

Final Report

Feasibility Study for Solid Waste Management in Jijel, Algeria

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PREPARED FOR

City of Jijel

PREPARED BY

Brown, Vence & Associates
65 Battery Street, Suite 200
San Francisco, CA 94111

f. cyp

with assistance from

Nationale Eau et Environnement
50 Rue Kelifa
Boukhalfa, Alger



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Table of Contents

EXECUTIVE SUMMARY

SECTION 1 | INTRODUCTION

1.1 Description of Study	1 - 2
1.2 Procedures Used to Prepare Study	1 - 3
1.3 Report Organization.....	1 - 3

SECTION 2 | JIJEL'S SOLID WASTE MANAGEMENT SYSTEM

2.1 Overview of Jijel's Solid Waste System	2 - 1
2.2 Solid Waste System Management	2 - 3
2.3 Operations	2 - 3
2.4 Facilities	2 - 6
2.5 Recycling	2 - 8
2.6 Environmental Laws and Regulations	2 - 11
2.7 Economic Considerations	2 - 15

SECTION 3 | WASTE GENERATION AND DISPOSAL

3.1 Background	3 - 1
3.2 Waste Sectors	3 - 2
3.3 Quantity of Waste Generation and Disposal	3 - 2
3.4 Projected Waste Generation and Disposal	3 - 5
3.5 Physical Characteristics of Waste	3 - 7
3.6 Moisture Content Analysis	3 - 8
3.7 Survey	3 - 12

SECTION 4 | WASTE MANAGEMENT TECHNOLOGIES

4.1 Collection Methods	4 - 1
4.2 Materials Recovery	4 - 2
4.3 Organic Materials Management	4 - 5
4.4 Sanitary Landfills	4 - 9
4.5 Landfill Gas Recovery	4 - 12
4.6 Incineration and Waste-to-Energy Technologies	4 - 16
4.7 Medical Waste Management	4 - 22

SECTION 5 | WASTE MANAGEMENT IMPROVEMENTS

5.1 Replacement of Collection Equipment	5 - 2
5.2 Mezraitine Dump Site Closure	5 - 10
5.3 Development of a New Sanitary Landfill	5 - 15
5.4 Slaughterhouse Waste Disposal	5 - 24
5.5 Medical Waste Incinerator Improvements	5 - 25

SECTION 6 | ENVIRONMENTAL IMPACTS AND REGULATORY ENFORCEMENT

6.1 Background	6 - 1
6.2 Waste Collection	6 - 2
6.3 Mezraitine Dump Site Closure	6 - 4
6.4 New Landfill and Vermicomposting Operation	6 - 6
6.5 Slaughterhouse Waste Disposal	6 - 9
6.6 Medical Waste Incinerator - Air Pollution Control Devices	6 - 10

SECTION 7 | OPERATION PLANS FOR WASTE MANAGEMENT IMPROVEMENTS

7.1 Waste Collection Operations Plan	7 - 1
7.2 Mezraitine Dump Site Closure Plan	7 - 5
7.3 Operations Plan for a New Sanitary Landfill with Vermicomposting Facilities ...	7 - 17
7.4 Slaughterhouse Waste Collection and Disposal Plan	7 - 21
7.5 Air Pollution Control Devices	7 - 22

SECTION 8 | FACILITY SITING

8.1 General Siting Criteria	8 - 1
8.2 Solid Waste Facility Siting Regulations	8 - 3
8.3 Environmental Criteria	8 - 4
8.4 Site Evaluation and Land Use Data	8 - 4
8.5 Barriers and Opportunities	8 - 7
8.6 Socioeconomic Factors	8 - 8
8.7 Waste Transportation	8 - 8

SECTION 9 | GENERATOR OPT-OUT CONDITIONS

Background	9 - 1
Recommendations	9 - 1

SECTION 10 | U.S. PRIVATE SECTOR CAPABILITIES

10.1 Summary of Events	10 - 2
10.2 Tour and Conference Evaluation	10 - 4
10.3 U.S. Private Sector Participation	10 - 5
10.4 U.S. Sources of Supply	10 - 7

SECTION 11 | CAPITAL AND OPERATING COSTS

11.1 Capital Costs of Improvements	11 - 2
11.2 Operating Costs of Improvements	11 - 7
11.3 Comparison of Existing to Proposed Costs	11 - 9

SECTION 12 | PRICING STRATEGY

Pricing Issues in Jijel	12 - 1
12.1 Revenue Generation Options	12 - 2
12.2 Typical User Fee Systems	12 - 5

SECTION 13 | FINANCING MECHANISMS

13.1 Public Financing Options	13 - 1
13.2 Private Financing Options.....	13 - 7
13.3 Loan Guarantees and Investment Insurance	13 - 14
13.4 Recommendation	13 - 17

SECTION 14 | PROJECT IMPLEMENTATION STRATEGY

14.1 Collection Equipment	14 - 2
14.2 Mezraitine Dump Site Closure	14 - 3
14.3 Development of a New Sanitary Landfill and Vermicomposting Facilities	14 - 4
14.4 Slaughterhouse Waste Disposal	14 - 5
14.5 Medical Waste Incinerator Improvements	14 - 6
14.6 Implementation Plan Summary	14 - 8

APPENDICES

Appendix A Legislative Articles Relating to Algerian Environmental Laws
Appendix B Waste Characterization Study Protocol
Appendix C Moisture Content Analysis
Appendix D Waste Survey Summaries and Forms
Appendix E Collection Equipment Vendor Information
Appendix F Vermicomposting Information
Appendix G Sanitary Landfill Site Information
Appendix H Sample Rate Tables

Executive Summary

Brown, Vence & Associates (BVA), with local assistance from Nationale Eau et Environnement (NEE), conducted a Solid Waste Feasibility Study (Study) for Jijel, Algeria. The City of Jijel (City), the U.S. Trade and Development Agency (TDA), an agency of the U.S. State Department that promotes U.S. exports to foreign countries, and BVA all co-funded the Study. The idea for the Study came from discussions between BVA, TDA, NEE, and Jijel officials regarding improvement of the City's solid waste management infrastructure. The City wants to improve and clean up its solid waste programs, facilities, and operations in order to attract more visitors and bolster its economy. With BVA and NEE supplying engineering, economic, environmental, and planning expertise, this report examines and evaluates the current solid waste infrastructure, proposes various alternatives available to the City for meeting its improvement and clean-up goals, and examines selected alternatives in detail, including economic analysis and strategic planning. TDA's interest in this Study is to develop projects from these alternatives that present opportunities for U.S. companies to provide supplies and equipment or engineering and consulting services.

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Principal Assumptions and Considerations

To prepare this Study, BVA and NEE collected information from several sources including the City, consultants, regulatory agencies and other sources. We have relied upon the information contained within the documents given to us by these sources, including their assumptions, to provide opinions and recommendations. We believe the use of such information and assumptions is reasonable for the purposes of our report.

The Study was conducted through implementation of several project tasks. Tasks included:

- Collecting and reviewing all relevant background information;
- Analyzing data with regard to generation and disposal of targeted waste streams;
- Identifying alternative management scenarios for the collection, handling, and disposal of the target waste streams;
- Reviewing and recommending appropriate types of storage, collection, recycling, disposal systems and equipment;
- Providing advice on regulatory enforcement;
- Preparing operating plans;
- Reviewing land use, socioeconomic, and transport data related to facility siting;
- Identifying the conditions under which generators might choose to opt out of the system;
- Providing information on U.S. Private-Sector capabilities;
- Assessing capital and operations costs for components of Jijel's operations;
- Assessing the options for setting a pricing strategy to encourage generators to participate in the system;
- Providing financial advice on public and private project finance mechanisms;
- Preparing a project implementation strategy plan.

Findings and Recommendations are summarized below.

Findings

Waste Quantities

- The average municipal solid waste generation in Jijel is approximately 700,000 kilograms per day or 70 metric tons per day.
- Residential and commercial generation from City collection vehicles is calculated to be approximately 50 tons daily or about 15,600 tons annually.
- Self-haul wastes from businesses and residents amount to approximately 20 tons per day.
- The waste growth rate is estimated to be about 3.43 percent per year between 1998 and 2003, 2.95 percent per year between 2004 and 2008 and 2.45 percent per year between 2009 and 2018.

Waste Characterization

- The waste characterization study conducted for Jijel shows that approximately 9.6 percent of the waste stream was paper, 0.9 percent glass, 1.9 percent metal, 8.3 percent plastics, 70.3 percent other organics, 7.5 percent other and 1.4 percent special waste. The largest portion of the waste stream was food waste at 59.4 percent.
- Moisture content of the waste was estimated to be approximately 48.5 percent.

Waste Collection

- The City collects residential and commercial waste from 10 zones, either door-to-door or from neighborhood collection points.
- All vehicles currently used to collect waste are open-top types; no compactor vehicles are being used by the City (although one compactor vehicle is owned by the City, it is not operational).
- All refuse collected by the City is disposed of at one disposal site, the Mezraitine dump site located approximately 8 kilometers southwest of the City.
- Some businesses and residents self-haul waste to the dump site.

Recycling

- Informal recycling occurs at the dump site. Recycled film plastic, paper, and ferrous metal are sold in Algiers.
- A glass factory in the Taher Commune, about 15 kilometers east of Jijel, buys glass that is separated from the waste stream before the waste goes to the dump site.

Disposal

- The dump site is open seven days a week. Because it has no gate or entrance station, formal operating hours are not applicable. There is no scale or entrance station at the facility. There is no information of depth, age, and quantity of refuse filled at the existing site. The deposited waste is scattered about rather than being uniformly filled. It appears that depths of waste burial are relatively shallow.
- A landfill gas-to-energy project at the Mezraitine site is not feasible due to the current filling methods.
- The Mezraitine dump site needs proper closure or rehabilitation for the following reasons: the dump has no environmental control measures; it is on fire; seagulls, dogs, goats, and cows graze on the deposited refuse; and there is no waste cover of any sort.
- The City has identified a proposed site for a new, properly managed sanitary landfill about 17 kilometers southeast of Jijel. This site is approximately 12 hectares in size.

- A portion of waste never reaches the dump site; numerous illegal dump sites exist in Jijel and throughout neighboring areas.
- Refuse is often scattered in the streets, necessitating street sweeping. Forty street sweepers clear the streets manually with brooms, shovels, and rakes.
- Some construction and demolition debris, including green waste, is disposed of along roads and highways.
- Waste-to-energy (WTE) does not appear to be feasible in Jijel due to high initial capital and operating costs, waste stream characteristics, and the low value of electricity in Jijel.

Industry

- The slaughterhouse disposed of approximately 679 kilograms of meats and 2,071 kilograms of organs in 1999. The slaughterhouse estimates that it has disposed of approximately 368 kilograms in the first quarter of 2000. These wastes are not disposed of at the dump site. It is reported that meat and organ wastes were dumped directly into the Mediterranean Sea.
- The tannery generates about 2,000 kilograms of biodegradable animal greases and skins per day and 7,800 kilograms of organic scrap tanning waste (treated with chromium). This scrap waste had historically been sent to Ain Defla for the manufacturing of mock leather. Ain Defla closed in 1996 and these wastes are currently disposed of at the dump site. The Jijel tannery is currently searching for financing to purchase equipment to manufacture the mock leather.
- Approximately 1,460,000 kilograms (1,460 tons) of cork waste are being generated and disposed of annually in the dump site by the two local cork manufacturing plants. The plants are currently looking at ways to use the waste in nurseries or as furnace fuel.
- Ecotex of Jijel produces about 300,000 shirts per year. Wastes consist of cloths (falls), spools, cardboard, and cellophane. Falls of cloths were sent to Enaditex of Bejaia for the manufacture of carpet by Sidi Aiche. However, due to the high cost of transportation, these wastes are currently being delivered weekly to the dump site.

