate storage of dry residues in the form of dust, such as boiler dust and dry residues from the treatment of combustion gases, shall take place in such a way as to prevent dispersal in the environment e.g. in closed containers.

Prior to determining the routes for the disposal or recycling of the residues from incineration and co-incineration plants, appropriate tests shall be carried out to establish the physical and chemical characteristics and the polluting potential of the different incineration residues. The analysis shall concern the total soluble fraction and heavy metals soluble fraction.

Article 10

Control and monitoring

1. Measurement equipment shall be installed and techniques used in order to monitor the parameters, conditions and mass concentrations relevant to the incineration or co-incineration process.

2. The measurement requirements shall be laid down in the permit or in the conditions attached to the permit issued by the competent authority.

3. The appropriate installation and the functioning of the automated monitoring equipment for emissions into air and water shall be subject to control and to an annual surveillance test. Calibration has to be done by means of parallel measurements with the reference methods at least every three years.

4. The location of the sampling or measurement points shall be laid down by the competent authority.

5. Periodic measurements of the emissions into the air and water shall be carried out in accordance with Annex III, points 1 and 2.

Article 11

Measurement requirements

1. Member States shall, either by specification in the conditions of the permit or by general binding rules, ensure that paragraphs 2 to 12 and 17, as regards air, and paragraphs 9 and 14 to 17, as regards water, are complied with.

2. The following measurements of air pollutants shall be carried out in accordance with Annex III at the incineration and co-incineration plant:

(a) continuous measurements of the following substances: NO_x, provided that emission limit values are set, CO, total dust, TOC, HCl, HF, SO_2;

(b) continuous measurements of the following process operation parameters: temperature near the inner wall or at another representative point of the combustion chamber as authorised by the competent authority, concentration of oxygen, pressure, temperature and water vapour content of the exhaust gas;

(c) at least two measurements per year of heavy metals, dioxins and furans; one measurement at least every three months shall however be carried out for the first 12 months of operation. Member States may fix measurement periods where they have set emission limit values for polycyclic aromatic hydrocarbons or other pollutants.

3. The residence time as well as the minimum temperature and the oxygen content of the exhaust gases shall be subject to appropriate verification, at least once when the incineration or co-incineration plant is brought into service and under the most unfavourable operating conditions anticipated.

4. The continuous measurement of HF may be omitted if treatment stages for HCl are used which ensure that the emission limit value for HCl is not being exceeded. In this case the emissions of HF shall be subject to periodic measurements as laid down in paragraph 2(c).

5. The continuous measurement of the water vapour content shall not be required if the sampled exhaust gas is dried before the emissions are analysed.

6. Periodic measurements as laid down in paragraph 2(c) of HCl, HF and SO_2 instead of continuous measuring may be authorised in the permit by the competent authority in incineration or co-incineration plants, if the operator can prove that the emissions of those pollutants can under no circumstances be higher than the prescribed emission limit values.

7. The reduction of the frequency of the periodic measurements for heavy metals from twice a year to once every two years and for dioxins and furans from twice a year to once every year may be authorised in the permit by the competent authority provided that the emissions resulting from co-incineration or incineration are below 50 % of the emission limit values determined according to Annex II or Annex V respectively and provided that criteria for the requirements to be met, developed in accordance with the procedure laid down in Article 17, are available. These criteria shall at least be based on the provisions of the second subparagraph, points (a) and (d).

Until 1 January 2005 the reduction of the frequency may be authorised even if no such criteria are available provided that:

(a) the waste to be co-incinerated or incinerated consists only of certain sorted combustible fractions of non-hazardous waste not suitable for recycling and presenting certain characteristics, and which is further specified on the basis of the assessment referred to in subparagraph (d);

(b) national quality criteria, which have been reported to the Commission, are available for these wastes;

(c) co-incineration and incineration of these wastes is in line with the relevant waste management plans referred to in Article 7 of Directive 75/442/EEC;

(d) the operator can prove to the competent authority that the emissions are under all circumstances significantly below the emission limit values set out in Annex II or Annex V for heavy metals, dioxins and furans; this assessment shall be based on information on the quality of the waste concerned and measurements of the emissions of the said pollutants;

(e) the quality criteria and the new period for the periodic measurements are specified in the permit; and

(f) all decisions on the frequency of measurements referred to in this paragraph, supplemented with information on the amount and quality of the waste concerned, shall be communicated on a yearly basis to the Commission.

8. The results of the measurements made to verify compliance with the emission limit values shall be standardised at the following conditions and for oxygen according to the formula as referred to in Annex VI:

(a) Temperature 273 K, pressure 101,3 kPa, 11 % oxygen, dry gas, in exhaust gas of incineration plants;

(b) Temperature 273 K, pressure 101,3 kPa, 3 % oxygen, dry gas, in exhaust gas of incineration of waste oil as defined in Directive 75/439/EEC;

(c) when the wastes are incinerated or co-incinerated in an oxygen-enriched atmosphere, the results of the measurements can be standardised at an oxygen content laid down by the competent authority reflecting the special circumstances of the individual case;

(d) in the case of co-incineration, the results of the measurements shall be standardised at a total oxygen content as calculated in Annex II.

When the emissions of pollutants are reduced by exhaust gas treatment in an incineration or co-incineration plant treating hazardous waste, the standardisation with respect to the oxygen contents provided for in the first subparagraph shall be done only if the oxygen content measured over the same period as for the pollutant concerned exceeds the relevant standard oxygen content.

9. All measurement results shall be recorded, processed and presented in an appropriate fashion in order to enable the competent authorities to verify compliance with the permitted operating conditions and emission limit values laid down in this Directive in accordance with procedures to be decided upon by those authorities.

10. The emission limit values for air shall be regarded as being complied with if:

(a) — none of the daily average values exceeds any of the emission limit values set out in Annex V(a) or Annex II;

— 97 % of the daily average value over the year does not exceed the emission limit value set out in Annex V(e) first indent;

(b) either none of the half-hourly average values exceeds any of the emission limit values set out in Annex V(b), column A or, where relevant, 97 % of the half-hourly average values over the year do not exceed any of the emission limit values set out in Annex V(b), column B;

(c) none of the average values over the sample period set out for heavy metals and dioxins and furans exceeds the emission limit values set out in Annex V(c) and (d) or Annex II;

(d) the provisions of Annex V(e), second indent or Annex II, are met.

11. The half-hourly average values and the 10-minute averages shall be determined within the effective operating time (excluding the start-up and shut-off periods if no waste is being incinerated) from the measured values after having subtracted the value of the confidence interval specified in point 3 of Annex III. The daily average values shall be determined from those validated average values.

To obtain a valid daily average value no more than five half-hourly average values in any day shall be discarded due to malfunction or maintenance of the continuous measurement system. No more than ten daily average values per year shall be discarded due to malfunction or maintenance of the continuous measurement system.

12. The average values over the sample period and the average values in the case of periodical measurements of HF, HCl and SO_2 shall be determined in accordance with the requirements of Article 10(2) and (4) and Annex III.

13. The Commission, acting in accordance with the procedure laid down in Article 17, shall decide, as soon as appropriate measurement techniques are available within the Community, the date from which continuous measurements of the air emission limit values for heavy metals, dioxins and furans shall be carried out in accordance with Annex III.

14. The following measurements shall be carried out at the point of waste water discharge:

(a) continuous measurements of the parameters referred to in Article 8(6)(b);

(b) spot sample daily measurements of total suspended solids; Member States may alternatively provide for measurements of a flow proportional representative sample over a period of 24 hours;

(c) at least monthly measurements of a flow proportional representative sample of the discharge over a period of 24 hours of the polluting substances referred to in Article 8(3) with respect to items 2 to 10 in Annex IV;

(d) at least every six months measurements of dioxins and furans; however one measurement at least every three months shall be carried out for the first 12 months of operation. Member States may fix measurement periods where they have set emission limit values for polycyclic aromatic hydrocarbons or other pollutants.

15. The monitoring of the mass of pollutants in the treated waste water shall be done in conformity with Community legislation and laid down in the permit as well as the frequency of the measurements.

16. The emission limit values for water shall be regarded as being complied with if:

(a) for total suspended solids (polluting substance number 1), 95 % and 100 % of the measured values do not exceed the respective emission limit values as set out in Annex IV;

(b) for heavy metals (polluting substances number 2 to 10) no more than one measurement per year exceeds the emission limit values set out in Annex IV; or, if the Member State provides for more than 20 samples per year, no more than 5 % of these samples exceed the emission limit values set out in Annex IV;

(c) for dioxins and furans (polluting substance 11), the twice-yearly measurements do not exceed the emission limit value set out in Annex IV.

17. Should the measurements taken show that the emission limit values for air or water laid down in this Directive have been exceeded, the competent authorities shall be informed without delay.

Article 12

Access to information and public participation

1. Without prejudice to Council Directive 90/313/EEC [1] and Directive 96/61/EC, applications for new permits for incineration and co-incineration plants shall be made available at one or more locations accessible to the public, such as local authority offices, for an appropriate period to enable it to comment on them before the competent authority reaches a decision. That decision, including at least a copy of the permit, and any subsequent updates, shall also be made available to the public.

2. For incineration or co-incineration plants with a nominal capacity of two tonnes or more per hour and notwithstanding Article 15(2) of Directive 96/61/EC, an annual report to be provided by the operator to the competent authority on the functioning and monitoring of the plant shall be made available to the public. This report shall, as a minimum requirement, give an account of the running of the process and the emissions into air and water compared with the emission standards in this Directive. A list of incineration or co-incineration plants with a nominal capacity of less than two tonnes per hour shall be drawn up by the competent authority and shall be made available to the public.

Article 13

Abnormal operating conditions

1. The competent authority shall lay down in the permit the maximum permissible period of any technically unavoidable stoppages, disturbances, or failures of the purification devices or the measurement devices, during which the concentrations in the discharges into the air and the purified waste water of the regulated substances may exceed the prescribed emission limit values.

2. In the case of a breakdown, the operator shall reduce or close down operations as soon as practicable until normal operations can be restored.

3. Without prejudice to Article 6(3)(c), the incineration plant or co-incineration plant or incineration line shall under no circumstances continue to incinerate waste for a period of more than four hours uninterrupted where emission limit values are exceeded; moreover, the cumulative duration of operation in such conditions over one year shall be less than 60 hours. The 60-hour duration applies to those lines of the entire plant which are linked to one single flue gas cleaning device.

4. The total dust content of the emissions into the air of an incineration plant shall under no circumstances exceed 150 mg/m^3 expressed as a half-hourly average; moreover the air emission limit values for CO and TOC shall not be exceeded. All other conditions referred to in Article 6 shall be complied with.