Medical Waste

- Hospital waste, including needles, syringes, expired medication, and bio-medical waste, is incinerated within the hospital. The ash and residue of the incinerated hospital waste are disposed at the existing Mezraitine dump site. On occasion, this waste is still burning when it is delivered to the dump site and subsequently ignites other waste.
- The hospital estimates that it currently generates about 150 to 200 kilograms per day of medical waste. Other medical facilities are estimated to generate about 75 to 85

kilograms per day. The medical waste is incinerated using two incinerators located at the hospital. The incinerators have a rated capacity of 60 to 90 kilograms per hour.

Legislation

- All Algerian national territories have put structures in practice to address potential environmental problems (Inspections of the Environment). The protection of the environment is governed by law number 83-03 dated on February 5, 1983. This law, considered as the fundamental basis of the Algerian environmental legislation, has been the subject of many application decrees and is composed of six titles.
- Local implementation and enforcement of applicable regulations appears to be incomplete in Jijel. For example, Jijel officials did not possess copies of the 1982 regulations that apply to Algerian cities.

Economics

Residents of Jijel currently pay between 375 and 500 dinars (US \$4 - \$6) per year as part of their property tax, for the solid waste management services the City provides. Commercial and industrial generators pay an annual tax of 1,000 to 4,000 dinars (US \$11 - \$45) per year for solid waste services, depending on business size and location. All property owners pay the fee whether or not they choose to use the City's collection service or transport waste to the dump site themselves. These fees are not paid separately but are instead combined with other required taxes. No disposal fees are collected at the dump site. In addition to these fees, residents and businesses purchase plastic bags at a relatively high cost of 15 - 20 dinars per bag (about US \$0.17 - \$0.22). Assuming that 1) residents generate about 0.6 kilograms (about 1.3 pounds) of refuse per person per day (according to the Algerian Inspection of the Environment), 2) each household contains approximately 6.58 residents, and 3) each bag holds about 15 kilograms, approximately 96 bags are needed per household per year. Thus it costs each household that uses the bags, an additional 1,400 - 2,000 dinars (approximately US \$15 - \$22) per year.

Recommendations

Waste Collection

- The City's current solid waste collection infrastructure consists of waste that is generated and left for collection in one of three ways: 1) residents dispose of waste throughout the City using plastic bags, cans, or bins at the curb or a fixed centralized collection point, 2) commercial and industrial businesses set out moderate to large amounts of waste that require multiple weekly pick-ups, and 3) waste is deposited in movable debris box containers at certain collection points throughout the City. To improve collection operations efficiency, a different type of waste collection vehicle should be used in each of these three scenarios. To collect residential wastes in bags and cans, a rear-loader collection vehicle is most efficient. To collect commercial and industrial business waste, a front-loader collection vehicle is most efficient. To collect the debris boxes, a roll-off vehicle is most efficient.
- In reviewing the amount of waste generated by the City, it is clear that residents generate the largest amount of waste. We are recommending the purchase of four rear-loader compaction vehicles to handle this waste. One front-loader compaction vehicle is recommended to handle the City's commercial and industrial businesses. One new roll-off vehicle is recommended for collection of the City's debris boxes. In addition, it is recommended that the City retain two to three of their current collection vehicles as back-ups including one roll-off vehicle.
- To operate the commercial and roll-off collection routes efficiently, new bins and debris boxes are recommended. We recommend that the City purchase 10 – 1.2 cubic meter bins, 30 – 2.3 cubic meter bins, and 10 – 4.6 cubic meter bins. In addition, we recommend that the City purchase 10 – 23 cubic meter roll-off boxes.
- Jijel's existing waste collection system will need to be modified to take advantage of the efficiencies created by the new equipment. Even before the equipment is delivered, several plans should be initiated. A plan for revised collection routes and delivery and installation of the new bins and boxes needs to be developed. Once the equipment is delivered, the solid waste management staff will require training in proper operation of the new equipment.

Mezraitine Dump Site

- BVA recommends that the Mezraitine dump site be properly closed and secured. Closure of the dump site should occur in several phases; 1) developing a closure plan that includes the identification of the limits of wastes, a waste consolidation plan, and a final cover soil placement plan, 2) developing and implementing an operations and

facilities transition plan, 3) implementing the actual dump site closure activities, and 4) long-term maintenance of the dump site after closure (post-closure).

- We recommend that the City adopt new operating protocols that consolidate and cover the waste at the dump site while it is still in operational mode, prior to opening the new site. A full-time skilled equipment operator needs to be hired and trained to consolidate and cover the fill. In addition, some contractor assistance, including securing the closed site with fencing will be required.

New Sanitary Landfill

The City is considering development of a new sanitary landfill at a 12-hectare site located approximately 17 kilometers south of the City. We recommend further investigation into development of this site as a sanitary landfill for Jijel. The new sanitary landfill should be designed to include:

- Liners to aid in the protection of the groundwater and the collection of leachate;
- Leachate collection system to prevent groundwater contamination;
- Gas recovery system planning for the future installation of monitoring and collection systems;
- Groundwater protection and monitoring, including wells;
- Adequate quantities of soil to provide daily cover soil and final cover soil needs;
- Effective operations to include a organized plan for cell management and vehicle traffic control;
- Trained personnel to conduct and manage landfill operations and oversee any other waste management activities at the site such as the planned vermicomposting operation;
- Equipment necessary to move, deposit, and compact incoming waste and manage other landfill activities.

The first step for Jijel in developing the landfill is to conduct a more in-depth environmental impact analysis on the proposed site. A consultant should be hired to evaluate the potential impacts and propose mitigations. The geological and hydrogeological conditions need careful examination. After it is determined that the site is appropriate for landfill operations, a consultant needs to be retain to develop a master plan and prepare the design. A contractor then needs to be hired to develop the initial cell. This would include excavating the initial landfill cell, stockpiling soil, and installing a liner. The initial cell should have four to five years of capacity.

Vermicomposting

- Approximately 60 percent of the total waste stream is food waste. Vermicomposting, a low-tech composting method capable of decomposing a large proportion of food waste, is being recommended because food waste accounts for such a large portion of the City's waste stream. Vermicomposting in windrows (long piles approximately 1 to 1.5 meters in height by 0.5 meters in width by any length) should be used because it is relatively inexpensive, though more labor intensive, compared to high-tech composting technologies using more costly equipment. Piles are of a manageable size for standard tools and labor and decomposition generally occurs more quickly than in conventional thermophilic composting.
- To initiate vermicomposting operations, two operators should be hired (one skilled and one unskilled). They should receive training from outside source. In addition certain equipment, including a water tank and watering system will need to be installed at the portion of the landfill site designated for vermicomposting. Worms will need to be procured and loads of organic material segregated and stockpiled. Increasing the size of operations past the initial phase may require the City to implement a separate organic materials collection program.

Slaughterhouse Wastes

- The slaughterhouse waste is currently self-hauled and disposed of in the Mediterranean Sea. The first step for the City in redirecting the slaughterhouse wastes is to meet with slaughterhouse representatives to discuss and prepare a plan for collection and disposal of their waste. Either the slaughterhouse will need to be required to haul their waste to the dump site or the City will need to collect this waste separately and charge the slaughterhouse accordingly.
- After the slaughterhouse waste is delivered to the dump site, special disposal methods should be employed. A distinct site for the burial of slaughterhouse wastes needs to be developed at the dump site and new sanitary landfill in Jijel. An isolated cell, or mono cell, will be built similarly to the other MSW landfill cells. However, this cell will be smaller in size and will not receive MSW loads.

Medical Waste Handling

- A two-step approach is proposed for Jijel's medical waste (MW).
- The first step is to retrofit the existing MWI units with appropriate air pollution control devices to limit fugitive emissions.
- The second step is to segregate MW ash as it enters the Mezraitine dump site or new sanitary landfill and place it in a separate mono cell away from other refuse.

Environmental Regulations

- The City may eventually help influence national environmental strategies and policies. However, we anticipate that the City's most expeditious route towards improving environmental protection in the municipality would be to work with its provincial EIA. A general recommendation for Jijel is to work with the EIA to properly implement and enforce existing regulations. Because the City cannot comply with current regulations without being aware of them, the first step is to obtain copies of applicable environmental laws and regulations and distribute them or make them readily available to local officials, solid waste system administrators and operators, and waste generators.
- Vehicles should use fuels that produce a minimum level of harmful air emissions. Lead in gasoline, sulfur in diesel fuel, and other toxic compounds should be limited or prohibited from use. New vehicles should use catalytic converters, which reduce emissions of hydrocarbons, diesel particulate matter, and air toxics.
- Waste generators must properly store refuse that is awaiting collection in a container of sufficient capacity to hold all of the waste generated between pickups. The container should have a tight-fitting lid that prevents vermin, flies, and other potential disease vectors from gaining access to the refuse.
- The City should establish a program to specifically collect hazardous waste from residential and commercial customers. These hazardous wastes should be properly treated or disposed of.
- The City should require that all closed landfills be actively monitored for at least 10 to 15 years following the closure and require landfill closure activities to include provisions for leachate control. An effective final landfill cover that reduces the filtration of rainfall into the solid waste will lessen leachate generation. However, some volume of leachate will continue to be produced due to the continued decomposition of waste. This leachate must be properly drained, collected, and treated before discharge. Treated leachate should meet regulated effluent standards. Require periodic ground and surface water quality monitoring to identify leachate leakage from the closed landfill. Require landfill closure activities to include provisions for landfill gas management for as long as the landfill produces landfill gas. Management methods may involve installation of landfill gas extraction, collection, and destruction (typically flaring) or utilization (typically energy recovery) systems. Require periodic air quality monitoring to identify landfill gas leaks from the closed landfill.
- The City should require that new sanitary landfills adopt landfilling standards to include proper liners that prevent the migration of leachate into underlying soils, develop minimum standards for landfill liners, and require periodic air quality monitoring to identify landfill gas leaks from the operating landfill.

- The City should prohibit generators of slaughterhouse waste from uncontrolled dumping into the Mediterranean Sea. Require all blood waste not beneficially utilized to be properly treated before discharge. Use of a local water treatment facility should be arranged. Discharged effluent should meet regulated effluent standards.
- The City should review current limits for waste water discharges, and, if necessary, modify these standards to apply to discharges from medical waste incineration facilities. The City should mandate that at a minimum, all incineration facilities control and treat their waste water to meet the required standards. It should set limits for concentrations of specified contaminants in solid waste from medical waste incineration facilities and mandate that all incineration facilities properly treat their solid waste to meet the required limits.

Generator Opt-Out Conditions

- Any waste generator seeking an exemption from the City's solid waste system should complete and submit an official application form and application fee to Jijel. Waste generators who do not meet the established criteria should be required to use the improved waste collection system. This is essential if the City expects to rely on the customer-generated revenues for all or a significant part of its operating revenues. Requiring the use of the system is also a good practice for business, health, and safety reasons. Enforcing this rule may involve levying an appropriate fine on waste generators who dump waste illegally or utilize the system without paying for it. The City may have to formulate additional penalties for waste generators who neglect to pay their fines. If appropriate, withholding other publicly provided utility services could serve this purpose.

Pricing Strategy

- Continue to subsidize the system initially while implementing a transition plan that gradually increases customer rates to the actual cost of service over a 5 to 10 year period.
- Gradually implement a different method of assessing customer fees, so customers who generate more waste pay a higher fee than those who generate less waste.
- Develop an enforcement mechanism for more complete and successful collection of bills so every waste generator that utilizes the system pays for the services.
- Implement the proposed system improvements; they will increase operational efficiencies

Financing

- We understand that the City is interested in continuing public ownership and operations of its solid waste infrastructure. In this case, the City should seek financing from the World Bank and the African Development Bank. The City should also consider the funding available from in-country sources. Another option is to seek financing from the various equipment vendors and suppliers of services and materials, with appropriate export bank guarantees.
- If the City desires to transfer the responsibility for some or all of the system improvements to the private sector and forego the lengthy process and requirements involved in obtaining multilateral bank funding, we recommend that the City require private contractors to finance the proposed solid waste system. The City could structure the project cost recovery method and solid waste management system so the arrangement is attractive to the private sector. Contractors and their financing agents will make their own assessment about whether the potential profits outweigh the financing risks. A well-structured project will attract interest and investment from the private sector.

Implementation Plan

The recommended implementation plan is attached as Exhibit 1.

Exhibit 1 | Implementation Plan

Implementation Step	Responsible Agency	Outside Resources	Timeframe	Capital Cost (dinars)	Annual Cost (dinars)
Collection Equipment			18 - 24 weeks	95,960,000 DA	Save 2,360,000 DA
Prepare Bid Document	City	Consultant	4 - 6 weeks	4,500,000 DA	None
Select Vendor	City	Consultant	4 - 6 weeks	Included Above	None
Negotiate Contract	City	Consultant	6 - 8 weeks	Included Above	None
Procure Financing	City	Finance Agency	6 - 8 weeks	Included Above	None
Revise Collection Zones	City	Consultant	10 - 12 weeks	Included Above	None
Operations Training	City	Consultant	2 - 4 weeks	Included Above	None
Mezraitine Closure			1 - 2 years	16,200,000 DA	1,000,000 DA
Develop Closure Plan	City	Consultant	6 - 8 weeks	4,500,000 DA	None
Develop Transition Plan	City	City & Consultant	6 - 8 weeks	Included Above	None
Hire/Train Equip Operator	City	City & Consultant	2 - 4 weeks	Included Above	Included Above
Close Site/Operations	City	Consultant & Contractor	1 - 2 years	9,000,000 DA	Additional 1,000,000 DA
Monitor Closed Site	City	City & Consultant	15 - 20 years	2,700,000 DA	Variable
New Sanitary Landfill			1 - 2 years	27,000,000 DA	1,000,000 DA
Environmental Analysis	City	Consultant	3 - 6 months	Included Above	Staff Time
Master Plan & Design	City	Consultant	3 - 6 months	Included Above	Staff Time
Develop Site	City	Contractor	6 -12 months	Included Above	Staff Time

Implementation Step	Responsible Agency	Outside Resources	Timeframe	Capital Cost (dinars)	Annual Cost (dinars)
Vermicomposting			2 - 3 months	16,200,000 DA	1,080,000 DA
Hire & Train Two Operators	City	City & Consultant	2 - 4 weeks	3,600,000 DA	450,000 DA
Procure & Install Equipment	City	Vendor	2 - 3 months	12,600,000 DA	None
Procure Worms/Begin Operations	City	Consultant	2 - 3 months	Included Above	630,000 DA
Slaughterhouse Waste			2 - 3 months	3,200,000 DA	Staff Time
Collection Plan	City	Slaughter House	4 - 6 weeks	Staff Time	Staff Time
Mono Cell Development	City	Consultant & Contractor	2 - 3 months	3,200,000 DA	Staff Time
Medical Waste Incinerators			18 - 24 weeks	21,650,000 DA	900,000 DA
Conduct Emissions Test	City	Consultant	4 - 6 weeks	450,000 DA	None
Prepare Bid Document	City	Consultant	4 - 6 weeks	4,500,000 DA	None
Select Vendor	City	Consultant	4 - 6 weeks	Included Above	None
Negotiate Contract	City	Consultant	6 - 8 weeks	Included Above	None
Procure Financing	City	Finance Agency	6 - 8 weeks	Staff Time	None
Installation & Start-Up	City	Vendor	8 - 16 weeks	Staff Time	None
Appoint & Train Staff Person	City	Consultant	1 - 3 months	2,700,000 DA	None
Public Education	City	Consultant	2 - 3 months	3,600,000 DA	900,000 DA

Section 1 | Introduction

Background

The Jijel, Algeria Solid Waste Feasibility Study (Study) was conducted by Brown, Vence & Associates (BVA) with local assistance from Nationale Eau et Environnement (NEE). The Study was co-funded by the City of Jijel (City) and the U.S. Trade and Development Agency (TDA), an agency of the U.S. State Department that promotes U.S. exports to foreign countries. BVA also contributed to the development of this Study. TDA hopes this Study will develop projects that present opportunities for U.S. companies to provide supplies, equipment, engineering, or consulting services to the City. It should be understood that there is no agreement by the City of Jijel or other Algerian government agencies to purchase any U.S. services or products upon completion of this Study.

The impetus for the Study came from discussions between BVA, TDA, NEE, and Jijel officials regarding improvement of the City's solid waste management infrastructure. The City was interested in improving its solid waste programs, facilities, and operations to attract more visitors and bolster its economy.

With BVA and NEE supplying engineering, economic, environmental, and planning expertise, this report examines and evaluates the current solid waste infrastructure, proposes alternatives for meeting the City's improvement and clean-up goals and provides regulatory, financial, economic and strategic assistance.

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1.1 | Description of Study

The Study was conducted through implementation of several project tasks, including:

- Collecting and reviewing all relevant background information;
- Analyzing data related to the generation and disposal of targeted waste streams;
- Identifying alternative management scenarios for the collection, handling, and disposal of the target waste streams.
- Reviewing and recommending appropriate types of storage, collection, recycling, disposal systems, and equipment;
- Providing advice on regulatory enforcement;
- Preparing operating plans;
- Reviewing land use, socioeconomic, and transport data related to facility siting;
- Identifying the conditions under which generators might choose to opt out of the system;
- Providing information on U.S. Private Sector capabilities;
- Assessing capital and operations costs for components of Jijel's operations;
- Assessing the options for setting a pricing strategy to encourage generators to participate in the system;
- Providing financial advice on public and private project finance mechanisms;
- Preparing a project implementation strategy plan.

1.1.1 | Site Visits

The Study began with a visit to Algeria to observe the solid waste infrastructure. Mr. Brian Keane and Mr. Michael Kent of BVA conducted a field visit to Algeria between March 25 and April 4, 2000. BVA met with NEE staff and Jijel officials several times during the visit. The NEE staff who worked with BVA were Monsieur Lyes Rouidi, the General Manager of NEE; Madame Fatima Zohra Abdelazziz, the Director of Environmental Impact Studies and Waste Management for NEE; Mademoiselle Fadila, an agricultural engineer for NEE; and Mademoiselle Soraya, an assistant to M. Rouidi and a translator.

BVA also met with the following Jijel officials several times: Monsieur Boussoufa Athmane, the Environmental Inspector for the province of Jijel; Monsieur Khireddine Abdou, the vice-mayor of Jijel and our main technical contact for gathering information in Jijel; and President (Mayor) Nassredine Kimouche.

These meetings were held to discuss past and current solid waste management practices, including operations and facilities; to obtain any prior studies, procurement documents, and laws and regulations regarding waste management; and to obtain operating data from Jijel's current collection, processing, handling, and disposal operations.

BVA visited the current Dump Site, as well as the site for a proposed new landfill, which is an undeveloped site in a rural area located about 17 km south of Jijel. Observations from these visits are included in Section 2.

1.1.2 | Surveys and Data Collection

BVA, with the assistance of NEE, conducted a waste characterization study in Jijel. According to NEE staff, the results of the waste characterization were similar to the results of previous waste characterizations conducted in other Algerian cities. Results of this waste characterization are described in Section 3. BVA, with the assistance of NEE, also carried out a survey of residents and businesses in Jijel to better understand the solid waste infrastructure. This survey is also discussed in Section 3.

1.1.3 | Review of Past Studies

Past solid waste studies from the Jijel region were not available for review. However, NEE and a German consultant conducted a solid waste feasibility study in 1994-95 for the province of Algiers, which addressed recycling, composting, and waste management alternatives. Waste composition studies have also been conducted for other Algerian cities. BVA reviewed this information as part of conducting the Study.

1.2 | Procedures Used to Prepare Study

To prepare this report, BVA and NEE collected information from several sources including the City, consultants, regulatory agencies, and other sources. We have relied upon the information provided in the documents we received from these sources, including their assumptions, to provide opinions and recommendations. We believe the use of such information and assumptions is reasonable for the purposes of our report.

1.3 | Report Organization

The report is structured to provide the following: an introduction, background, and description of the Study (Section 1); information on Jijel's current solid waste management

system (Section 2); waste generation and disposal quantity and composition analyses (Section 3); waste management technology descriptions (Section 4); improvements appropriate for Jijel (Section 5); regulatory review (Section 6); operations plans for Jijel improvements (Section 7); siting issues (Section 8); generator opt-out conditions (Section 9); description of U.S. capabilities (Section 10); project economics (Section 11); pricing strategies (Section 12); discussion of finance mechanisms (Section 13); and an implementation strategy plan (Section 14).

Section 2 | Jijel's Solid Waste Management System

Jijel is a resort town located on the Mediterranean coastline in the northern part of the Wilaya (province) of Jijel, approximately 359 kilometers east of the country's capital of Algiers. Jijel is bordered to the north by the Mediterranean Sea, to the south by the Township of Kaous, to the east by the Township of the Emir Abdel Kader, and to the west by the Township of El Aouana. Exhibit 2-1 shows Jijel and the surrounding areas. Jijel occupies approximately 6.57 hectares in area. Jijel's population is approximately 119,147 according to a 1999 projection from the City of Jijel Planning and Urbanism Plan. Jijel has commercial and industrial business sectors and a port for shipping and receiving. This section describes Jijel's current waste management system and includes an overview of management, operations, equipment, facilities, environmental laws and regulations, and economic considerations.

2.1 | Overview of Jijel's Solid Waste System

The City of Jijel manages urban solid waste collection for its residents. Residential, commercial, and street sweeping waste is collected from 10 city zones, either door-to-door or from neighborhood collection points. Sweeper personnel are employed to clear the streets of scattered refuse. All refuse collected in this manner is combined prior to disposal at the official disposal site, the Mezraitine dump site located approximately 8 kilometers southwest of the City. The Mezraitine dump site receives waste from City collectors as well as self-hauled waste from various large industries and small generators. Informal recycling occurs by way of individuals or scavengers who recover recyclable materials for resale either prior to the refuse arriving at the dump site or at the dump site site. Numerous illegal dump sites also exist throughout Jijel and neighboring areas.

2.2 | Solid Waste System Management

The organizational structure of the City government (referred to as the APC, Assembly of Popular Commune) consists of several layers of management. The government department associated with Jijel's solid waste management is the Department of Maintenance and Networks, which manages the system's collection trucks, loaders, and street sweepers. This department is organized into two sections: the Cleaning Section and the Maintenance Section. The Cleaning Section is responsible for street cleaning and waste collection and consists of two administrative employees, 34 loader personnel, and 40 street sweeping personnel. The Maintenance Section is responsible for operating and maintaining the collection vehicles and consists of two administrative employees, 12 drivers, four vehicle electricians, four mechanics, and three employees to lubricate the vehicles.

2.3 | Operations

Solid waste operations conducted by Jijel include waste collection, street sweeping, disposal, medical waste handling, and equipment operations and maintenance.