Article 14

Review clause

Without prejudice to Directive 96/61/EC, the Commission shall submit a report to the European Parliament and the Council before 31 December 2008 based on experience of the application of this Directive, in particular for new plants, and on the progress achieved in emission control techniques and experience in waste management. Furthermore, the report shall be based on the development of the state of technology, of experience in the operation of the plants, of environmental requirements. This report will include a specific section on the application of Annex II.1.1. and in particular on the economic and technical feasibility for existing cement kilns as referred to in the footnote to Annex II.1.1. of respecting the NO_x emission limit value for new cement kilns set out in that Annex. The report shall, as appropriate, be accompanied by proposals for revision of the related provisions of this Directive. However, the Commission shall, if appropriate, propose an amendment for Annex II.3 before the said report, if major waste streams are directed to types of co-incineration plants other than those dealt with in Annex II.1 and II.2.

[1] Council Directive 90/313/EEC of 7 June 1990 on the freedom of access to information on the environment (OJ L 158, 23.6.1990, p. 56). Directive as last amended by the Accession Act of 1994.

Article 15

Reporting

The reports on the implementation of this Directive shall be established in accordance with the procedure laid down in Article 5 of Council Directive 91/692/EEC. The first report shall cover at least the first full three-year period after 28 December 2002 and comply with the periods referred to in Article 17 of Directive 94/67/EC and in Article 16(3) of Directive 96/61/EC. To this effect, the Commission shall elaborate the appropriate questionnaire in due time.

Article 16

Future adaptation of the directive

The Commission shall, in accordance with the procedure laid down in Article 17(2), amend Articles 10, 11 and 13 and Annexes I and III in order to adapt them to technical progress or new findings concerning the health benefits of emission reductions.

Article 17

Regulatory committee

1. The Commission shall be assisted by a regulatory committee.

2. Where reference is made to this paragraph, Articles 5 and 7 of Decision 1999/468/EC shall apply, having regard to the provisions of Article 8 thereof.

The period laid down in Article 5(6) of Decision 1999/468/EC shall be set at three months.

3. The committee shall adopt its own rules of procedure.

Article 18

Repeal

The following shall be repealed as from 28 December 2005:

(a) Article 8(1) and the Annex to Directive 75/439/EEC;

(b) Directive 89/369/EEC;

(c) Directive 89/429/EEC;

(d) Directive 94/67/EC.

Article 19

Penalties

The Member States shall determine penalties applicable to breaches of the national provisions adopted pursuant to this Directive. The penalties thus provided for shall be effective, proportionate and dissuasive. The Member States shall notify those provisions to the Commission by 28 December 2002 at the latest and shall notify it without delay of any subsequent amendment affecting them.

Article 20

Transitional provisions

1. Without prejudice to the specific transitional provisions provided for in the Annexes to this Directive, the provisions of this Directive shall apply to existing plants as from 28 December 2005.

2. For new plants, i.e. plants not falling under the definition of 'existing incineration or co-incineration plant' in Article 3(6) or paragraph 3 of this Article, this Directive, instead of the Directives mentioned in Article 18, shall apply as from 28 December 2002.

3. Stationary or mobile plants whose purpose is the generation of energy or production of material products and which are in operation and have a permit in accordance with existing Community legislation where required and which start co-incinerating waste not later than 28 December 2004 are to be regarded as existing co-incineration plants.

Article 21

Implementation

1. Member States shall bring into force the laws, regulations and administrative provisions necessary to comply with this Directive not later than 28 December 2002. They shall forthwith inform the Commission thereof.

When Member States adopt those measures, they shall contain a reference to this Directive or be accompanied by such reference on the occasion of their official publication. The methods of making such reference shall be laid down by the Member States.

2. Member States shall communicate to the Commission the text of the provisions of domestic law which they adopt in the field governed by this Directive.

Article 22

Entry into force

This Directive shall enter into force on the day of its publication in the *Official Journal of the European Communities*.

Article 23

Addressees

This Directive is addressed to the Member States.

Done at Brussels, 4 December 2000.

For the European Parliament	*For the Council*
The President	*The President*
N. FONTAINE	F. VÉDRINE

ANNEX I

Equivalence factors for dibenzo-p-dioxins and dibenzofurans

For the determination of the total concentration (TE) of dioxins and furans, the mass concentrations of the following dibenzo-p-dioxins and dibenzofurans shall be multiplied by the following equivalence factors before summing:

		Toxic equivalence factor
2,3,7,8	— Tetrachlorodibenzodioxin (TCDD)	1
1,2,3,7,8	— Pentachlorodibenzodioxin (PeCDD)	0,5
1,2,3,4,7,8	— Hexachlorodibenzodioxin (HxCDD)	0,1
1,2,3,6,7,8	— Hexachlorodibenzodioxin (HxCDD)	0,1
1,2,3,7,8,9	— Hexachlorodibenzodioxin (HxCDD)	0,1
1,2,3,4,6,7,8	— Heptachlorodibenzodioxin (HpCDD)	0,01
	— Octachlorodibenzodioxin (OCDD)	0,001
2,3,7,8	— Tetrachlorodibenzofuran (TCDF)	0,1
2,3,4,7,8	— Pentachlorodibenzofuran (PeCDF)	0,5
1,2,3,7,8	— Pentachlorodibenzofuran (PeCDF)	0,05
1,2,3,4,7,8	— Hexachlorodibenzofuran (HxCDF)	0,1
1,2,3,6,7,8	— Hexachlorodibenzofuran (HxCDF)	0,1
1,2,3,7,8,9	— Hexachlorodibenzofuran (HxCDF)	0,1
2,3,4,6,7,8	— Hexachlorodibenzofuran (HxCDF)	0,1
1,2,3,4,6,7,8	— Heptachlorodibenzofuran (HpCDF)	0,01
1,2,3,4,7,8,9	— Heptachlorodibenzofuran (HpCDF)	0,01
	— Octachlorodibenzofuran (OCDF)	0,001

ANNEX II

DETERMINATION OF AIR EMISSION LIMIT VALUES FOR THE CO-INCINERATION OF WASTE

The following formula (mixing rule) is to be applied whenever a specific total emission limit value 'C' has not been set out in a table in this Annex.

The limit value for each relevant pollutant and carbon monoxide in the exhaust gas resulting from the co-incineration of waste shall be calculated as follows:

$$\frac{V_{waste} \times C_{waste} + V_{proc} \times C_{proc}}{V_{waste} + V_{proc}} = C$$

V_{waste}: exhaust gas volume resulting from the incineration of waste only determined from the waste with the lowest calorific value specified in the permit and standardised at the conditions given hy this Directive.

If the resulting heat release from the incineration of hazardous waste amounts to less than 10 % of the total heat released in the plant, V_{waste} must he calculated from a (notional) quantity of waste that, being incinerated, would equal 10 % heat release, the total heat release being fixed.

C_{waste}: emission limit values set for incineration plants in Annex V for the relevant pollutants and carbon monoxide.

V_{proc}: exhaust gas volume resulting from the plant process including the combustion of the authorised fuels normally used in the plant (wastes excluded) determined on the basis of oxygen contents at which the emissions must be standardised as laid down in Community or national regulations. In the absence of regulations for this kind of plant, the real oxygen content in the exhaust gas without being thinned by addition of air unnecessary for the process must be used. The standardisation at the other conditions is given in this Directive.

C_{proc}: emission limit values as laid down in the tables of this annex for certain industrial sectors or in case of the absence of such a table or such values, emission limit values of the relevant pollutants and carbon monoxide in the flue gas of plants which comply with the national laws, regulations and administrative provisions for such plants while burning the normally authorised fuels (wastes excluded). In the absence of these measures the emission limit values laid down in the permit are used. In the absence of such permit values the real mass concentrations are used.

C: total emission limit values and oxygen content as laid down in the tables of this annex for certain industrial sectors and certain pollutants or in case of the absence of such a table or such values total emission limit values for CO and the relevant pollutants replacing the emission limit values as laid down in specific Annexes of this Directive. The total oxygen content to replace the oxygen content for the standardisation is calculated on the basis of the content above respecting the partial volumes.

Member States may lay down rules governing the exemptions provided for in this Annex.

II.1. Special provisions for cement kilns co-incinerating waste

Daily average values (for continuous measurements) Sample periods and other measurement requirements as in Article 7. All values in mg/m³ (Dioxins and furans ng/m³). Half-hourly average values shall only be needed in view of calculating the daily average values.

The results of the measurements made to verify compliance with the emission limit values shall be standardised at the following conditions: Temperature 273 K, pressure 101,3 kPa, 10 % oxygen, dry gas.

II.1.1. C — *total emission limit values*

Pollutant	C
Total dust	30
HCl	10
HF	1
NO_x for existing plants	800
NO_x for new plants	500 (1)

Pollutant	C
Cd + Tl	0,05
Hg	0,05
Sb + As + Pb + Cr + Co + Cu + Mn + Ni + V	0,5
Dioxins and furans	0,1

(1) For the implementation of the NO_x emission limit values, cement kilns which are in operation and have a permit in accordance with existing Community legislation and which start co-incinerating waste after the date mentioned in Article 20(3) are not to be regarded as new plants.

Until 1 January 2008, exemptions for NO_x may be authorised by the competent authorities for existing wet process cement kilns or cement kilns which burn less than three tonnes of waste per hour, provided that the permit foresees a total emission limit value for NO_x of not more than 1200 mg/m³.

Until 1 January 2008, exemptions for dust may be authorised by the competent authority for cement kilns which burn less than three tonnes of waste per hour, provided that the permit foresees a total emission limit value of not more than 50 mg/m³.

II.1.2. C — *total emission limit values for SO_2 and TOC*

Pollutant	C
SO_2	50
TOC	10

Exemptions may be authorised by the competent authority in cases where TOC and SO_2 do not result from the incineration of waste.

II.1.3. *Emission limit value for CO*

Emission limit values for CO can be set by the competent authority.

II.2. Special provisions for combustion plants co-incinerating waste

II.2.1. *Daily average values*

Without prejudice to Directive 88/609/EEC and in the case where, for large combustion plants, more stringent emission limit values are set according to future Community legislation, the latter shall replace, for the plants and pollutants concerned, the emission limit values as laid down in the following tables (C_{proc}). In that case, the following tables shall be adapted to these more stringent emission limit values in accordance with the procedure laid down in Article 17 without delay.

Half-hourly average values shall only be needed in view of calculating the daily average values.

C_{proc}:

C_{proc} for solid fuels expressed in mg/Nm³ (O_2 content 6 %):

Pollutants	< 50 MWth	50-100 MWth	100 to 300 MWth	> 300 MWth
SO_2				
general case		850	850 to 200 (linear decrease from 100 to 300 MWth)	200
indigenous fuels		or rate of desulphurisation ≥90 %	or rate of desulphurisation ≥92 %	or rate of desulphurisation ≥95 %
NO_x		400	300	200
Dust	50	50	30	30

Until 1 January 2007 and without prejudice to relevant Community legislation, the emission limit value for NO_x does not apply to plants only co-incinerating hazardous waste.