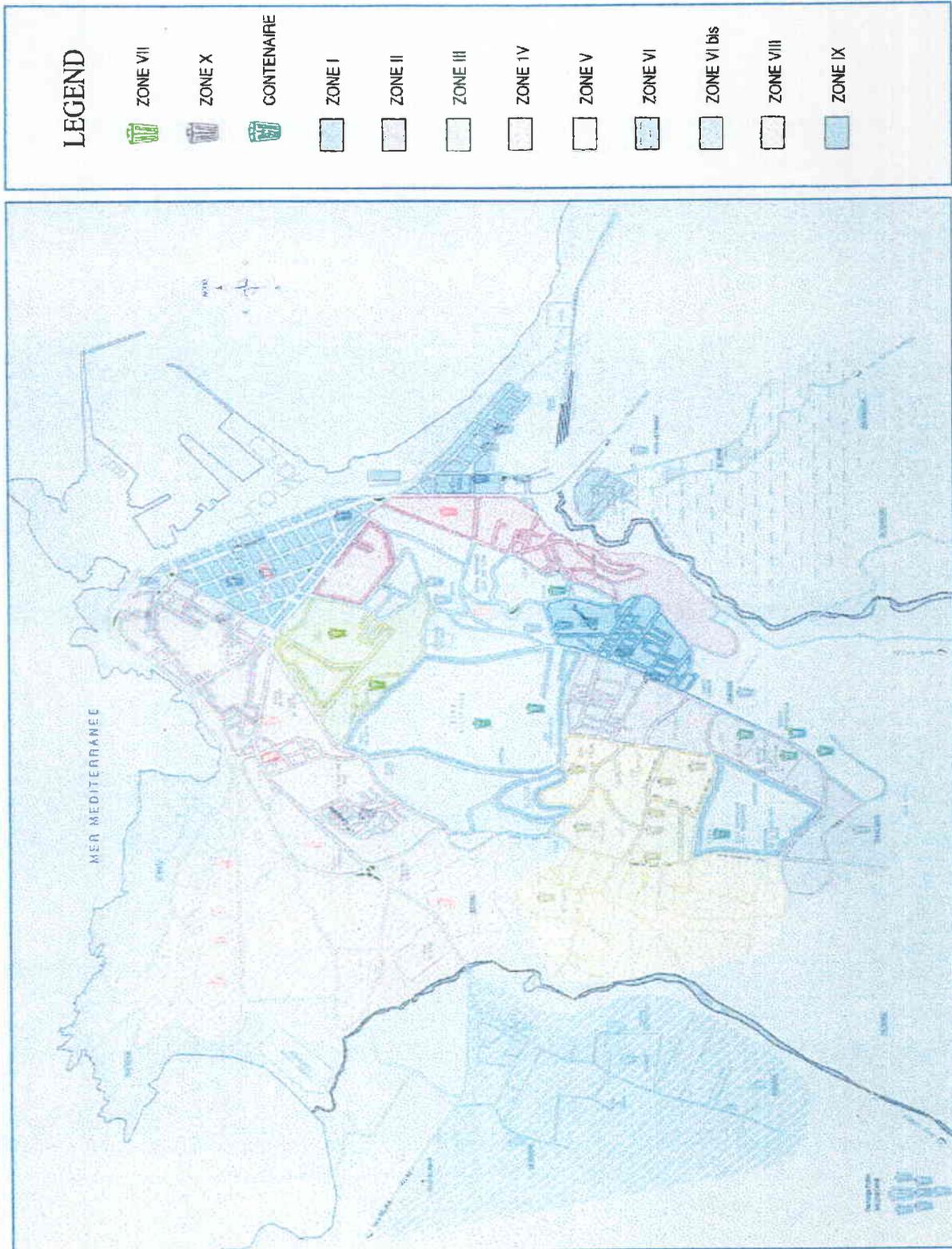
2.3.1 | Collection

Waste is collected from 10 collection zones, as illustrated in Exhibit 2-2. In the majority of zones, collection occurs between 6:00 a.m. and 11:00 a.m. six days per week. Each vehicle travels its route once per day. No evening or night collection takes place. Collection trucks typically have a crew of one driver and two loaders, and bagged garbage is loaded by hand. Waste is often set out improperly, overflowing and scattering on the streets. Commercial waste is combined with residential waste before disposal.

The current method of collection varies from zone to zone, depending available equipment and specific local conditions. We observed two methods of waste collection. The primary method is door-to-door collection, in which waste is placed in front of the house or building near the street, primarily in plastic bags of varying size and type purchased by waste generators. In cases where these bags are not used, it may be due to either their relatively high cost of 15 - 20 dinars per bag (about US \$0.17 - \$0.22) or their unsuitably large capacity. According to the Algerian Inspection of the Environment, residents generate about 0.6 kilograms (about 1.3 pounds) of refuse per person daily. In rare cases, residents may also set their refuse out in hard plastic trashcans.

Some collection zones use a collection method that involves gathering waste in centralized locations. In these zones, residents may place their waste in metal cans (made from half of a

Exhibit 2-2 | Waste Collection Zones



55-gallon steel drum), steel debris boxes (which require more effort on the part of the loaders), or concrete-walled neighborhood depots, to await collection.

A list of collection containers and times of collection by zone follows:

- Zone 1 - Start collection at 6:00 a.m.; collect from plastic bags and half-containers.
- Zone 2 - Start collection at 7:30 a.m.; collect from plastic bags and half-containers.
- Zone 3 - Start collection at 9:00 a.m.; collect from plastic bags and half-containers.
- Zone 4 - Start collection at 7:00 a.m.; collect from plastic bags, half-containers, and concrete-walled depots.
- Zone 5 - Start collection at 7:00 a.m.; collect from plastic bags and half-containers.
- Zone 6 - Start collection at 7:00 a.m.; collect from plastic bags, half-containers, and concrete-walled depots.
- Zone 7 - Start collection at 7:00 a.m.; no information on collection sources in this zone.
- Zone 8 - Start collection at 7:00 a.m.; collect from plastic bags, half-containers, and concrete-walled depots.
- Zone 9 - Start collection at 7:00 a.m.; collect from plastic bags and half-containers.
- Zone 10 - Start collection at 10:00 a.m.; collect from half-containers.

The majority of City collection vehicles delivering waste to the dump site are open-bed trucks with no covers. All loads should be covered according to Algerian law.

2.3.2 | Street Sweeping

Due to the unorganized method of waste set-outs, refuse is often scattered in the streets, which necessitates street sweeping. The collection zones do not employ mechanical sweeping equipment. Forty street sweepers clear the streets manually with brooms, shovels, and rakes. Some mechanical equipment is used in Zones 1 and 4 as described in the equipment section below. Waste gathered by street sweepers is picked up by the loaders during regular collection hours.

2.3.3 | Disposal

Collected waste is hauled to the Mezraitine dump site approximately 8 kilometers southwest of Jijel. The route to the dump site is a narrow road pitted with potholes. It takes about 20 minutes to reach the dump site from Jijel. Several large industries in town (two cork factories, a leather factory, a shirt factory, and a slaughterhouse) direct-haul their industrial waste to the

dump site. Some self-haul residential and commercial customers also direct-haul their waste to the dump site. Some construction and demolition debris, including green waste, is disposed of along roads and highways. Meats and organs from the slaughterhouse are disposed directly into the sea.

The dump site is open seven days a week, including Friday (the Islamic holy day). Because it has no gate entrance station, formal operating hours are not applicable. BVA observed it to be in use from early morning until late afternoon.

2.3.4 | Medical Waste

Hospital waste, including needles, syringes, expired medication, and biomedical waste, is incinerated at the hospital. The ash and residue of the incinerated hospital waste are disposed of at the Mezraitine dump site. Occasionally this waste is still burning when it is delivered to the dump site where it ignites other waste.

2.3.5 | Equipment

Exhibit 2-3 describes the equipment used by the City of Jijel for its solid waste operations. Ten trucks owned or contracted by the City collect waste in the 10 city collection zones. Eight SNVI brand trucks (models K 66 and K 120) are used in collection Zones 2, 3, 5, 6, 7, 8, 9, and 10 to collect refuse door-to-door, as well as refuse from centralized collection points. They are flatbed trucks with low-profile sidewalls and some mechanical dumping capabilities. Loading is done by hand.

Two SNVI brand trucks (model K 120) handle the steel debris boxes in collection Zones 1 and 4. These trucks are able to place empty debris boxes at the collection points, retrieve full boxes, and transport them to the Dump Site where they are emptied by hand. One Isuzu-brand compactor vehicle is also used to densify waste. It is equipped with a top loading mechanical device that automatically empties trashcans.

Lastly, street sweepers use agricultural tractors equipped with trailers in collection Zones 1 - 4 to load materials gathered with the 18 wheelbarrows and the trash bins. In addition, a bulldozer and a rubber-tire front-end loader move materials.

2.4 | Facilities

This section describes the facilities currently used for the City's solid waste management operations, including the Mezraitine dump site, numerous informal dump sites, and vehicle repair yards.

Exhibit 2-3 | City's Owned Equipment Utilized for Solid Waste Operations

I.D. Numbers	Types	Model	Capacity	Year	Condition
01317-29018	SNVI Truck K 120	Ampliroll	7 TS	1990	Good
01318-29018	SNVI Truck K 120	Ampliroll	7 TS	1990	Good
00188-29718	SNVI Truck K 120	Skip	7 TS	1997	Good
00189-29718	SNVI Truck K 120	Skip	7 TS	1997	Good
00190-29718	SNVI Truck K 120	Skip	7 TS	1997	Good
00191-297	SNVI Truck K 120	Skip	7 TS	1997	Good
00197-29318	SNVI Truck K 66	Skip	2.5 TS	1993	Good
00201-29318	SNVI Truck K 66	Skip	2.5 TS	1993	Good
00012-29918	SNVI Truck K 66	Skip	2.5 TS	1999	Good
00013-29918	SNVI Truck K 66	Skip	2.5 TS	1999	Good
01306-28818	ISUZU Truck	Skip Compactor	7 TS	1988	Motor in disrepair
00175-69618	Agricultural Tractor	With trailers	4 TS	1996	Good
00177-69618	Agricultural Tractor	With trailers	4 TS	1996	Good
10.559.18	CAT Bull-Dozer	Not Available	N/A	2000	Radiator in disrepair
041.0398.18	Shipper W 120	Bull-Dozer	N/A	1994	Good

2.4.1 | Legal Disposal Site

Mezraitine dump site, the official open dump site, is located approximately 8 kilometers southwest of Jijel, as shown on Exhibit 2-4. There is no scale entrance station at the facility. There are no records of depth, age, and quantity of refuse filled at the existing site. The deposited waste is scattered about haphazardly rather than being uniformly filled. It appears that the waste quantities are relatively low and the dump site depths relatively shallow. This facility needs proper closure or rehabilitation for the following reasons: the dump has no environmental control measures; it is on fire; seagulls, dogs, goats, and cows graze on the

deposited refuse; and there is no waste cover. Exhibits 2-5 and 2-6 illustrate the current state of the dump site.

The City of Jijel understands that the current dump site is unsatisfactory and that a new landfill is needed. There are no other established, proper sanitary landfills nearby that can be used. The City has a proposed site for a new, properly managed sanitary landfill about 17 kilometers southeast of Jijel, which is also shown on Exhibit 2-4. The site is approximately 12 hectares in size.

2.4.2 | Illegal Disposal Sites

Numerous small, informal dump sites are located in areas throughout Jijel.

2.4.3 | Repair Yards

The City has a general facility for vehicle repairs, which includes a vehicle garage and a repair shop where electrical and mechanical maintenance work is done. A second, small repair yard services detachable equipment and fuels city-owned vehicles. Vehicles in need of repair are sometimes incapacitated for months at a time, due to the City's complex process for approving material purchases as well as the lack of spare parts. Although vehicle maintenance is generally satisfactory, additional repair and maintenance facilities and access to spare parts could improve the solid waste management operations.