Until 1 January 2008, exemptions for NO_x and SO_2 may be authorised by the competent authorities for existing co-incineration plants between 100 and 300 MWth using fluidised bed technology and burning solid fuels provided that the permit foresees a C_{proc} value of not more than 350 mg/Nm³ for NO_x and not more than 850 to 400 mg/Nm³ (linear decrease from 100 to 300 MWth) for SO_2.

C_{proc} for biomass expressed in mg/Nm³ (O_2 content 6 %):

'Biomass' means: products consisting of any whole or part of a vegetable matter from agriculture or forestry, which can be used for the purpose of recovering its energy content as well as wastes listed in Article 2(2)(a)(i) to (v).

Pollutants	< 50 MWth	50 to 100 MWth	100 to 300 MWth	> 300 MWth
SO_2		200	200	200
NO_x		350	300	300
Dust	50	50	30	30

Until 1 January 2008, exemptions for NO_x may be authorised by the competent authorities for existing co-incineration plants between 100 and 300 MWth using fluidised bed technology and burning biomass provided that the permit foresees a C_{proc} value of not more than 350 mg/Nm³.

C_{proc} for liquid fuels expressed in mg/Nm³ (O_2 content 3 %):

Pollutants	< 50 MWth	50 to 100 MWth	100 to 300 MWth	> 300 MWth
SO_2		850	850 to 200 (linear decrease from 100 to 300 MWth)	200
NO_x		400	300	200
Dust	50	50	30	30

II.2.2. *C — total emission limit values*

C expressed in mg/Nm³ (O_2 content 6 %). All average values over the sample period of a minimum of 30 minutes and a maximum of 8 hours:

Pollutant	C
Cd + Tl	0,05
Hg	0,05
Sb + As + Pb + Cr + Co + Cu + Mn + Ni + V	0,5

C expressed in ng/Nm³ (O_2 content 6 %). All average values measured over the sample period of a minimum of 6 hours and a maximum of 8 hours:

Pollutant	C
Dioxins and furans	0,1

II.3. **Special provisions for industrial sectors not covered under II.1 or II.2 co-incinerating waste**

II.3.1. *C — total emission limit values:*

C expressed in ng/Nm³. All average values measured over the sample period of a minimum of 6 hours and a maximum of 8 hours:

Pollutant	C
Dioxins and furans	0,1

C expressed in mg/Nm³. All average values over the sample period of a minimum of 30 minutes and a maximum of 8 hours:

Pollutant	C
Cd + Tl	0,05
Hg	0,05

ANNEX III

Measurement techniques

1. Measurements for the determination of concentrations of air and water polluting substances have to be carried out representatively.

2. Sampling and analysis of all pollutants including dioxins and furans as well as reference measurement methods to calibrate automated measurement systems shall be carried out as given by CEN-standards. If CEN standards are not available, ISO standards, national or international standards which will ensure the provision of data of an equivalent scientific quality shall apply.

3. At the daily emission limit value level, the values of the 95 % confidence intervals of a single measured result shall not exceed the following percentages of the emission limit values:

Carbon monoxide:	10 %
Sulphur dioxide:	20 %
Nitrogen dioxide:	20 %
Total dust:	30 %
Total organic carbon:	30 %
Hydrogen chloride:	40 %
Hydrogen fluoride:	40 %.

ANNEX IV

Emission limit values for discharges of waste water from the cleaning of exhaust gases

Polluting substances	Emission limit values expressed in mass concentrations for unfiltered samples	
1. Total suspended solids as defined by Directive 91/271/EEC	95 % 30 mg/l	100 % 45 mg/l
2. Mercury and its compounds, expressed as mercury (Hg)	0,03 mg/l	
3. Cadmium and its compounds, expressed as cadmium (Cd)	0,05 mg/l	
4. Thallium and its compounds, expressed as thallium (Tl)	0,05 mg/l	
5. Arsenic and its compounds, expressed as arsenic (As)	0,15 mg/l	
6. Lead and its compounds, expressed as lead (Pb)	0,2 mg/l	
7. Chromium and its compounds, expressed as chromium (Cr)	0,5 mg/l	
8. Copper and its compounds, expressed as copper (Cu)	0,5 mg/l	
9. Nickel and its compounds, expressed as nickel (Ni)	0,5 mg/l	
10. Zinc and its compounds, expressed as zinc (Zn)	1,5 mg/l	
11. Dioxins and furans, defined as the sum of the individual dioxins and furans evaluated in accordance with Annex I	0,3 mg/l	

Until 1 January 2008, exemptions for total suspended solids may be authorised by the competent authority for existing incineration plants provided the permit foresees that 80 % of the measured values do not exceed 30 mg/l and none of them exceed 45 mg/l.

ANNEX V

AIR EMISSION LIMIT VALUES

(a) **Daily average values**

Total dust	10 mg/m³
Gaseous and vaporous organic substances, expressed as total organic carbon	10 mg/m³
Hydrogen chloride (HCl)	10 mg/m³
Hydrogen fluoride (HF)	1 mg/m³
Sulphur dioxide (SO_2)	50 mg/m³
Nitrogen monoxide (NO) and nitrogen dioxide (NO_2) expressed as nitrogen dioxide for existing incineration plants with a nominal capacity exceeding 6 tonnes per hour or new incineration plants	200 mg/m³ (*)
Nitrogen monoxide (NO) and nitrogen dioxide (NO_2), expressed as nitrogen dioxide for existing incineration plants with a nominal capacity of 6 tonnes per hour or less	400 mg/m³ (*)

(*) Until 1 January 2007 and without prejudice to relevant (Community) legislation the emission limit value for NO_x does not apply to plants only incinerating hazardous waste.

Exemptions for NO_x may be authorised by the competent authority for existing incineration plants:

— with a nominal capacity of 6 tonnes per hour, provided that the permit foresees the daily average values do not exceed 500 mg/m³ and this until 1 January 2008,

— with a nominal capacity of >6 tonnes per hour but equal or less than 16 tonnes per hour, provided the permit foresees the daily average values do not exceed 400 mg/m³ and this until 1 January 2010,

— with a nominal capacity of >16 tonnes per hour but <25 tonnes per hour and which do not produce water discharges, provided that the permit foresees the daily average values do not exceed 400 mg/m³ and this until 1 January 2008.

Until 1 January 2008, exemptions for dust may be authorised by the competent authority for existing incinerating plants, provided that the permit foresees the daily average values do not exceed 20 mg/m³.

(b) **Half-hourly average values**

	(100 %) A	(97 %) B
Total dust	30 mg/m³	10 mg/m³
Gaseous and vaporous organic substances, expressed as total organic carbon	20 mg/m³	10 mg/m³
Hydrogen chloride (HCl)	60 mg/m³	10 mg/m³
Hydrogen fluoride (HF)	4 mg/m³	2 mg/m³
Sulphur dioxide (SO_2)	200 mg/m³	50 mg/m³
Nitrogen monoxide (NO) and nitrogen dioxide (NO_2), expressed as nitrogen dixoide for existing incineration plants with a nominal capacity exceeding 6 tonnes per hour or new incineration plants	400 mg/m³ (*)	200 mg/m³ (*)

(*) Until 1 January 2007 and without prejudice to relevant Community legislation the emission limit value for NO_x does not apply to plants only incinerating hazardous waste.

Until 1 January 2010, exemptions for NO_x may be authorised by the competent authority for existing incineration plants with a nominal capacity between 6 and 16 tonnes per hour, provided the half-hourly average value does not exceed 600 mg/m³ for column A or 400 mg/m³ for column B.

(c) **All average values over the sample period of a minimum of 30 minutes and a maximum of 8 hours**

Cadmium and its compounds, expressed as cadmium (Cd)		
Thallium and its compounds, expressed as thallium (Tl)	total 0,05 mg/m³	total 0,1 mg/m³ (*)
Mercury and its compounds, expressed as mercury (Hg)	0,05 mg/m³	0,1 mg/m³ (*)
Antimony and its compounds, expressed as antimony (Sb)		
Arsenic and its compounds, expressed as arsenic (As)		
Lead and its compounds, expressed as lead (Pb)		
Chromium and its compounds, expressed as chromium (Cr)		
Cobalt and its compounds, expressed as cobalt (Co)	total 0,5 mg/m³	total 1 mg/m³ (*)
Copper and its compounds, expressed as copper (Cu)		
Manganese and its compounds, expressed as manganese (Mn)		
Nickel and its compounds, expressed as nickel (Ni)		
Vanadium and its compounds, expressed as vanadium (V)		

(*) Until 1 January 2007 average values for existing plants for which the permit to operate has been granted before 31 December 1996, and which incinerate hazardous waste only.

These average values cover also gaseous and the vapour forms of the relevant heavy metal emissions as well as their compounds.

(d) **Average values shall be measured over a sample period of a minimum of 6 hours and a maximum of 8 hours. The emission limit value refers to the total concentration of dioxins and furans calculated using the concept of toxic equivalence in accordance with Annex I.**

Dioxins and furans	0,1 ng/m³

(e) **The following emission limit values of carbon monoxide (CO) concentrations shall not be exceeded in the combustion gases (excluding the start-up and shut-down phase):**

— 50 milligrams/m³ of combustion gas determined as daily average value;

— 150 milligrams/m³ of combustion gas of at least 95 % of all measurements determined as 10-minute average values or 100 mg/m³ of combustion gas of all measurements determined as half-hourly average values taken in any 24-hour period.

Exemptions may be authorised by the competent authority for incineration plants using fluidised bed technology, provided that the permit foresees an emission limit value for carbon monoxide (CO) of not more than 100 mg/m³ as an hourly average value.

(f) **Member States may lay down rules governing the exemptions provided for in this Annex.**

ANNEX VI

Formula to calculate the emission concentration at the standard percentage oxygen concentration

$$E_S = \frac{21 - O_S}{21 - O_M} \times E_M$$

E_S = calculated emission concentration at the standard percentage oxygen concentration

E_M = measured emission concentration

O_S = standard oxygen concentration

O_M = *measured oxygen concentration*

I

(Acts whose publication is obligatory)

DIRECTIVE 2001/80/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL

of 23 October 2001

on the limitation of emissions of certain pollutants into the air from large combustion plants

THE EUROPEAN PARLIAMENT AND THE COUNCIL OF THE EUROPEAN UNION,

Having regard to the Treaty establishing the European Community, and in particular Article 175(1) thereof,

Having regard to the proposal from the Commission [1],

Having regard to the Opinion of the Economic and Social Committee [2],

Having consulted the Committee of the Regions,

Acting in accordance with the procedure laid down in Article 251 of the Treaty [3], in the light of the joint text approved by the Conciliation Committee on 2 August 2001,

Whereas:

(1) Council Directive 88/609/EEC of 24 November 1988 on the limitation of emissions of certain pollutants into the air from large combustion plants [4] has contributed to the reduction and control of atmospheric emissions from large combustion plants. It should be recast in the interests of clarity.

(2) The Fifth Environmental Action Programme [5] sets as objectives that the critical loads and levels of certain acidifying pollutants such as sulphur dioxide (SO_2) and nitrogen oxides (NO_x) should not be exceeded at any time and, as regards air quality, that all people should be effectively protected against recognised health risks from air pollution.

(3) All Member States have signed the Gothenburg Protocol of 1 December 1999 to the 1979 Convention of the United Nations Economic Commission for Europe (UNECE) on long-range transboundary air pollution to abate acidification, eutrophication and ground-level ozone, which includes, *inter alia*, commitments to reduce emissions of sulphur dioxide and oxides of nitrogen.

(4) The Commission has published a Communication on a Community strategy to combat acidification in which the revision of Directive 88/609/EEC was identified as being an integral component of that strategy with the long term aim of reducing emissions of sulphur dioxide and nitrogen oxides sufficiently to bring depositions and concentrations down to levels below the critical loads and levels.

(5) In accordance with the principle of subsidiarity as set out in Article 5 of the Treaty, the objective of reducing acidifying emissions from large combustion plants cannot be sufficiently achieved by the Member States acting individually and unconcerted action offers no guarantee of achieving the desired objective; in view of the need to reduce acidifying emissions across the Community, it is more effective to take action at Community level.

(6) Existing large combustion plants are significant contributors to emissions of sulphur dioxide and nitrogen oxides in the Community and it is necessary to reduce these emissions. It is therefore necessary to adapt the approach to the different characteristics of the large combustion plant sector in the Member States.

(7) Council Directive 96/61/EC of 24 September 1996 concerning integrated pollution prevention and control [6] sets out an integrated approach to pollution prevention and control in which all the aspects of an installation's environmental performance are considered

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(1) OJ C 300, 29.9.1998, p. 6, OJ C 212 E, 25.7.2000, p. 36.
(2) OJ C 101, 12.4.1999, p. 55.
(3) Opinion of the European Parliament of 14 April 1999 (OJ C 219, 30.7.1999, p. 175), Council Common Position of 9 November 2000 (OJ C 375, 28.12.2000, p. 12) and Decision of the European Parliament of 14 March 2001 (not yet published in the Official Journal). Decision of the European Parliament of 20 September 2001 and Decision of the Council of 27 September 2001.
(4) OJ L 336, 7.12.1988, p. 1. Directive as last amended by Council Directive 94/66/EC (OJ L 337, 24.12.1994, p. 83).
(5) OJ C 138, 17.5.1993, p. 1.
(6) OJ L 257, 10.10.1996, p. 26.

in an integrated manner: combustion installations with a rated thermal input exceeding 50 MW are included within the scope of that Directive; pursuant to Article 15(3) of that Directive an inventory of the principal emissions and sources responsible is to be published every three years by the Commission on the basis of data supplied by the Member States. Pursuant to Article 18 of that Directive, acting on a proposal from the Commission, the Council will set emission limit values in accordance with the procedures laid down in the Treaty for which the need for Community action has been identified, on the basis, in particular, of the exchange of information provided for in Article 16 of that Directive.

(8) Compliance with the emission limit values laid down by this Directive should be regarded as a necessary but not sufficient condition for compliance with the requirements of Directive 96/61/EC regarding the use of best available techniques. Such compliance may involve more stringent emission limit values, emission limit values for other substances and other media, and other appropriate conditions.

(9) Industrial experience in the implementation of techniques for the reduction of polluting emissions from large combustion plants has been acquired over a period of 15 years.

(10) The Protocol on heavy metals to the UNECE Convention on long-range transboundary air pollution recommends the adoption of measures to reduce heavy metals emitted by certain installations. It is known that benefits from reducing dust emissions by dust abatement equipment will provide benefits on reducing particle-bound heavy metal emissions.

(11) Installations for the production of electricity represent an important part of the large combustion plant sector.

(12) Directive 96/92/EC of the European Parliament and of the Council of 19 December 1996 concerning common rules for the internal market in electricity [1] is intended inter alia to have the effect of distributing new production capacity among new arrivals in the sector.

(13) The Community is committed to a reduction of carbon dioxide emissions. Where it is feasible the combined production of heat and electricity represents a valuable opportunity for significantly improving overall efficiency in fuel use.

(14) A significant increase in the use of natural gas for producing electricity is already underway and is likely to continue, in particular through the use of gas turbines.

(15) In view of the increase in energy production from biomass, specific emission standards for this fuel are justified.

(16) The Council Resolution of 24 February 1997 on a Community strategy for waste management [2] emphasises the need for promoting waste recovery and states that appropriate emission standards should apply to the operation of facilities in which waste is incinerated in order to ensure a high level of protection for the environment.

(17) Industrial experience has been gained concerning techniques and equipment for the measurement of the principal pollutants emitted by large combustion plants; the European Committee for Standardisation (CEN) has undertaken work with the aim of providing a framework securing comparable measurement results within the Community and guaranteeing a high level of quality of such measurements.

(18) There is a need to improve knowledge concerning the emission of the principal pollutants from large combustion plants. In order to be genuinely representative of the level of pollution of an installation, such information should also be associated with knowledge concerning its energy consumption.

(19) This Directive is without prejudice to the time limits within which the Member States must transpose and implement Directive 88/609/EEC,

HAVE ADOPTED THIS DIRECTIVE:

Article 1

This Directive shall apply to combustion plants, the rated thermal input of which is equal to or greater than 50 MW, irrespective of the type of fuel used (solid, liquid or gaseous).

Article 2

For the purpose of this Directive:

(1) 'emission' means the discharge of substances from the combustion plant into the air;

(2) 'waste gases' means gaseous discharges containing solid, liquid or gaseous emissions; their volumetric flow rates shall be expressed in cubic metres per hour at standard temperature (273 K) and pressure (101,3 kPa) after correction for the water vapour content, hereinafter referred to as (Nm^3/h);

[1] OJ L 27, 30.1.1997, p. 20.

[2] OJ C 76, 11.3.1997, p. 1.

(3) 'emission limit value' means the permissible quantity of a substance contained in the waste gases from the combustion plant which may be discharged into the air during a given period; it shall be calculated in terms of mass per volume of the waste gases expressed in mg/Nm^3, assuming an oxygen content by volume in the waste gas of 3 % in the case of liquid and gaseous fuels, 6 % in the case of solid fuels and 15 % in the case of gas turbines;

(4) 'rate of desulphurisation' means the ratio of the quantity of sulphur which is not emitted into the air at the combustion plant site over a given period to the quantity of sulphur contained in the fuel which is introduced into the combustion plant facilities and which is used over the same period;

(5) 'operator' means any natural or legal person who operates the combustion plant, or who has or has been delegated decisive economic power over it;

(6) 'fuel' means any solid, liquid or gaseous combustible material used to fire the combustion plant with the exception of waste covered by Council Directive 89/369/EEC of 8 June 1989 on the prevention of air pollution from new municipal waste incineration plants [1], Council Directive 89/429/EEC of 21 June 1989 on the reduction of air pollution from existing municipal waste incineration plants [2], and Council Directive 94/67/EC of 16 December 1994 concerning the incineration of hazardous waste [3] or any subsequent Community act repealing and replacing one or more of these Directives;

(7) 'combustion plant' means any technical apparatus in which fuels are oxidised in order to use the heat thus generated.

This Directive shall apply only to combustion plants designed for production of energy with the exception of those which make direct use of the products of combustion in manufacturing processes. In particular, this Directive shall not apply to the following combustion plants:

(a) plants in which the products of combustion are used for the direct heating, drying, or any other treatment of objects or materials e.g. reheating furnaces, furnaces for heat treatment;

(b) post-combustion plants i.e. any technical apparatus designed to purify the waste gases by combustion which is not operated as an independent combustion plant;

(c) facilities for the regeneration of catalytic cracking catalysts;

(d) facilities for the conversion of hydrogen sulphide into sulphur;

(e) reactors used in the chemical industry;

(f) coke battery furnaces;

(g) cowpers;

(h) any technical apparatus used in the propulsion of a vehicle, ship or aircraft;

(i) gas turbines used on offshore platforms;

(j) gas turbines licensed before 27 November 2002 or which in the view of the competent authority are the subject of a full request for a licence before 27 November 2002 provided that the plant is put into operation no later than 27 November 2003 without prejudice to Article 7(1) and Annex VIII(A) and (B);

Plants powered by diesel, petrol and gas engines shall not be covered by this Directive.

Where two or more separate new plants are installed in such a way that, taking technical and economic factors into account, their waste gases could, in the judgement of the competent authorities, be discharged through a common stack, the combination formed by such plants shall be regarded as a single unit;

(8) 'multi-fuel firing unit' means any combustion plant which may be fired simultaneously or alternately by two or more types of fuel;

(9) 'new plant' means any combustion plant for which the original construction licence or, in the absence of such a procedure, the original operating licence was granted on or after 1 July 1987;

(10) 'existing plant' means any combustion plant for which the original construction licence or, in the absence of such a procedure, the original operating licence was granted before 1 July 1987;

(11) 'biomass' means products consisting of any whole or part of a vegetable matter from agriculture or forestry which can be used as a fuel for the purpose of recovering its energy content and the following waste used as a fuel:

(a) vegetable waste from agriculture and forestry;

(1) OJ L 163, 14.6.1989, p. 32.
(2) OJ L 203, 15.7.1989, p. 50.
(3) OJ L 365, 31.12.1994, p. 34.

(b) vegetable waste from the food processing industry, if the heat generated is recovered;

(c) fibrous vegetable waste from virgin pulp production and from production of paper from pulp, if it is co-incinerated at the place of production and the heat generated is recovered;

(d) cork waste;

(e) wood waste with the exception of wood waste which may contain halogenated organic compounds or heavy metals as a result of treatment with wood preservatives or coating, and which includes in particular such wood waste originating from construction and demolition waste;

(12) 'gas turbine' means any rotating machine which converts thermal energy into mechanical work, consisting mainly of a compressor, a thermal device in which fuel is oxidised in order to heat the working fluid, and a turbine.

(13) 'Outermost Regions' means the French Overseas Departments with regard to France, the Azores and Madeira with regard to Portugal and the Canary Islands with regard to Spain.

Article 3

1. Not later than 1 July 1990 Member States shall draw up appropriate programmes for the progressive reduction of total annual emissions from existing plants. The programmes shall set out the timetables and the implementing procedures.

2. In accordance with the programmes mentioned in paragraph 1, Member States shall continue to comply with the emission ceilings and with the corresponding percentage reductions laid down for sulphur dioxide in Annex I, columns 1 to 6, and for oxides of nitrogen in Annex II, columns 1 to 4, by the dates specified in those Annexes, until the implementation of the provisions of Article 4 that apply to existing plants.

3. When the programmes are being carried out, Member States shall also determine the total annual emissions in accordance with Annex VIII(C).