2.5 | Recycling

Informal recycling occurs at the dump site. For example, individuals salvage materials such as film plastic at the dump site.

In addition, a glass factory in Taher Commune, a local government about 15 kilometers east of Jijel, buys glass that is separated from the waste stream before the waste goes to the dump site. The factory makes its own arrangement for pick-up and purchase of the glass directly with the

Exhibit 2-4 | Jijel Dump Site Reference Map

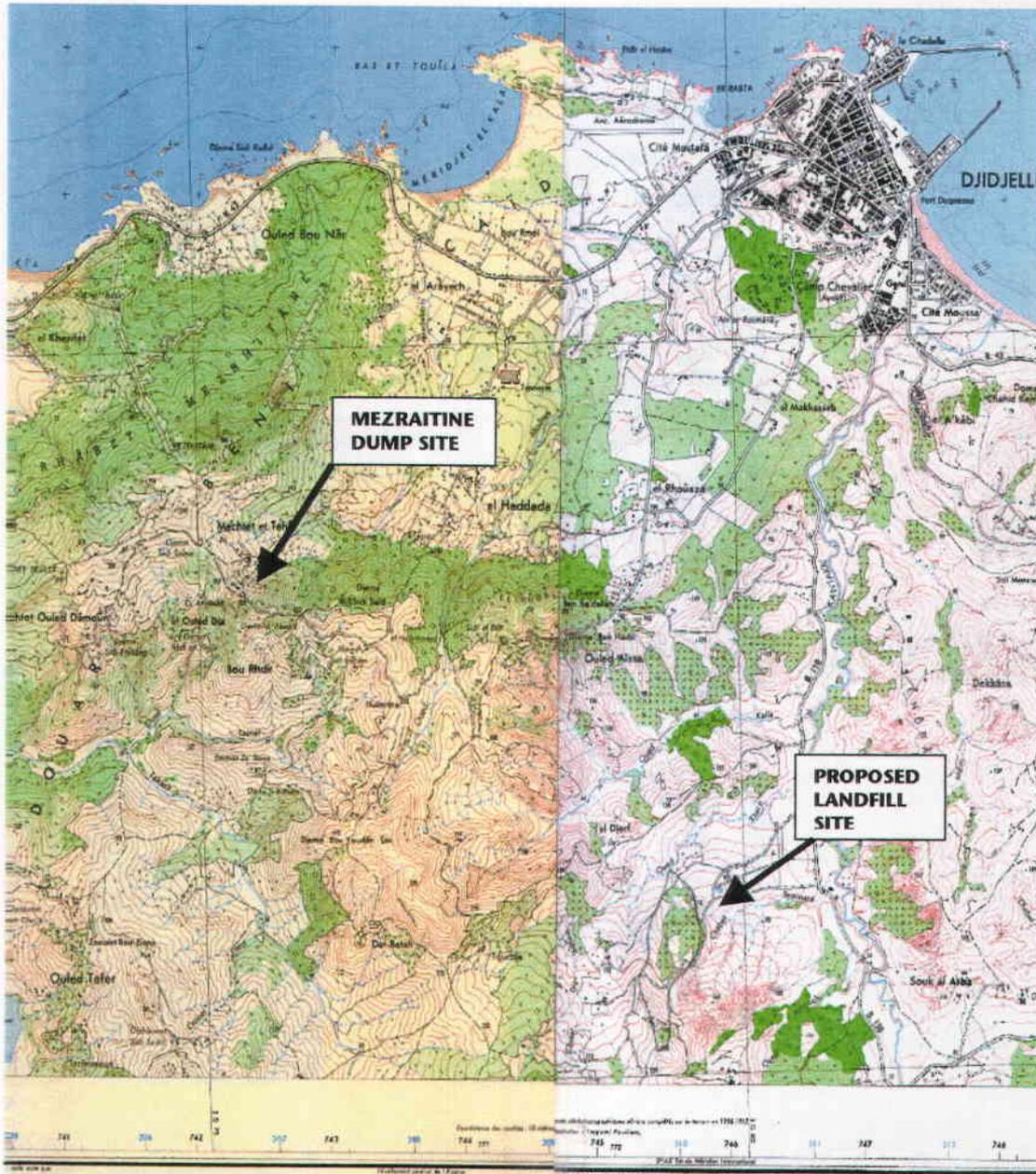


Exhibit 2-5 and 2-6 | Views of Current Dump Site



individuals who separate the glass from the waste stream. No formal arrangement exists between the Jijel government and the glass collectors.

2.6 | Environmental Laws and Regulations

All national territories in Algeria have laws that address potential environmental problems (Inspections of the Environment). The protection of the environment is governed by law number 83-03 dated on February 5, 1983. This law, considered as the fundamental basis of Algerian environmental legislation, has been the subject of many application decrees and is composed of six titles. These titles include:

1. General arrangements;
2. Protection of fauna;
3. Protection of receiving media;
4. Protection against nuisances;
5. Environmental impact studies;
6. Observations and research of offences.

Each territory must abide by these regulations and must apply portions of the relative law for environmental protection, as published on February 5, 1983. These laws and decrees include:

- Law number 83/03 dated on 05/02/1983, relative to the environmental code.
- Law number 83/17 dated on 16/07/1983, relative to the waters code which is modified and completed by the order number 96/13 dated on 15/07/1996.
- Law number 85/05 dated on 16/02/1985, relative to the protection and the promotion of health.
- Law number 87/03 dated on 27/01/1987, relative to regional development.
- Law number 90/29 dated on 01/12/1990, relative to planning and urbanism.
- Law number 90/09 dated on 07/04/1990, relative to the code of the Wilaya (province).
- Law number 90/08 dated on 07/04/1990, relative to the local code,
- Decree number 88/227 dated on 05/11/1988, relative to assignment, organization, and operation of the inspector corps, charged with protection of the environment.
- Decree number 84/378 dated on 15/12/1984, fixing conditions of cleaning, collection and treatment of urban solid waste.
- Decree number 88/149 dated on 26/07/1988, defining the regulation applicable to classified facilities and fixing their nomenclature.

- Ministerial decree number 90/78 dated on 27/02/1990, relative to the environmental impact studies.
- Decree number 93/161 of the 10/07/1993, defining standards for industrial liquid sewage disposal.
- Ministerial decree number 93/165 dated on 10/07/1993, regulating atmospheric emissions of smoke, gases, dusts, odors, and particles from stationary facilities.

A summary of applicable articles is included in Appendix A.

Local implementation and enforcement of applicable regulations appears to be incomplete in Jijel. For example, Jijel officials did not possess copies of the 1982 environmental regulations that apply to Algerian cities. The local and national entities responsible for areas involving solid waste are described below.

2.6.1 | Ministries of Local Affairs, Local Organizations, and Environment

Since August 10, 1994, the Ministries of Local Affairs, Local Organizations, and Environment together have been responsible for the following areas involving environmental protection:

- Proposing to appropriate ministries rules and protective conservation measures for the preservation of the natural habitat, including endangered fauna and flora;
- Defining rules for the preservation of areas from pollution and nuisances of all types and implementing these rules including necessary technical controls;
- Establishing and maintaining a system of classification of facilities and substances harmful to public health and the environment;
- Regulating methods of storage, transport, and treatment of waste;
- Participating in the system for managing and controlling radioactive materials in cooperation with concerned organization;
- Reviewing project impact studies and, where appropriate, ordering environmental impact studies for projects;
- Making an inventory of natural sites and creating recreational areas, forests, parks, and green spaces, in cooperation with appropriate ministries.

2.6.2 | Department of the Environment

The Department of the Environment was created on August 10, 1994. Its responsibilities are as follows:

- Identifying all types of pollution;
- Identifying all types of degradations to the natural environment;
- Preserving biological diversity;
- Enforcing environmental laws and regulations;
- Approving environmental permits and authorizations issued at the provincial level;
- Approving environmental impact studies;
- Promoting activities for public information and education on the environment at the national level;
- Promoting international cooperation in the area of the environment.

In turn, this department is composed of five subdepartments as follows:

- Department of Administration and Means: responsible for budgets and accounting, personnel, and National Fund for the Environment.
- Department of Pollution Prevention and Nuisances: responsible for industrial pollution control, urban environments, major risks, and clean technologies.
- Department of Biodiversity and Natural Spaces: responsible for species protection, protected spaces, prevention of desertification and soil erosion, and protection of natural resources and ecosystems.
- Department of Environmental Education and International Actions: responsible for public information and education, data storage, and international actions.
- Department of Regulation and Implementation: responsible for environmental impact studies, authorizations, and permits.

2.6.3 | High Council of the Environment and Sustainable Development

The High Council of the Environment and Sustainable Development (HCEDD) was created on December 25, 1994. It is presided over by the head of government, and in addition to six environmental and development experts appointed by the President of the Republic, consists of the following entities:

- Minister of Environment
- Minister of National Defense

- Minister of Foreign Affairs
- Minister of Local Organizations
- Minister of Finance
- Minister of Transportation
- Minister of Agriculture
- Minister of Industry
- Minister of Energy
- Minister of Hydraulics
- Minister of Public Health
- Minister of Higher Education and Scientific Research

The HCEDD's responsibilities are the following:

- Developing national strategies for environmental protection and promotion of sustainable development;
- Regularly reviewing the state of the environment;
- Regularly evaluating the implementation of legislation and regulations concerning environmental protection and selecting appropriate measures;
- Reviewing the development of international environmental politics and ordering studies for use in government decision-making;
- Providing opinions on major ecological problems identified by the Ministry of Environment;
- Presenting an annual report on environmental conditions and an assessment of the implementation of environmental protection strategies to the President of the Republic.

Two permanent technical commissions assist the HCEDD in achieving its objectives: the Legal and Economic Commission and the Commission of Intersectoral Activities of the Environment. These commissions are each composed of 24 members, including civil servants, representatives of environmental associations, academics, environmental experts, and environmental researchers. Together, these two commissions conduct studies to help define environmental goals and sustainable development, analyze sector policies in relation to their compatibility with environmental goals, formulate environmental protection strategies, and propose standard economic and financial instruments to allow better environmental protection.

2.6.4 | Provincial Environmental Inspection Agencies

- Established on April 12, 1995, there are 48 Environmental Inspection Agencies in place, one for each province. They have at their disposal a network of environmental laboratories and observatories to assist them in preserving public health and the environment in their jurisdictions. Their responsibilities include the following:
- Developing and implementing an environmental protection program for the province in coordination with other relevant national, provincial, and city agencies;
- Issuing official environmental licenses, authorizations, and permits for the province;
- Assisting and coordinating with national agencies, measures for preventing environmental degradation from all sources, including pollution, nuisances, and soil erosion; as well as developing biological diversity, preserving hunting resources, and promoting parks and horticultural activities;
- Promoting activities for public information and education on the environment on the provincial level;
- Instituting measures that improve the environment and quality of life.

2.7 | Economic Considerations

Residents of Jijel currently pay between 375 and 500 dinars (US \$4 - \$6) per year as part of their property tax, for the solid waste management services the City provides. Commercial and industrial generators pay an annual tax of 1,000 to 4,000 dinars (US \$11 - \$45) per year for solid waste services, depending on business size and location. All property owners pay the fee whether or not they choose to use the City's collection service or transport waste to the dump site themselves. These fees are not paid separately but are instead combined with other required taxes. No disposal fees are collected at the dump site. In addition to these fees, residents and businesses purchase plastic bags at a relatively high cost of 15 - 20 dinars per bag (about US \$0.17 - \$0.22). Assuming that 1) residents generate about 0.6 kilograms (about 1.3 pounds) of refuse per person per day (according to the Algerian Inspection of the Environment), 2) each household contains approximately 6.58 residents, and 3) each bag holds about 15 kilograms, approximately 96 bags are needed per household per year. Thus it costs each household that uses the bags, an additional 1,400 - 2,000 dinars (approximately US \$15 - \$22) per year.