4. 4. If a substantial and unexpected change in energy demand or in the availability of certain fuels or certain generating installations creates serious technical difficulties for the implementation by a Member State of its programme drawn up under paragraph 1, the Commission shall, at the request of the Member State concerned and taking into account the terms of the request, take a decision to modify, for that Member State, the emission ceilings and/or the dates set out in Annexes I and II and communicate its decision to the Council and to the Member States. Any Member State may within three months refer the decision of the Commission to the Council. The Council, acting by a qualified majority, may within three months take a different decision.

Article 4

1. Without prejudice to Article 17 Member States shall take appropriate measures to ensure that all licences for the construction or, in the absence of such a procedure, for the operation of new plants which in the view of the competent authority are the subject of a full request for a licence before 27 November 2002, provided that the plant is put into operation no later than 27 November 2003 contain conditions relating to compliance with the emission limit values laid down in part A of Annexes III to VII in respect of sulphur dioxide, nitrogen oxides and dust.

2. Member States shall take appropriate measures to ensure that all licences for the construction or, in the absence of such a procedure, for the operation of new plants, other than those covered by paragraph 1, contain conditions relating to compliance with the emission limit values laid down in part B of Annexes III to VII in respect of sulphur dioxide, nitrogen oxides and dust.

3. Without prejudice to Directive 96/61/EC and Council Directive 96/62/EC of 27 September 1996 on ambient air quality assessment and management [1], Member States shall, by 1 January 2008 at the latest, achieve significant emission reductions by:

(a) taking appropriate measures to ensure that all licences for the operation of existing plants contain conditions relating to compliance with the emission limit values established for new plants referred to in paragraph 1; or

(b) ensuring that existing plants are subject to the national emission reduction plan referred to in paragraph 6;

and, where appropriate, applying Articles 5, 7 and 8.

4. Without prejudice to Directives 96/61/EC and 96/62/EC, existing plants may be exempted from compliance with the emission limit values referred to in paragraph 3 and from their inclusion in the national emission reduction plan on the following conditions:

(a) the operator of an existing plant undertakes, in a written declaration submitted by 30 June 2004 at the latest to the competent authority, not to operate the plant for more than 20 000 operational hours starting from 1 January 2008 and ending no later than 31 December 2015;

[1] OJ L 296, 21.11.1996, p. 55.

(b) the operator is required to submit each year to the competent authority a record of the used and unused time allowed for the plants' remaining operational life.

5. Member States may require compliance with emission limit values and time limits for implementation which are more stringent than those set out in paragraphs 1, 2, 3 and 4 and in Article 10. They may include other pollutants, and they may impose additional requirements or adaptation of plant to technical progress.

6. Member States may, without prejudice to this Directive and Directive 96/61/EC, and taking into consideration the costs and benefits as well as their obligations under Directive 2001/81/EC of the European Parliament and of the Council of 23 October 2001 on national emission ceilings for certain atmospheric pollutants [1] and Directive 96/62/EC, define and implement a national emission reduction plan for existing plants, taking into account, *inter alia*, compliance with the ceilings as set out in Annexes I and II.

The national emission reduction plan shall reduce the total annual emissions of nitrogen oxides (NO_x), sulphur dioxide (SO_2) and dust from existing plants to the levels that would have been achieved by applying the emission limit values referred to in paragraph 3 to the existing plants in operation in the year 2000, (including those existing plants undergoing a rehabilitation plan in 2000, approved by the competent authority, to meet emission reductions required by national legislation) on the basis of each plant's actual annual operating time, fuel used and thermal input, averaged over the last five years of operation up to and including 2000.

The closure of a plant included in the national emission reduction plan shall not result in an increase in the total annual emissions from the remaining plants covered by the plan.

The national emission reduction plan may under no circumstances exempt a plant from the provisions laid down in relevant Community legislation, including inter alia Directive 96/61/EC.

The following conditions shall apply to national emission reduction plans:

(a) the plan shall comprise objectives and related targets, measures and timetables for reaching these objectives and targets, and a monitoring mechanism;

(b) Member States shall communicate their national emission reduction plan to the Commission no later than 27 November 2003;

(c) within six months of the communication referred to in point (b) the Commission shall evaluate whether or not the plan meets the requirements of this paragraph. When the Commission considers that this is not the case, it shall inform the Member State and within the subsequent three months the Member State shall communicate any measures it has taken in order to ensure that the requirements of this paragraph are met;

(d) the Commission shall, no later than 27 November 2002, develop guidelines to assist Member States in the preparation of their plans.

7. Not later than 31 December 2004 and in the light of progress towards protecting human health and attaining the Community's environmental objectives for acidification and for air quality pursuant to Directive 96/62/EC, the Commission shall submit a report to the European Parliament and the Council in which it shall assess:

(a) the need for further measures;

(b) the amounts of heavy metals emitted by large combustion plants;

(c) the cost-effectiveness and costs and advantages of further emission reductions in the combustion plants sector in Member States compared to other sectors;

(d) the technical and economic feasibility of such emission reductions;

(e) the effects of both the standards set for the large combustion plants sector including the provisions for indigenous solid fuels, and the competition situation in the energy market, on the environment and the internal market;

(f) any national emission reduction plans provided by Member States in accordance with paragraph 6.

The Commission shall include in its report an appropriate proposal of possible end dates or of lower limit values for the derogation contained in footnote 2 to Annex VI A.

8. The report referred to in paragraph 7 shall, as appropriate, be accompanied by related proposals, having regard to Directive 96/61/EC.

Article 5

By way of derogation from Annex III:

(1) Plants, of a rated thermal input equal to or greater than 400 MW, which do not operate more than the following

[1] See p. 22 of this Edition of the Official Journal.

numbers of hours a year (rolling average over a period of five years),

— until 31 December 2015, 2 000 hours;

— from 1 January 2016, 1 500 hours;

shall be subject to a limit value for sulphur dioxide emissions of 800 mg/Nm³.

This provision shall not apply to new plants for which the licence is granted pursuant to Article 4(2).

(2) Until 31 December 1999, the Kingdom of Spain may authorise new power plants with a rated thermal input equal to or greater than 500 MW burning indigenous or imported solid fuels, commissioned before the end of 2005 and complying with the following requirements:

(a) in the case of imported solid fuels, a sulphur dioxide emission limit value of 800 mg/Nm³;

(b) in the case of indigenous solid fuels, at least a 60 % rate of desulphurisation,

provided that the total authorised capacity of such plants to which this derogation applies does not exceed:

— 2 000 MWe in the case of plants burning indigenous solid fuels;

— in the case of plants burning imported solid fuels either 7 500 or 50 % of all the new capacity of all plants burning solid fuels authorised up to 31 December 1999, whichever is the lower.

Article 6

In the case of new plants for which the licence is granted pursuant to Article 4(2) or plants covered by Article 10, Member States shall ensure that the technical and economic feasibility of providing for the combined generation of heat and power is examined. Where this feasibility is confirmed, bearing in mind the market and the distribution situation, installations shall be developed accordingly.

Article 7

1. Member States shall ensure that provision is made in the licences or permits referred to in Article 4 for procedures relating to malfunction or breakdown of the abatement equipment. In case of a breakdown the competent authority shall in particular require the operator to reduce or close down operations if a return to normal operation is not achieved within 24 hours, or to operate the plant using low polluting fuels. In any case the competent authority shall be notified within 48 hours. In no circumstances shall the cumulative duration of unabated operation in any twelve-month period exceed 120 hours. The competent authority may allow exceptions to the limits of 24 hours and 120 hours above in cases where, in their judgement:

(a) there is an overriding need to maintain energy supplies, or

(b) the plant with the breakdown would be replaced for a limited period by another plant which would cause an overall increase in emissions.

2. The competent authority may allow a suspension for a maximum of six months from the obligation to comply with the emission limit values provided for in Article 4 for sulphur dioxide in respect of a plant which to this end normally uses low-sulphur fuel, in cases where the operator is unable to comply with these limit values because of an interruption in the supply of low-sulphur fuel resulting from a serious shortage. The Commission shall immediately be informed of such cases.

3. The competent authority may allow a derogation from the obligation to comply with the emission limit values provided for in Article 4 in cases where a plant which normally uses only gaseous fuel, and which would otherwise need to be equipped with a waste gas purification facility, has to resort exceptionally, and for a period not exceeding 10 days except where there is an overriding need to maintain energy supplies, to the use of other fuels because of a sudden interruption in the supply of gas. The competent authority shall immediately be informed of each specific case as it arises. Member States shall inform the Commission immediately of the cases referred to in this paragraph.

Article 8

1. In the case of plants with a multi-firing unit involving the simultaneous use of two or more fuels, when granting the licence referred to in Articles 4(1) or 4(2), and in the case of such plants covered by Articles 4(3) or 10, the competent authority shall set the emission limit values as follows:

(a) firstly by taking the emission limit value relevant for each individual fuel and pollutant corresponding to the rated thermal input of the combustion plant as given in Annexes III to VII,

(b) secondly by determining fuel-weighted emission limit values, which are obtained by multiplying the above individual emission limit value by the thermal input delivered by each fuel, the product of multiplication being divided by the sum of the thermal inputs delivered by all fuels,

(c) thirdly by aggregating the fuel-weighted limit values.

2. In multi-firing units using the distillation and conversion residues from crude-oil refining for own consumption, alone or with other fuels, the provisions for the fuel with the highest emission limit value (determinative fuel) shall apply, notwithstanding paragraph 1 above, if during the operation of the combustion plant the proportion contributed by that fuel to the sum of the thermal inputs delivered by all fuels is at least 50 %.

Where the proportion of the determinative fuel is lower than 50 %, the emission limit value is determined on a pro rata basis of the heat input supplied by the individual fuels in relation to the sum of the thermal inputs delivered by all fuels as follows:

(a) firstly by taking the emission limit value relevant for each individual fuel and pollutant corresponding to the rated heat input of the combustion plant as given in Annexes III to VII,

(b) secondly by calculating the emission limit value of the determinative fuel (fuel with the highest emission limit value according to Annexes III to VII and, in the case of two fuels having the same emission limit value, the fuel with the higher thermal input); this value is obtained by multiplying the emission limit value laid down in Annexes III to VII for that fuel by a factor of two, and subtracting from this product the emission limit value of the fuel with the lowest emission limit value,

(c) thirdly by determining the fuel-weighted emission limit values, which are obtained by multiplying the calculated fuel emission limit value by the thermal input of the determinative fuel and the other individual emission limit values by the thermal input delivered by each fuel, the product of multiplication being divided by the sum of the thermal inputs delivered by all fuels,

(d) fourthly by aggregating the fuel-weighted emission limit values.

3. As an alternative to paragraph 2, the following average emission limit values for sulphur dioxide may be applied (irrespective of the fuel combination used):

(a) for plants referred to in Article 4(1) and (3): 1 000 mg/Nm^3, averaged over all such plants within the refinery;

(b) for new plants referred to in Article 4(2): 600 mg/Nm^3, averaged over all such plants within the refinery, with the exception of gas turbines.

The competent authorities shall ensure that the application of this provision does not lead to an increase in emissions from existing plants.