Section 3 | Waste Generation and Disposal in Jijel

This section describes the waste generation and disposal situation in Jijel, existing waste sectors, and current amounts and types of wastes generated and disposed of in Jijel. It also provides future projections of waste types and quantities. A waste characterization study and survey were conducted for Jijel. Results from these activities are included in this section.

3.1 | Background

A material type becomes waste only when a specific owner ceases to have any use for it. Wherever people live, domestic wastes are produced. In their simplest forms, domestic wastes may be comprised of food waste, plastic, paper, and worn out clothing. In a village community these wastes are readily accepted into nature's cycle; animals consume food, residues and other materials are gradually incorporated into the soil. In a city, however, the management of municipal solid wastes is more complex. A city with a large population and a higher population density generates greater quantities of municipal solid wastes. The average municipal solid waste generation in Jijel is approximately 70,000 kilograms per day or 70 metric tons per day. (It should be noted that metric tons will be referred to as tons throughout this report.)

Wastes are generated from different sources such as:

- Residences
- Markets
- Institutions
- Commercial Establishments
- Industries
- Hospitals

Open dumping of these wastes for consumption by nature not only requires large dumping areas but also raises safety, health, and environmental issues. The quality of the environment is a matter of growing concern to the City in its effort to attract tourism to the region. The importance of efficient waste management is increasingly recognized as a priority. Jijel recognizes that municipal solid waste (MSW) and medical waste (MW) management is a complex and extensive responsibility.

The search for a solution to similar problems in different countries has led to improved techniques of MSW and MW handling, processing, and disposal. Some of these techniques address safety, health, and environmental aspects of handling, processing, and disposal, whereas some others focus mainly on the reduction of bulk of wastes. The type of waste sectors generating waste, the quantity of waste generation, and the characteristics of the MSW and MW are major factors in selecting appropriate technology for waste management.

3.2 | Waste Sectors

The main sources of solid wastes for which a municipality assumes responsibility are residences, shops, offices, hotels, institutions, industries, and hospitals, plus the refuse swept from the streets. The ingredients and characteristics of wastes from each of these sources differ due to variation in the activities responsible for generating the waste. In Jijel, waste is generated from three main sectors; residential, commercial, and industrial.

As discussed in Section 2, Jijel's municipal solid waste is collected in ten regional zones. Collection in each of these zones involves commingling of residential and commercial waste and makes any distinction as to their separate characteristics unfeasible. Industrial waste generated at the local cork factories, the leather factory and other businesses, as well as residential and other self-haul waste can be distinguished separately as these wastes are not commingled prior to arriving at the dump site.

3.3 | Quantity of Waste Generation and Disposal

Waste generated and disposed of by residents, commercial operations, and industrial operations totals approximately 70,000 kilograms per day (70 tons per day) or about 22,000 tons per year based six days per week of disposal. The wastes are currently being disposed of at the Mezraitine dump site, approximately 8 kilometers southwest of the City. Some waste never makes it to the dump site; it is illegally disposed of and scattered about the region. In addition, a minimal amount of materials is recycled from the residential, commercial, and industrial waste streams. A small amount of glass is transported to the glass factory in Taher; very small amounts of film plastics, paper and metals are scavenged from the Jijel waste stream. Wastes

deposited at the Mezraitine dump site are delivered in one of three ways: collection trucks from the 10 city collection zones, self-haul from industries, and other self-haul or collection vehicles. Each of these methods is discussed below.

3.3.1 | Residential/Commercial Waste Generation and Disposal

Waste from generators in each of the 10 city collection zones is comprised of residential and commercial materials that are mixed in each of the collection zones. As a result, waste quantity or composition cannot be broken down by generator type with great accuracy. Residential and commercial volumes are considered as one source for collection and evaluation purposes in this analysis.

The City does not weigh the waste it disposes of or generates. Therefore, tonnage figures for residential/commercial waste have been calculated based on visual observations and rated truck capacities. As noted in Section 2, residential and commercial collection from the 10 refuse collection zones is handled by ten SNVI Model K 120 or Model K 66 trucks. Six trucks have a 7-ton capacity and four trucks have a 2.5-ton capacity. One of the 7-ton trucks services the military zone and usually arrives at the dump site two-thirds full. The rest of the trucks take full capacity loads to the dump site. Waste is collected six days per week. From this information, combined residential and commercial generation is calculated to be approximately 50 tons (50,000 kilograms) of disposal daily or about 15,600 tons per year.

3.3.2 | Industrial Waste/Self-Haul Generation and Disposal

Waste that is not taken to the dump site by the APC collection vehicles is considered self-haul. Jijel estimates that self-haul contributes about three to four tons per day (3,000 to 4,000 kilograms). We have assumed an average of 3.5 tons per day for this study.

To supplement this information, surveys of selected local industries were conducted by NEE. Industries contacted included.

- Slaughterhouse
- Tannery
- Public Cork Manufacturer
- Private Cork Manufacturer
- Shirt Manufacturer

The slaughterhouse disposed of approximately 679 kilograms of meats and 2,071 kilograms of organs in 1999. The slaughterhouse estimates that it has disposed of approximately 368

kilograms in the first quarter of 2000. These wastes never made it to the dump site. It is reported that meat and organ wastes were dumped directly into the Mediterranean Sea.

Tannery

The publicly operated tannery has been producing finished skins and leathers since 1967. They produce about 32,000 kilograms or 17.5 million skins/leathers per year. The tannery generates about 2,000 kilograms of biodegradable animal greases and skins per day and 7,800 kilograms of organic scrap tanning waste (treated with chromium). This scrap waste had historically been sent to Ain Defla for the manufacturing of mock leather. Ain Defla closed in 1996 and these wastes are currently landfilled. The Jijel tannery is currently searching for financing to purchase equipment to manufacture the mock leather.

Cork Factories

There are two cork factories operating in Jijel. One is operated by the public sector, the other by the private sector. Approximately 1,460,000 kilograms (1,460 tons) of cork waste is being generated and disposed of in the dump site by the two plants annually. The plants are currently looking at ways to use the waste in nurseries or as furnace fuel.

Shirt Factory

Ecotex of Jijel produces about 300,000 shirts per year. Wastes consist of cloths (falls), spools, cardboard, and cellophane. Falls of cloths were sent to Enaditex of Bejaia for the manufacture of carpet by Sidi Aiche. However, due to the high cost of transportation, these wastes are currently being delivered weekly to the dump site.

3.3.3 | Total Municipal Solid Waste Generation and Disposal

As discussed above, it is estimated that approximately 50 tons per day are currently being disposed of at the dump site from residential and commercial sources serviced by the APC in the 10 collection zones. In addition, industrial and self-haul waste is estimated to be about 20 tons per day. All waste disposed at the Mezraitine dump site totals about 70 tons per day. According to the Algerian Inspection of the Environment, solid waste is generated at a rate of 0.60 kilograms per resident per day. At the current 1999 population estimate of 119,147 residents, this equates to approximately 71,500 kilograms per day or 71.5 tons per day. These two sources of information correlate well.

3.3.4 | Medical Waste

Medical waste (MW) is generated at the Jijel Hospital, two clinics, four care rooms, and one laboratory in Jijel. The hospital estimates that it currently generates about 150 to 200 kg of

waste per day. The other facilities are estimated to generate about 75 to 85 kilograms per day. This totals to about 225 to 285 kilograms per day of MW from all sources in Jijel. This averages to about 255 kilograms per day or 80 tons per year based on a 6-day week for disposal. MW is incinerated using two incinerators located at the hospital. The incinerators have a rated capacity of 60 to 90 kilograms per hour. Materials incinerated include bandaging, anatomical waste, and cultures from the laboratory. The ash from the incineration process is currently brought to the dump site for disposal. Occasionally the waste is still hot when it arrives at the dump site and ignites other waste. The heavy smoke that results creates a nuisance and affects the region's air quality.

3.4 | Projected Waste Generation and Disposal

Forecasting waste generation in an area depends on projected population growth of the area and the possible changes in the per capita waste generation growth rate (in terms of quantity and composition). The Center of Studies and Realizations in Urbanism for Jijel has published demographic assessments and population projections through 2018. As discussed, the City was estimated to have a total population of 119,147 in 1999. The projected population growth rate was applied directly to the current waste disposal rates for both MSW and MW to project future waste quantity trends. According to this data, it is predicted that there will be a population growth rate and associated waste growth rate of about 3.43 percent between 1998 and 2003, 2.95 percent between 2004 and 2008, and 2.45 percent between 2009 and 2018. Using the base figures of 22,000 tons per year for MSW disposed in 1999, and 80 tons per year of MW disposed in 1999, projections were developed through 2018. These projections are shown in Exhibit 3-1.

3.4.1 | Residential Waste Stream

Residential waste projections are population-driven and should rise in direct proportion to an increase in population.

3.4.2 | Commercial and Industrial Waste Stream

Commercial and industrial waste projections are related to business productivity and output. Although productivity and output may increase as construction of the new ship port is completed, we have no business projections to substantiate any additional increase above the assumed population projections. Therefore for purposes of this Study, all projected increases are attributed to population.

Exhibit 3-1 | Population and Waste Projections

Year	Total Jijel Population	Growth Rate (%/Year)	Projected Solid Waste (M Tons/Year)	Projected Medical Waste (M Tons/Year)
1999	119,147	3.43%	22,000	80
2000	123,234	3.43%	22,800	83
2001	127,461	3.43%	23,600	86
2002	131,833	3.43%	24,400	89
2003	136,355	3.43%	25,200	92
2004	140,377	2.95%	25,900	95
2005	144,518	2.95%	26,700	98
2006	148,781	2.95%	27,500	101
2007	153,170	2.95%	28,300	104
2008	157,689	2.95%	29,100	107
2009	161,552	2.45%	29,800	110
2010	165,510	2.45%	30,500	113
2011	169,565	2.45%	31,200	116
2012	173,719	2.45%	32,000	119
2013	177,975	2.45%	32,800	122
2014	182,335	2.45%	33,600	125
2015	186,802	2.45%	34,400	128
2016	191,379	2.45%	35,200	131
2017	196,068	2.45%	36,100	134
2018	200,872	2.45%	37,000	137

3.4.3 | Projected Waste Composition

It is reasonable to expect that waste composition may change slightly to include more cans, plastic and glass bottles, and newspapers as tourism in the City increases. It is assumed that this slight change in the future composition of the City's waste stream will not affect programs considered in this Study.

3.5 | Physical Characteristics of Waste

The composition of waste generated is one of the major considerations in the development of new solid waste programs. A study of the physical characterization of the City's municipal solid waste gives a first-hand look at the physical composition of the City's wastes and potential programs.

3.5.1 | Waste Characterization Study

A waste characterization study was conducted over a three-day period (March 28, 29, and 30, 2000) to determine the waste composition of the residential and commercial components of the City's 10 waste collection zones. The study protocol consisted of three phases: initial planning, field work, and data analysis. The study's protocol is included in Appendix B and has been documented in sufficient detail so that a person familiar with waste characterization methods could replicate it.