4. In the case of plants with a multi-firing unit involving the alternative use of two or more fuels, when granting the licence referred to in Article 4(1) and (2), and in the case of such plants covered by Articles 4(3) or 10, the emission limit values set out in Annexes III to VII corresponding to each fuel used shall be applied.

Article 9

Waste gases from combustion plants shall be discharged in controlled fashion by means of a stack. The licence referred to in Article 4 and licences for combustion plants covered by Article 10 shall lay down the discharge conditions. The competent authority shall in particular ensure that the stack height is calculated in such a way as to safeguard health and the environment.

Article 10

Where a combustion plant is extended by at least 50 MW, the emission limit values as set in part B of Annexes III to VII shall apply to the new part of the plant and shall be fixed in relation to the thermal capacity of the entire plant. This provision shall not apply in the cases referred to in Article 8(2) and (3).

Where the operator of a combustion plant is envisaging a change according to Articles 2(10)(b) and 12(2) of Directive 96/61/EC, the emission limit values as set out in part B of Annexes III to VII in respect of sulphur dioxide, nitrogen oxides and dust shall apply.

Article 11

In the case of construction of combustion plants which are likely to have significant effects on the environment in another Member State, the Member States shall ensure that all appropriate information and consultation takes place, in accordance with Article 7 of Council Directive 85/337/EEC of 27 June 1985 on the assessment of the effects of certain public and private projects on the environment [1].

Article 12

Member States shall take the necessary measures to ensure the monitoring, in accordance with Annex VIII(A), of emissions from the combustion plants covered by this Directive and of all other values required for the implementation of this

[1] OJ L 175, 5.7.1985, p. 40. Directive as last amended by Council Directive 97/11/EC (OJ L 73, 14.3.1997, p. 5).

Directive. Member States may require that such monitoring shall be carried out at the operator's expense.

Article 13

Member States shall take appropriate measures to ensure that the operator informs the competent authorities within reasonable time limits about the results of the continuous measurements, the checking of the measuring equipment, the individual measurements and all other measurements carried out in order to assess compliance with this Directive.

Article 14

1. In the event of continuous measurements, the emission limit values set out in part A of Annexes III to VII shall be regarded as having been complied with if the evaluation of the results indicates, for operating hours within a calendar year, that:

(a) none of the calendar monthly mean values exceeds the emission limit values; and

(b) in the case of:

(i) sulphur dioxide and dust: 97 % of all the 48 hourly mean values do not exceed 110 % of the emission limit values,

(ii) nitrogen oxides: 95 % of all the 48 hourly mean values do not exceed 110 % of the emission limit values.

The periods referred to in Article 7 as well as start-up and shut-down periods shall be disregarded.

2. In cases where only discontinuous measurements or other appropriate procedures for determination are required, the emission limit values set out in Annexes III to VII shall be regarded as having been complied with if the results of each of the series of measurements or of the other procedures defined and determined according to the rules laid down by the competent authorities do not exceed the emission limit values.

3. In the cases referred to in Article 5(2) and (3), the rates of desulphurisation shall be regarded as having been complied with if the evaluation of measurements carried out pursuant to Annex VIII, point A.3, indicates that all of the calendar monthly mean values or all of the rolling monthly mean values achieve the required desulphurisation rates.

The periods referred to in Article 7 as well as start-up and shut-down periods shall be disregarded.

4. For new plants for which the licence is granted pursuant to Article 4(2), the emission limit values shall be regarded, for operating hours within a calendar year, as complied with if:

(a) no validated daily average value exceeds the relevant figures set out in part B of Annexes III to VII, and

(b) 95 % of all the validated hourly average values over the year do not exceed 200 % of the relevant figures set out in part B of Annexes III to VII.

The 'validated average values' are determined as set out in point A.6 of Annex VIII.

The periods referred to in Article 7 as well as start up and shut down periods shall be disregarded.

Article 15

1. Member States shall, not later than 31 December 1990, inform the Commission of the programmes drawn up in accordance with Article 3(1).

At the latest one year after the end of the different phases for reduction of emissions from existing plants, the Member States shall forward to the Commission a summary report on the results of the implementation of the programmes.

An intermediate report is required as well in the middle of each phase.

2. The reports referred to in paragraph 1 shall provide an overall view of:

(a) all the combustion plants covered by this Directive,

(b) emissions of sulphur dioxide, and oxides of nitrogen expressed in tonnes per annum and as concentrations of these substances in the waste gases,

(c) measures already taken or envisaged with a view to reducing emissions, and of changes in the choice of fuel used,

(d) changes in the method of operation already made or envisaged,

(e) definitive closures of combustion plants already effected or envisaged, and

(f) where appropriate, the emission limit values imposed in the programmes in respect of existing plants.

When determining the annual emissions and concentrations of pollutants in the waste gases, Member States shall take account of Articles 12, 13 and 14.

3. Member States applying Article 5 or the provisions of the Nota Bene in Annex III or the footnotes in Annex VI.A shall report thereon annually to the Commission.

Article 16

The Member States shall determine the penalties applicable to breaches of the national provisions adopted pursuant to this Directive. The penalties thus provided for shall be effective, proportionate and dissuasive.

Article 17

1. Directive 88/609/EEC shall be repealed with effect from 27 November 2002, without prejudice to paragraph 2 or to the obligations of Member States concerning the time limits for transposition and application of that Directive listed in Annex IX hereto.

2. In the case of new plants licensed before 27 November 2002 Article 4(1) of this Directive, Article 4(1), Article 5(2), Article 6, Article 15(3), Annexes III, VI, VIII and point A.2 of Annex IX to Directive 88/609/EEC as amended by Directive 94/66/EC shall remain in effect until 1 January 2008 after which they shall be repealed.

3. References to Directive 88/609/EEC shall be construed as references to this Directive and shall be read in accordance with the correlation table in Annex X hereto.

Article 18

1. Member States shall bring into force the laws, regulations and administrative provisions necessary to comply with this Directive before 27 November 2002. They shall forthwith inform the Commission thereof.

When Member States adopt these provisions, they shall contain a reference to this Directive or shall be accompanied by such reference on the occasion of their official publication. The methods of making such reference shall be laid down by Member States.

2. For existing plant, and for new plant for which a licence is granted pursuant to Article 4(1), the provisions of point A.2 of Annex VIII shall be applied from 27 November 2004.

3. Member States shall communicate to the Commission the texts of the provisions of national law which they adopt in the field covered by this Directive.

Article 19

This Directive shall enter into force on the day of its publication in the *Official Journal of the European Communities*.

Article 20

This Directive is addressed to the Member States.

Done at Luxembourg, 23 October 2001.

For the European Parliament	*For the Council*
The President	*The President*
N. FONTAINE	A. NEYTS-UYTTEBROECK

ANNEX I

CEILINGS AND REDUCTION TARGETS FOR EMISSIONS OF SO_2 FROM EXISTING PLANTS (1) (2)

Member State	0	1	2	3	4	5	6	7	8	9
	SO_2 emissions by large *combustion* plants 1980 ktonnes	Emission ceiling (ktonnes/year)			% reduction over 1980 emissions			% reduction over adjusted 1980 emissions		
		Phase 1	Phase 2	Phase 3	Phase 1	Phase 2	Phase 3	Phase 1	Phase 2	Phase 3
		1993	1998	2003	1993	1998	2003	1993	1998	2003
Belgium	530	318	212	159	- 40	- 60	- 70	- 40	- 60	- 70
Denmark	323	213	141	106	- 34	- 56	- 67	- 40	- 60	- 70
Germany	2 225	1 335	890	668	- 40	- 60	- 70	- 40	- 60	- 70
Greece	303	320	320	320	+ 6	+ 6	+ 6	- 45	- 45	- 45
Spain	2 290	2 290	1 730	1 440	0	- 24	- 37	- 21	- 40	- 50
France	1 910	1 146	764	573	- 40	- 60	- 70	- 40	- 60	- 70
Ireland	99	124	124	124	+ 25	+ 25	+ 25	- 29	- 29	- 29
Italy	2 450	1 800	1 500	900	- 27	- 39	- 63	- 40	- 50	- 70
Luxembourg	3	1,8	1,5	1,5	- 40	- 50	- 60	- 40	- 50	- 50
Netherlands	299	180	120	90	- 40	- 60	- 70	- 40	- 60	- 70
Portugal	115	232	270	206	+ 102	+ 135	+ 79	- 25	- 13	- 34
United Kingdom	3 883	3 106	2 330	1 553	- 20	- 40	- 60	- 20	- 40	- 60
Austria	90	54	36	27	- 40	- 60	- 70	- 40	- 60	- 70
Finland	171	102	68	51	- 40	- 60	- 70	- 40	- 60	- 70
Sweden	112	67	45	34	- 40	- 60	- 70	- 40	- 60	- 70

(1) Additional emissions may arise from capacity authorised on or after 1 July 1987.

(2) Emissions coming from combustion plants authorised before 1 July 1987 but not yet in operation before that date and which have not been taken into account in establishing the emission ceilings fixed by this Annex shall either comply with the requirements established by this Directive for new plants or be accounted for in the overall emissions from existing plants that must not exceed the ceilings fixed in this Annex.

ANNEX II

CEILINGS AND REDUCTION TARGETS FOR EMISSIONS OF NO_X FROM EXISTING PLANTS (1) (2)

Member State	0	1	2	3	4	5	6
	NO_x emissions (as NO_2) by large combustion plants 1980 ktonnes	NO_x emission ceilings (ktonnes/year)		% reduction over 1980 emissions		% reduction over adjusted 1980 emissions	
		Phase 1	Phase 2	Phase 1	Phase 2	Phase 1	Phase 2
		1993 (1)	1998	1993 (1)	1998	1993 (1)	1998
Belgium	110	88	66	- 20	- 40	- 20	- 40
Denmark	124	121	81	- 3	- 35	- 10	- 40
Germany	870	696	522	- 20	- 40	- 20	- 40
Greece	36	70	70	+ 94	+ 94	0	0
Spain	366	368	277	+ 1	- 24	- 20	- 40
France	400	320	240	- 20	- 40	- 20	- 40
Ireland	28	50	50	+ 79	+ 79	0	0
Italy	580	570	428	- 2	- 26	- 20	- 40
Luxembourg	3	2,4	1,8	- 20	- 40	- 20	- 40
Netherlands	122	98	73	- 20	- 40	- 20	- 40
Portugal	23	59	64	+ 157	+ 178	- 8	0
United Kingdom	1 016	864	711	- 15	- 30	- 15	- 30
Austria	19	15	11	- 20	- 40	- 20	- 40
Finland	81	65	48	- 20	- 40	- 20	- 40
Sweden	31	25	19	- 20	- 40	- 20	- 40

(1) Member States may for technical reasons delay for up to two years the phase 1 date for reduction in NO_x emissions by notifying the Commission within one month of the notification of this Directive.

(1) Additional emissions may arise from capacity authorised on or after 1 July 1987.

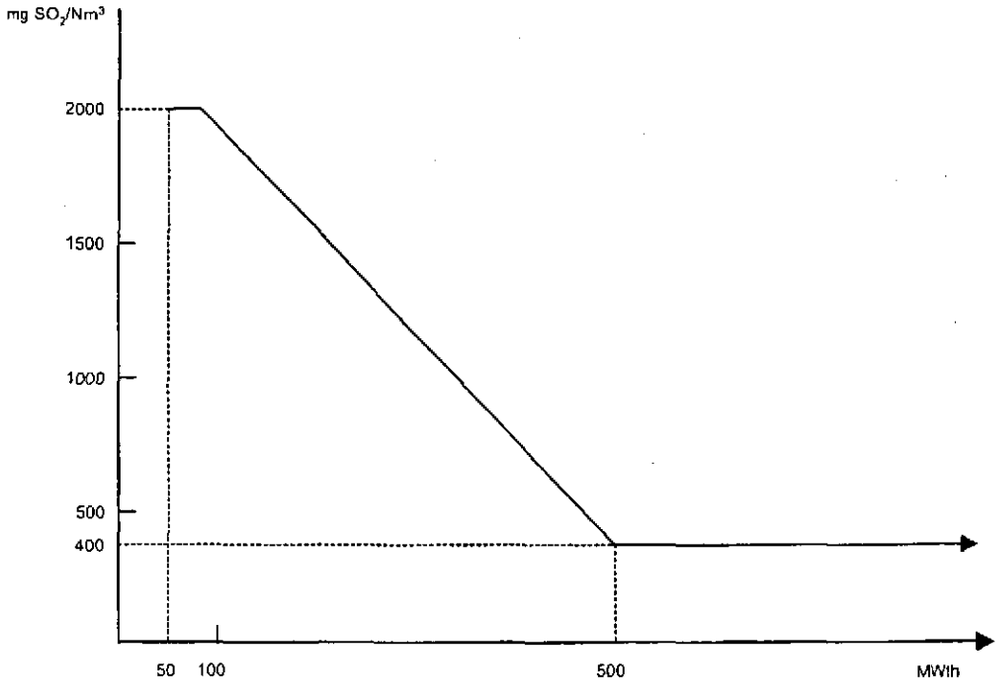
(2) Emissions coming from combustion plants authorised before 1 July 1987 but not yet in operation before that date and which have not been taken into account in establishing the emission ceilings fixed by this Annex shall either comply with the requirements established by this Directive for new plants or be accounted for in the overall emissions from existing plants that must not exceed the ceilings fixed in this Annex.

ANNEX III

EMISSION LIMIT VALUES FOR SO_2

Solid fuel

A. *SO_2 emission limit values expressed in mg/Nm³ (O_2 content 6 %) to be applied by new and existing plants pursuant to Article 4(1) and 4(3) respectively:*



NB. Where the emission limit values above cannot be met due to the characteristics of the fuel, a rate of desulphurisation of at least 60 % shall be achieved in the case of plants with a rated thermal input of less than or equal to 100 MWth, 75 % for plants greater than 100 MWth and less than or equal to 300 MWth and 90 % for plants greater than 300 MWth. For plants greater than 500 MWth, a desulphurisation rate of at least 94 % shall apply or of at least 92 % where a contract for the fitting of flue gas desulphurisation or lime injection equipment has been entered into, and work on its installation has commenced, before 1 January 2001.

B. SO_2 emission limit values expressed in mg/Nm³ (O_2 content 6 %) to be applied by new plants pursuant to Article 4(2) with the exception of gas turbines.

Type of fuel	50 to 100 MWth	100 to 300 MWth	> 300 MWth
Biomass	200	200	200
General case	850	200 (1)	200

(1) Except in the case of the 'Outermost Regions' where 850 to 200 mg/Nm³ (linear decrease) shall apply.

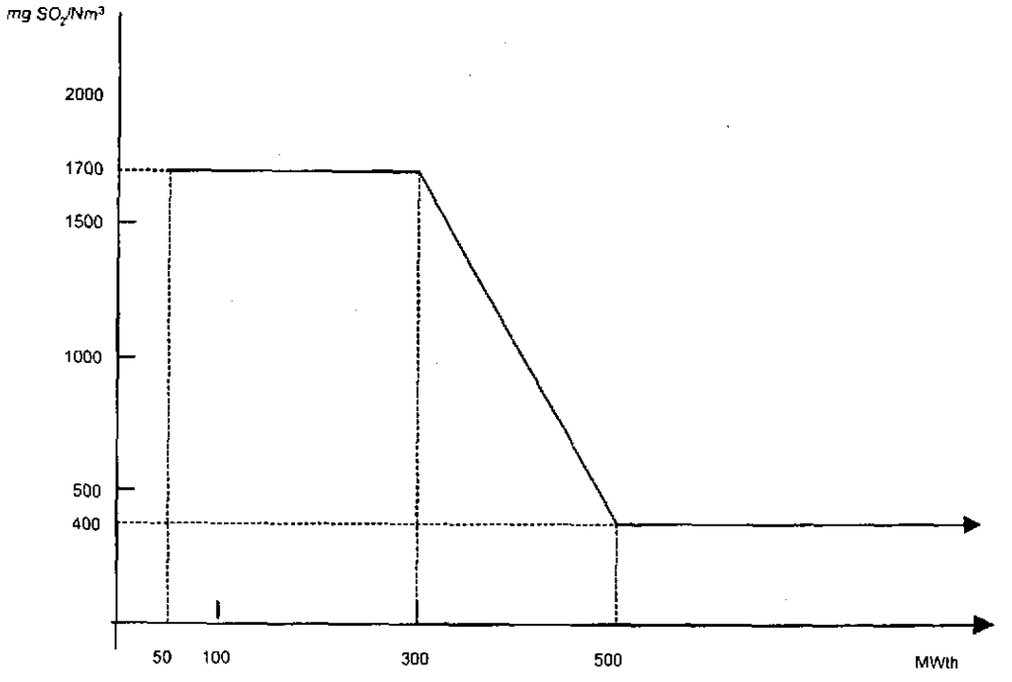
NB. Where the emission limit values above cannot be met due to the characteristics of the fuel, installations shall achieve 300 mg/Nm³ SO_2, or a rate of desulphurisation of at least 92 % shall be achieved in the case of plants with a rated thermal input of less than or equal to 300 MWth and in the case of plants with a rated thermal input greater than 300 MWth a rate of desulphurisation of at least 95 % together with a maximum permissible emission limit value of 400 mg/Nm³ shall apply.

ANNEX IV

EMISSION LIMIT VALUES FOR SO_2

Liquid fuels

A. SO_2 emission limit values expressed in mg/Nm³ (O_2 content 3 %) to be applied by new and existing plants pursuant to Article 4(1) and 4(3), respectively:



B. SO_2 emission limit values expressed in mg/Nm³ (O_2 content 3 %) to be applied by new plants pursuant to Article 4(2) with the exception of gas turbines

50 to 100 MWth	100 to 300 MWth	> 300 MWth
850	400 to 200 *(linear decrease)* (1)	200

(1) Except in the case of the 'Outermost Regions' where 850 to 200 mg/Nm³ (linear decrease) shall apply.

In the case of two installations with a rated thermal input of 250 MWth on Crete and Rhodos to be licensed before 31 December 2007 the emission limit value of 1 700 mg/Nm³ shall apply.

ANNEX V

EMISSION LIMIT VALUES FOR SO_2

Gaseous fuels

A. SO_2 emission limit values expressed in mg/Nm^3 (O_2 content 3 %) to be applied by new and existing plants pursuant to Article 4(1) and 4(3), respectively:

Type of fuel	Limit values (mg/Nm^3)
Gaseous fuels in general	35
Liquefied gas	5
Low calorific gases from gasification of refinery residues, coke oven gas, blast-furnace gas	800
Gas from gasification of coal	(1)

(1) The Council will fix the emission limit values applicable to such gas at a later stage on the basis of proposals from the Commission to be made in the light of further technical experience.

B. SO_2 emission limit values expressed in mg/Nm^3 (O_2 content 3 %) to be applied by new plants pursuant to Article 4(2):

Gaseous fuels in general	35
Liquefied gas	5
Low calorific gases from coke oven	400
Low caloric gases from blast furnace	200

ANNEX VI

EMISSION LIMIT VALUES FOR NO_x (MEASURED AS NO_2)

A. NO_x emission limit values expressed in mg/Nm³ (O_2 content 6 % for solid fuels, 3 % for liquid and gaseous fuels) to be applied by new and existing plants pursuant to Article 4(1) and 4(3), respectively:

Type of fuel:	Limit values (1) (mg/Nm³)
Solid (2), (3):	
50 to 500 MWth:	600
>500 MWth:	500
From 1 January 2016	
50 to 500 MWth:	600
>500 MWth:	200
Liquid:	
50 to 500 MWth:	450
>500 MWth:	400
Gaseous:	
50 to 500 MWth:	300
>500 MWth:	200

(1) *Except in the case of the 'Outermost Regions' where the following values shall apply:*
Solid in general: 650
Solid with < 10 % vol comps: 1 300
Liquid: 450
Gaseous: 350

(2) Until 31 December 2015 plants of a rated thermal input greater than 500 MW, which from 2008 onwards do not operate more than 2 000 hours a year (rolling average over a period of five years), shall:
— in the case of plant licensed in accordance with Article 4(3)(a), be subject to a limit value for nitrogen oxide emissions (measured as NO_2) of 600 mg/Nm³;
— in the case of plant subject to a national plan under Article 4(6), have their contribution to the national plan assessed on the basis of a limit value of 600 mg/Nm³.
From 1 January 2016 such plants, which do not operate more than 1 500 hours a year (rolling average over a period of five years), shall be subject to a limit value for nitrogen oxide emissions (measured as NO_2) of 450 mg/Nm³.

(3) Until 1 January 2018 in the case of plants that in the 12 month period ending on 1 January 2001 operated on, and continue to operate on, solid fuels whose volatile content is less than 10 %, 1 200 mg/Nm³ shall apply.

B. NO_x emission limit values expressed in mg/Nm³ to be applied by new plants pursuant to Article 4(2) with the exception of gas turbines

Solid fuels (O_2 content 6 %)

Type of fuel	50 to 100 MWth	100 to 300 MWth	> 300 MWth
Biomass	400	300	200
General case	400	200 (1)	200

(1) Except in the case of the 'Outermost Regions' where 300 mg/Nm³ shall apply.

Liquid fuels (O_2 content 3 %)

50 to 100 MWth	100 to 300 MWth	> 300 MWth
400	200 (1)	200

(1) Except in the case of the 'Outermost Regions' where 300 mg/Nm³ shall apply.

In the case of two installations with a rated thermal input of 250 MWth on Crete and Rhodos to be licensed before 31 December 2007 the emission limit value of 400 mg/Nm³ shall apply.