3.5.2 | Waste Characterization Study Results

Results for the waste characterization study are shown in the table and chart of Exhibit 3-2 and 3-3. The results show that approximately 9.6 percent of the waste stream was paper, 0.9 percent glass, 1.9 percent metal, 8.3 percent plastics, 70.3 percent other organics, 7.5 percent other, and 1.4 percent special waste. The largest portion of the waste stream was food waste at 59.4 percent. We understand that the proportions of bone, wool, and textiles may be somewhat higher than normal for the City due to the religious holiday "L'Aid El Adha." The waste characterization study was conducted soon after this holiday, which involves the sacrifice and consumption of a sheep by each family, generating more bone, wool, and textile waste than would normally be present in the waste stream.

Exhibit 3-4 shows a comparison to other waste characterization studies conducted in Algeria. The comparison shows that the study was probably not greatly affected by the holiday; previous studies in other Algerian townships showed that the organic portion of the waste stream varied from between 50 percent and 77.26 percent. Other waste stream components

also compare closely to previous study results. For this reason, we believe that the waste composition study conducted for the City is representative of its typical waste stream. The study also showed very few “typical” recyclable materials in the waste stream; only 0.7 percent beverage glass, 1.9 percent metals, 1.5 percent plastic containers, and 7.4 percent cardboard/newspaper/office paper. Appendix B includes all weight data collected in the field for each sample, the calculated composition, standard deviations for each material type, and the margin of error (calculated at a 90 percent confidence limit) for each material type.

3.6 | Moisture Content Analysis

A 5.1 kilogram (5,158.69 grams) sample of waste reflecting the results of the waste composition study was assembled and sent to the Agency of National Resources and Hydrology (ANRH) laboratory in Algiers for moisture content analysis. The laboratory first separated and weighed all materials with no moisture content such as plastic bottles, aluminum foil and cans, stones and glass. These materials weighed 1,264.27 grams. Next, the remainder of materials containing moisture was divided into organics (two samples), newspaper, cardboard, and cloth. Each material was dried separately using an oven at 105 degrees C. Weights were measured after each period of two hours of drying time until very little moisture remained. The dry weight of each portion was:

- Newspaper - 209.34 grams
- Cardboard - 305.85 grams
- Cloth - 240.87 grams
- Organic (first half) - 257.10 grams
- Organics (second half) - 380.66 grams

The total dry weight of the original 5,158.69-gram sample was 2,658.09 grams. The moisture content was calculated as:

$$(5,158.69\text{g} - 2,658.09\text{g})/5,158.69\text{g} = 48.5\% \text{ moisture content}$$

Details of the laboratory analysis are included in Appendix C.

Exhibit 3-2 | Waste Characterization Results For Jijel

Categories	Sample Days (wts. In killograms)			Totals	
	1 3/28/00	2 3/29/00	3 3/30/00	Total Wt (killograms)	Total %
Paper					
Cardboard, uncoated, corrugated	43.1	20.6	18.6	82.3	4.6%
Newspaper	31.9	25.5	19.0	76.4	2.6%
Office Paper	16.4	20.8	23.2	60.4	2.0%
Remainder/Composite Paper	15.0	27.4	24.0	66.4	2.2%
Subtotal	106.4	94.3	84.8	285.5	9.6%
Glass					
Beverage	6.0	9.5	6.6	22.1	0.7%
Remainder/Composite Glass	1.4	2.8	1.5	5.7	0.2%
Subtotal	7.4	12.3	7.9	27.6	0.9%
Metal					
Tin/Steel	21.1	23.4	8.7	53.2	1.8%
Aluminum/Other Metal	0.0	1.7	0.4	2.1	0.1%
Remainder/Composite Metal	0.0	1.8	0.0	1.8	0.1%
Subtotal	21.1	26.9	9.9	57.9	1.9%
Plastic					
Plastic Containers	12.3	14.8	16.7	43.8	1.5%
Film Plastic	33.7	59.4	58.2	151.3	5.1%
Durable Plastic	8.7	13.9	2.0	24.6	0.8%
Remainder/Composite Plastic	1.9	18.2	5.2	25.3	0.9%
Subtotal	56.6	106.3	82.6	245.5	8.3%
Other Organics					
Food	566.5	513.1	686.2	1765.8	59.4%
Landscape & Agriculture	0.0	59.5	39.3	98.8	3.3%
Bone	8.7	13.7	8.5	30.9	1.0%
Textiles	34.9	56.1	35.4	126.4	4.2%
Remainder/Composite Organics	4.6	50.2	15.4	70.2	2.4%
Subtotal	614.7	692.6	784.8	2092.1	70.3%
Other					
Construction & Demolition	130.2	70.5	11.8	212.5	7.1%
Soil	0.0	10.1	0.0	10.1	0.3%
Ash	0.2	0.0	0.0	0.2	0.0%
Subtotal	130.4	80.6	11.8	222.8	7.5%
Special Waste					
Tires	0.0	0.0	0.0	0.0	0.0%
Mixed Residue	5.3	21.4	12.7	39.4	1.3%
Hazardous Waste (Med & house)	0.3	1.8	0.3	2.4	0.1%
Subtotal	5.6	23.2	14.3	43.1	1.4%
Total	942.15	1036.20	996.05	2974.4	100%

Exhibit 3-3 | Jijel Solid Waste Composition

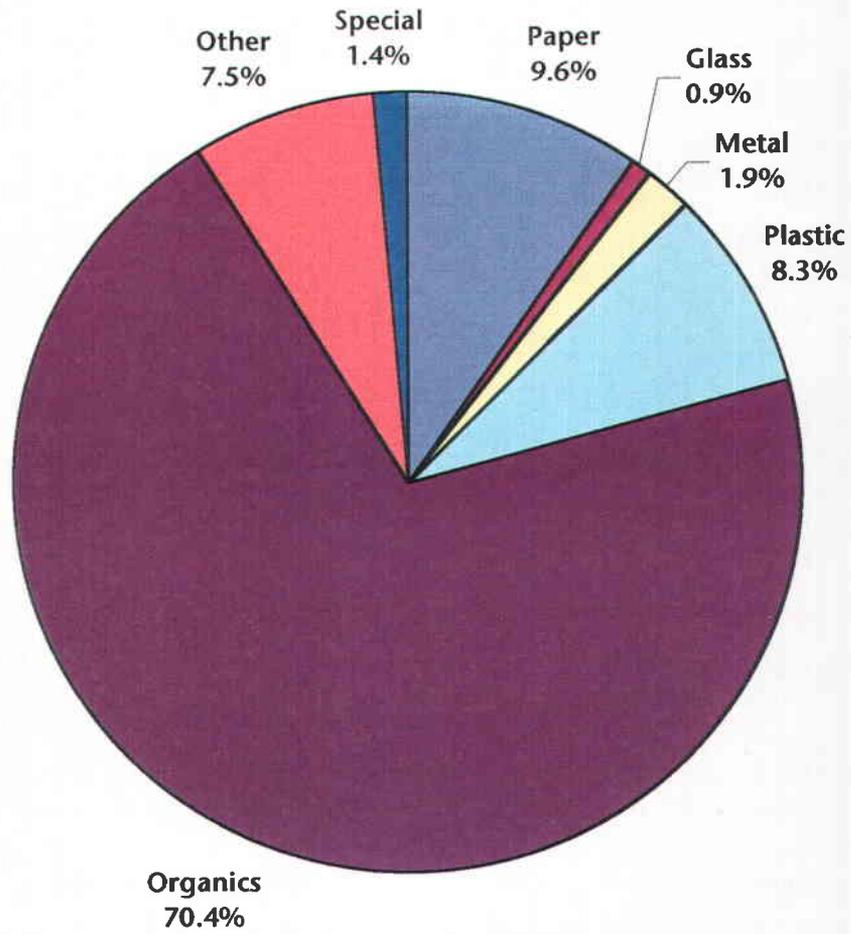


Exhibit 3-4 | Comparison of Waste Characterization Studies in Algeria

Townships/Date of Study	Jijel 2000	Constantine 1985	Belchar 1997	Djelfa 1983	Mila 1995	Medea 1994	Algiers 1994	Setif 1999	Biskra 1999	Khenchia 1997	Algeria 1983
Organics Material	65.1%	68.6%	46.53%	73.8%	66.0%	64.0%	74.4%	66.7%	50.0%	63%	77.26%
Paper/Cardboard	9.6%	21.27%	13.2%	8.44%	11.2%	11.65%	11.5%	12.2%	15.7%	10%	9.82%
Plastics	8.3%	5.33%	12.8%	2.25%	3.0%	13.5%	7.3%	9.65%	14.2%	7%	2.6%
Metals	1.9%	0.73%	4.86%	1.9%	2.45%	1.35%	1.3%	1.75%	8.5%	3%	2.8%
Rags/Textiles	4.2%	2.33%	11.46%	0.37%	1.71%	3.35%	2.3%	3.6%	6.0%	8%	2.02%
Glass	0.9%	0.80%	2.66%	2.06%	0.6%	0.5%	0.8%	1.25%	3.0%	4%	1.01%
Leather	—	---	1.50%	---	---	2.35%	---	---	---	---	1.34%
Wood	—	---	1.73%	0.37%	0.1%	0.5%	0.8%	0.35%	---	3%	1.34%
Bones/Garbage	2.4%	---	1.0%	4.5%	6.3%	---	0.3%	1.8%	2.0%	2%	---
Stones/Various	7.5%	---	4.26%	8.25%	8.8%	0.32%	0.6%	2.7%	---	---	1.6%

3.7 | Survey

A survey was administered to 45 residential customers (15 each from low, middle, and high income neighborhoods) and 15 commercial customers in an effort to better understand the current solid waste situation of the City. Summaries of the survey results, including all survey forms are included in Appendix D. The residential and commercial surveys are discussed below.

3.7.1 | Residential Survey Method

The residential survey was conducted by performing a random survey of three deliberately distinct economic sectors of the City. Three members of NEE conducted the survey to avoid language barriers and to adhere to accepted cultural norms. Questions asked included:

1. Do you have any type of waste or recyclable collection service? If yes, please describe.
2. What does this collection service cost?
3. How often are your waste and/or recyclables collected?
4. If you do not have any collection service, how do you dispose of your waste or recycle materials?
5. What is the cost and frequency of this disposal method?
6. Please estimate how much waste you dispose of or recycle. For example, "We dispose of 2 - 100 liter cans each week".
7. What are the five types of waste you dispose of in the largest amounts? For example: paper, food, plastics, glass, tin. 1) _____ food _____, 2) _____ plastic _____, 3) _____ paper _____, 4) _____ tin _____, 5) _____ glass _____.
8. Are you aware of any laws or regulations concerning wastes? If yes, please describe.
9. Are you aware of any waste disposal or recyclable handling sites in or near Jijel? If yes, please list.

The following summaries can be drawn from results of the residential survey responses: Low income districts were more willing than high income districts to pay for a privatized collection system if the system was clean and good.

- High income districts generate more waste than lower income districts.
- The waste composition is much the same across income districts.

- Residents were not aware of: 1) laws/regulations concerning waste or 2) disposal/recyclable operations near Jijel.

3.7.2 | Commercial Survey Method

The commercial survey was conducted by performing a random survey of 15 businesses throughout the City. These businesses included: women's hairdresser, men's hairdresser, restaurant, domestic store, television repair shop, butcher shop, general food store, pharmacy, baker, wood shop, hotel, and mechanic. As in the residential survey, three members of NEE conducted the survey to avoid language barriers and to adhere to accepted cultural norms.

Questions asked included:

1. Do you have any type of waste or recyclable collection service? If yes, please describe.
2. What does this collection service cost?
3. How often are your waste and/or recyclables collected?
4. If you do not have any collection service, how do you dispose of your waste or recycle materials?
5. What is the cost and frequency of this disposal method?
6. Please estimate how much waste you dispose of or recycle. For example, "We dispose of 2 - 100 liter cans each week".
7. What are the five types of waste you dispose of in the largest amounts? For example: paper, food, plastics, glass, tin. 1) _____ food _____, 2) _____ plastic _____, 3) _____ paper _____, 4) _____ tin _____, 5) _____ glass _____.
8. Are you aware of any laws or regulations concerning wastes? If yes, please describe.
9. Are you aware of any waste disposal or recyclable handling sites in or near Jijel? If yes, please list.