Gaseous fuels (O_2 content 3 %)

	50 to 300 MWth	> 300 MWth
Natural gas (note 1)	150	100
Other gases	200	200

Gas Turbines

NO_x emission limit values expressed in mg/Nm³ (O_2 content 15 %) to be applied by a single gas turbine unit pursuant to Article 4(2) (the limit values apply only above 70 % load):

	> 50 MWth (thermal input at ISO conditions)
Natural gas (Note 1)	50 (Note 2)
Liquid fuels (Note 3)	120
Gaseous fuels (other than natural gas)	120

Gas turbines for emergency use that operate less than 500 hours per year are excluded from these limit values. The operator of such plants is required to submit each year to the competent authority a record of such used time.

Note 1: Natural gas is naturally occurring methane with not more than 20 % (by volume) of inerts and other constituents.

Note 2: 75 mg/Nm³ in the following cases, where the efficiency of the gas turbine is determined at ISO base load conditions:
- gas turbines, used in combined heat and power systems having an overall efficiency greater than 75 %;
- gas turbines used in combined cycle plants having an annual average overall electrical efficiency greater than 55 %;
- gas turbines for mechanical drives.

For single cycle gas turbines not falling into any of the above categories, but having an efficiency greater than 35 % – determined at ISO base load conditions – the emission limit value shall be $50*\eta/35$ where η is the gas turbine efficiency expressed as a percentage (and at ISO base load conditions).

Note 3: This emission limit value only applies to gas turbines firing light and middle distillates.

ANNEX VII

EMISSION LIMIT VALUES FOR DUST

A. Dust emission limit values expressed in mg/Nm³ (O_2 content 6 % for solid fuels, 3 % for liquid and gaseous fuels) to be applied by new and existing plants pursuant to Article 4(1) and 4(3), respectively:

Type of fuel	Rated thermal input (MW)	Emission limit values (mg/Nm³)
Solid	≥ 500 < 500	50 (²) 100
Liquid (¹)	all plants	50
Gaseous	all plants	5 as a rule 10 for blast furnace gas 50 for gases produced by the steel industry which can be used elsewhere

(¹) A limit value of 100 mg/Nm³ may be applied to plants with a rated thermal input of less than 500 MWth burning liquid fuel with an ash content of more than 0,06 %.

(²) A limit value of 100 mg/Nm³ may be applied to plants licensed pursuaot to Article 4(3) with a rated thermal input greater than or equal to 500 MWth burning solid fuel with a heat content of less than 5 800 kJ/kg (net calorific value), a moisture content greater than 45 % by weight, a combined moisture and ash content greater than 60 % by weight and a calcium oxide content greater than 10 %.

B. Dust emission limit values expressed in mg/Nm³ to be applied by new plants, pursuant to Article 4(2) with the exception of gas turbines:

Solid fuels (O_2 content 6 %)

50 to 100 MWth	> 100 MWth
50	30

Liquid fuels (O_2 content 3 %)

50 to 100 MWth	> 100 MWth
50	30

In the case of two installations with a rated thermal input of 250 MWth on Crete and Rhodos to be licensed before 31 December 2007 the emission limit value of 50 mg/Nm³ shall apply.

Gaseous fuels (O_2 content 3 %)

As a rule	5
For blast furnace gas	10
For gases produced by the steel industry which can be used elsewhere	30

ANNEX VIII

METHODS OF MEASUREMENT OF EMISSIONS

A. Procedures for measuring and evaluating emissions from combustion plants.

1. *Until 27 November 2004*

Concentrations of SO_2, dust, NO_x shall be measured continuously in the case of new plants for which a licence is granted pursuant to Article 4(1) with a rated thermal input of more than 300 MW. However, monitoring of SO_2 and dust may be confined to discontinuous measurements or other appropriate determination procedures in cases where such measurements or procedures, which must be verified and approved by the competent authorities, may be used to obtain concentration.

In the case of new plants for which a licence is granted pursuant to Article 4(1) not covered by the first subparagraph, the competent authorities may require continuous measurements of those three pollutants to be carried out where considered necessary. Where continuous measurements are not required, discontinuous measurements or appropriate determination procedures as approved by the competent authorities shall be used regularly to evaluate the quantity of the above-mentioned substances present in the emissions.

2. *From 27 November 2002 and without prejudice to Article 18(2)*

Competent authorities shall require continuous measurements of concentrations of SO_2, NO_x, and dust from waste gases from each combustion plant with a rated thermal input of 100 MW or more.

By way of derogation from the first subparagraph, continuous measurements may not be required in the following cases:

— for combustion plants with a life span of less than 10 000 operational hours;

— for SO_2 and dust from natural gas burning boilers or from gas turbines firing natural gas;

— for SO_2 from gas turbines or boilers firing oil with known sulphur content in cases where there is no desulphurisation equipment;

— for SO_2 from biomass firing boilers if the operator can prove that the SO_2 emissions can under no circumstances be higher than the prescribed emission limit values.

Where continuous measurements are not required, discontinuous measurements shall be required at least every six months. As an alternative, appropriate determination procedures, which must be verified and approved by the competent authorities, may be used to evaluate the quantity of the above mentioned pollutants present in the emissions. Such procedures shall use relevant CEN standards as soon as they are available. If CEN standards are not available ISO standards, national or international standards which will ensure the provision of data of an equivalent scientific quality shall apply.

3. In the case of plants which must comply with the desulphurisation rates fixed by Article 5(2) and and Annex III, the requirements concerning SO_2 emission measurements established under paragraph 2 of this point shall apply. Moreover, the sulphur content of the fuel which is introduced into the combustion plant facilities must be regularly monitored.

4. The competent authorities shall be informed of substantial changes in the type of fuel used or in the mode of operation of the plant. They shall decide whether the monitoring requirements laid down in paragraph 2 are still adequate or require adaptation.

5. The continuous measurements carried out in compliance with paragraph 2 shall include the relevant process operation parameters of oxygen content, temperature, pressure and water vapour content. The continuous measurement of the water vapour content of the exhaust gases shall not be necessary, provided that the sampled exhaust gas is dried before the emissions are analysed.

Representative measurements, i.e. sampling and analysis, of relevant pollutants and process parameters as well as reference measurement methods to calibrate automated measurement systems shall be carried out in accordance with CEN standards as soon as they are available. If CEN standards are not available ISO standards, national or international standards which will ensure the provision of data of an equivalent scientific quality shall apply.

Continuous measuring systems shall be subject to control by means of parallel measurements with the reference methods at least every year.

6. The values of the 95 % confidence intervals of a single measured result shall not exceed the following percentages of the emission limit values:

Sulphur dioxide	20 %
Nitrogen oxides	20 %
Dust	30 %

The validated hourly and daily average values shall be determined from the measured valid hourly average values after having subtracted the value of the confidence interval specified above.

Any day in which more than three hourly average values are invalid due to malfunction or maintenance of the continuous measurement system shall be invalidated. If more than ten days over a year are invalidated for such situations the competent authority shall require the operator to take adequate measures to improve the reliability of the continuous monitoring system.

B. Determination of total annual emissions of combustion plants

Until and including 2003 the competent authorities shall obtain determination of the total annual emissions of SO_2 and NO_x from new combustion plants. When continuous monitoring is used, the operator of the combustion plant shall add up separately for each pollutant the mass of pollutant emitted each day, on the basis of the volumetric flow rates of waste gases. Where continuous monitoring is not in use, estimates of the total annual emissions shall be determined by the operator on the basis of paragraph A.1 to the satisfaction of the competent authorities.

Member States shall communicate to the Commission the total annual SO_2 and NO_x emissions of new combustion plants at the same time as the communication required under paragraph C.3 concerning the total annual emissions of existing plants.

Member States shall establish, starting in 2004 and for each subsequent year, an inventory of SO_2, NO_x and dust emissions from all combustion plants with a rated thermal input of 50 MW or more. The competent authority shall obtain for each plant operated under the control of one operator at a given location the following data:

— the total annual emissions of SO_2, NO_x and dust (as total suspended particles).

— the total annual amount of energy input, related to the net calorific value, broken down in terms of the five categories of fuel: biomass, other solid fuels, liquid fuels, natural gas, other gases.

A summary of the results of this inventory that shows the emissions from refineries separately shall be communicated to the Commission every three years within twelve months from the end of the three-year period considered . The yearly plant-by-plant data shall be made available to the Commission upon request. The Commission shall make available to the Member States a summary of the comparison and evaluation of the national inventories within twelve months of receipt of the national inventories.

Commencing on 1 January 2008 Member States shall report annually to the Commission on those existing plants declared for eligibility under Article 4(4) along with the record of the used and unused time allowed for the plants' remaining operational life.

C. Determination of the total annual emissions of existing plants until and including 2003.

1. Member States shall establish, starting in 1990 and for each subsequent year until and including 2003, a complete emission inventory for existing plants covering SO_2 and NO_x:

   — on a plant by plant basis for plants above 300 MWth and for refineries;

   — on an overall basis for other combustion plants to which this Directive applies.

2. The methodology used for these inventories shall be consistent with that used to determine SO_2 and NO_x emissions from combustion plants in 1980.

3. The results of this inventory shall be communicated to the Commission in a conveniently aggregated form within nine months from the end of the year considered. The methodology used for establishing such emission inventories and the detailed base information shall be made available to the Commission at its request.

4. The Commission shall organise a systematic comparison of such national inventories and, if appropriate, shall submit proposals to the Council aiming at harmonising emission inventory methodologies, for the needs of an effective implementation of this Directive.

ANNEX IX

TIME-LIMITS FOR TRANSPOSITION AND IMPLEMENTATION OF THE REPEALED DIRECTIVE

(referred to in Article 17(1))

Directive	Time-limits for transposition	Time-limits for application
88/609/EEC (OJ L 336, 7.12.1988, p. 1)	30 June 1990	1 July 1990 31 December 1990 31 December 1993 31 December 1998 31 December 2003
94/66/EC (OJ L 337, 24.12.1994, p. 83)	24 June 1995	

ANNEX X

CORRELATION TABLE

(Referred to in Article 17(3))

This Directive	Directive 88/609/EEC
Article 1	Article 1
Article 2	Article 2
Article 3	Article 3
Article 4(1)	Article 4(1)
Article 4(2), (3) and (4)	
Article 4(5)	Article 4(3)
Article 4(6), (7) and (8)	
Article 5	Article 5
	Article 6
Article 6	
Article 7	Article 8
Article 8	Article 9
Article 9	Article 10
Article 10	Article 11
Article 11	Article 12
Article 12	Article 13(1)
Article 13	Article 14
Article 14	Article 15
Article 15(1), (2) and (3)	Article 16(1), (2) and (4)
Article 16	
Article 17	
Article 18(1), first subparagraph, and (3)	Article 17(1) and (2)
Article 18(1), second subparagraph, and (2) and Article 19	
Article 20	Article 18
Annexes I to VIII	Annexes I to IX
Annex IX and X	—