The following summaries can be drawn from results of the commercial survey responses:

- Commercial businesses are willing to pay for a privatized collection system if the system is clean, effective, and everyone shares in the cost.
- Commercial businesses generate more waste than residents.
- The waste composition is somewhat different than residential waste.
- Commercial businesses were not aware of: 1) laws/regulations concerning waste or 2) disposal/recyclable operations near Jijel.

Section 4 | Waste Management Technologies

This section describes waste management technologies currently employed throughout the world to manage the collection, recovery, and disposal of municipal solid waste (MSW) and medical waste (MW). Technologies discussed include collection methods, materials recovery, organics materials management, sanitary landfills, landfill gas recovery, and waste-to-energy. Technologies for handling MW are also discussed.

4.1 | Collection Methods

Modern collection of MSW can be accomplished in numerous ways. The goal of the collection process is to aggregate the discarded materials in an efficient manner to enhance processing and disposal.

4.1.1 | Wet-Dry Collection

Wet-dry separation is a method whereby the resident and/or business is asked to do an initial waste sort at the source of generation. Wet materials are compostible food and moisture-rich materials and dry materials would include everything else (paper and plastic packaging, glass, metals, wood, textiles, and diapers). Miscellaneous paper could be placed in with the wet mix in order to absorb some of the moisture (for preparation in composting if this option is considered). This type of source separation requires more customer education, but it decreases the amount of mixed and contaminated material received at the landfill or materials recovery facility and allows for cleaner separation and salvage of materials. Dry wastes can be collected in boxes or other loose containers, whereas wet material can be placed in bags. Centralized neighborhood collection containers can also be placed appropriately for the collection of dry materials.

4.1.2 | Collection Containers

An efficient method is to collect MSW from individual cans, carts, or bins rather than from rubbish piles. Placing the MSW in reusable, sturdy containers allows for efficient loading of the material onto the collection vehicle, either manually or mechanically emptying the container into the vehicle. Using collection containers can also reduce the environmental and human health effects of exposed MSW. MSW containers include individual cans or carts for small generators, such as individual residences or small businesses, as well as larger wheeled bins that can be one to 10 cubic meters in volume for large generators like large commercial establishments or multi-unit residences. For very large construction projects or demolition waste, there are large specialty containers, often called drop boxes, that can be as large as 40 cubic meters.

4.1.3 | Collection Vehicles

There are many different types of MSW collection vehicles designed to perform specialized functions. Selection of the most appropriate trucks depends on a number of factors including street width, container sizes and types, and costs. Standard collection vehicles can be roughly divided into two categories: route vehicles and transfer vehicles. Route vehicles are typically referred to by their loading mechanism (rear loaders, side loaders, and front loaders). Rear loaders, or “packer” trucks, are loaded from the back and usually include a packing blade that compacts the MSW. Rear loaders are typically used for residential collection from individual cans or carts, but can also be used to empty larger bins of one to two cubic meters. Side loaders, which empty containers from the side of the vehicle, are typically used to empty wheeled collection carts.

Front loaders have a mechanized arm which can lift the cart or bin over the front cab of the vehicle for emptying. This mechanism can be fully automated, allowing the driver to remain inside the vehicle as it is loaded. Roll-off trucks are used to service large drop boxes. The boxes are not emptied, but are rather loaded onto the truck for transport.

4.2 | Materials Recovery

A materials recovery facility (MRF) can incorporate both manual and/or mechanical methods for recovery of targeted recyclable materials from the incoming waste stream. MRFs are sometimes classified as one of two basic types depending on whether the incoming materials consist of commingled MSW (a waste stream with recyclables and waste mixed together) or source-separated mixed recyclables (a waste stream that has a portion of the recyclables separated from the waste at the source by the resident or business). A MRF that handles source-separated mixed recyclables is called an intermediate processing center; a MRF that

handles commingled MSW is usually called a mixed waste processing facility. A third type of MRF is designed to handle construction and demolition waste. The equipment and labor requirements of any of these MRFs are dependent on the type of waste stream to be handled, the amount and type of materials available for recovery from that waste stream, the market or end-use specifications for the recovered materials, and the relative cost of labor and machinery. Some MRFs are also very "low-tech," not employing any stationary equipment, utilizing hand labor to sort and separate materials.

While MRFs may have any number of specific functions, a common feature of many facilities is the use of a tipping floor for initial screening and removal of undesirable bulky items from the MSW and a conveyor system to move materials uniformly through a picking station where workers can pull off recyclables or contaminants. In addition to hand-picking operations from a tipping floor or along a conveyor belt, mechanical equipment such as magnetic or air vacuum equipment, shaker screens, trommels, air classifiers, and balers may be incorporated into the recovery system. A typical MRF is shown in Exhibit 4-1.

4.2.1 | Types of MRFs

Intermediate Processing Center

This type of facility is designed to receive and process source-separated recyclables from curbside collection programs, commercial collection programs, drop-off centers, or other sources of recyclable materials containing minimal contamination. A new development in this technology is the separation and processing of mixed recyclables. The sorting line, processing equipment, and labor requirements of these facilities are designed for specific processing and marketing requirements in conjunction with a local collection program. A number of large regional facilities have been built to serve multiple jurisdictions.

Mixed Waste Processing Facility

MRFs for receiving MSW can be designed for a number of functions including:

- Separating and processing metals, glass, paper, plastics, and other materials for recycling markets;
- Removal of contaminants to allow for more efficient MSW composting;
- Removal of contaminants and processing of the residual waste as refuse-derived fuel or other feedstock for energy recovery;
- Recovery of target materials only from select loads rich in those materials.

In areas like Jijel, where labor costs are low, these types of facilities tend to be very labor intensive, using little mechanized equipment.

Exhibit 4-1 | Typical MRF

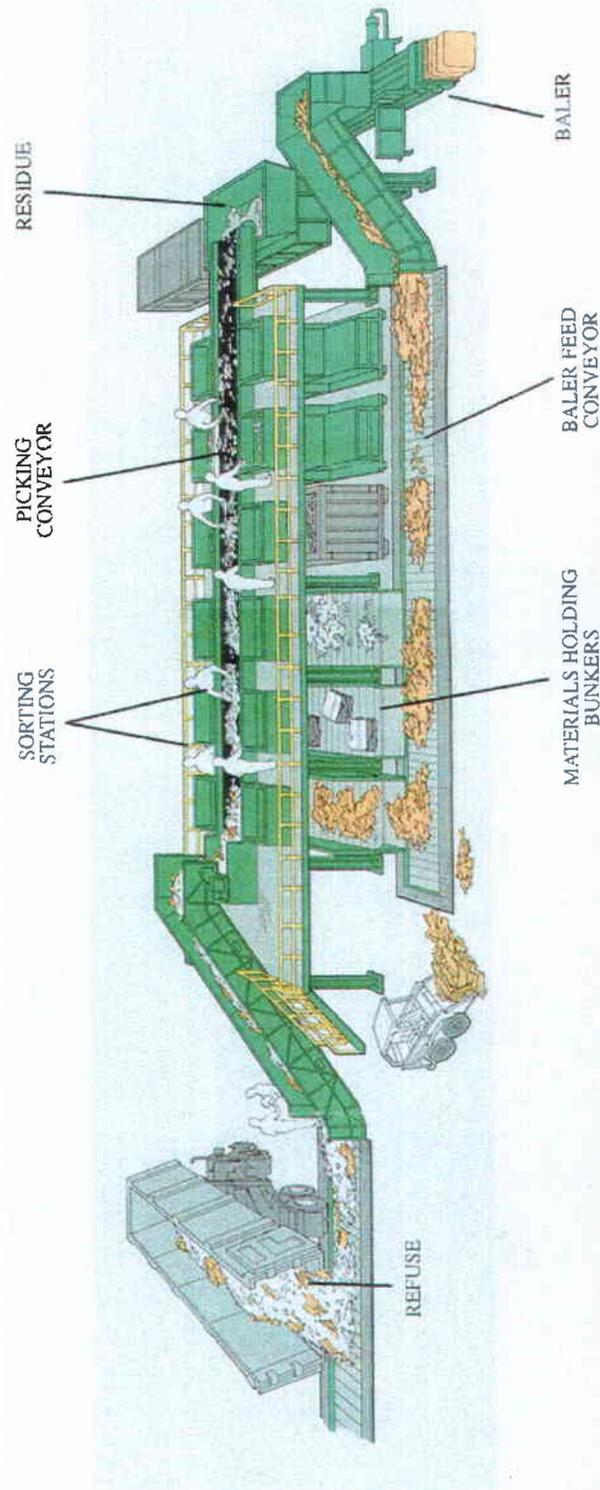


Diagram from public information supplied by Mayfran International

Construction/Demolition Waste Recovery Facility

This type of MRF is suitable for areas with very high levels of construction and demolition (C&D) activity. These facilities are designed specifically to separate and process major components of the waste stream generated during demolition and construction activities. Target materials may include inerts such as asphalt, concrete and dirt; wood waste suitable for reuse, fuel, or mulch/compost feedstock; gypsum board, ferrous and nonferrous metals, and any other material type that has a viable market and is found in sufficient quantity. The materials are typically delivered by haulers bringing drop-boxes or roll-off containers from construction sites. C&D waste can be a substantial portion of the waste stream and is the portion most affected by the condition of the economy.

4.3 | Organic Materials Management

Organic materials often make up a large portion of MSW. In Jijel, approximately 70 percent of the waste stream consists of organic materials, including food waste, clean wood, natural textiles and soiled paper, landscape debris from gardens, parks and street trees, and any low-grade paper without other markets. If these materials cannot be reused, as animal feed or mulch, organics can be processed into soil amendments or compost.

4.3.1 | Animal Feed

The most common end-use for food waste is as animal feed since little processing is needed. If food can be source-separated cleanly at large generators (restaurants) for animal feed collection, it can be picked up by individual farmers or processed and sterilized at a central location by heating the food before incorporating adding it to the feed. Animal feed can also include bakery scraps, if they are not already being salvaged for a higher reuse. Food waste recovery can assist the community by providing a low cost animal feed and reducing waste at the landfill.

4.3.2 | Composting: Categories and Methods

Composting is the biological decomposition of organic matter into humus suitable for use as a soil amendment or as an intermediate, absorbant landfill cover. Microorganisms, or microbes, are the essential agents of decomposition. Composting relies on aerobic bacteria (bacteria that require oxygen). To maximize the rate of microbial activity, the composting process must be designed to properly control factors such as temperature, oxygen and nutrient availability, physical substrate, moisture, and pH.

The three major categories of composting technologies are green waste composting, MSW composting, and co-composting of MSW with sewage treatment sludge. Alternative biological alternatives include vermicomposting and anaerobic digestion. To be effective, each of these techniques must separate contaminants by manual or mechanical means, grind or screen for particle size reduction, and control moisture content, temperature, and the carbon/nitrogen rates to promote the activity of microorganisms that decompose the organic matter.

Green Waste Composting

Green waste consists of leaves, brush, tree trimmings, grass, and related materials generated by nurseries, landscapers municipal collection programs, and individuals. Some programs provide a collection system, others accept green waste brought by residents and gardeners to a centralized processing site. Most existing leaf composting operations utilize the windrow composting method. This involves building elongated piles and controlling water and temperature levels. A simple windrow process typically creates a finished end-product in 24 to 36 weeks, depending on the methods used.

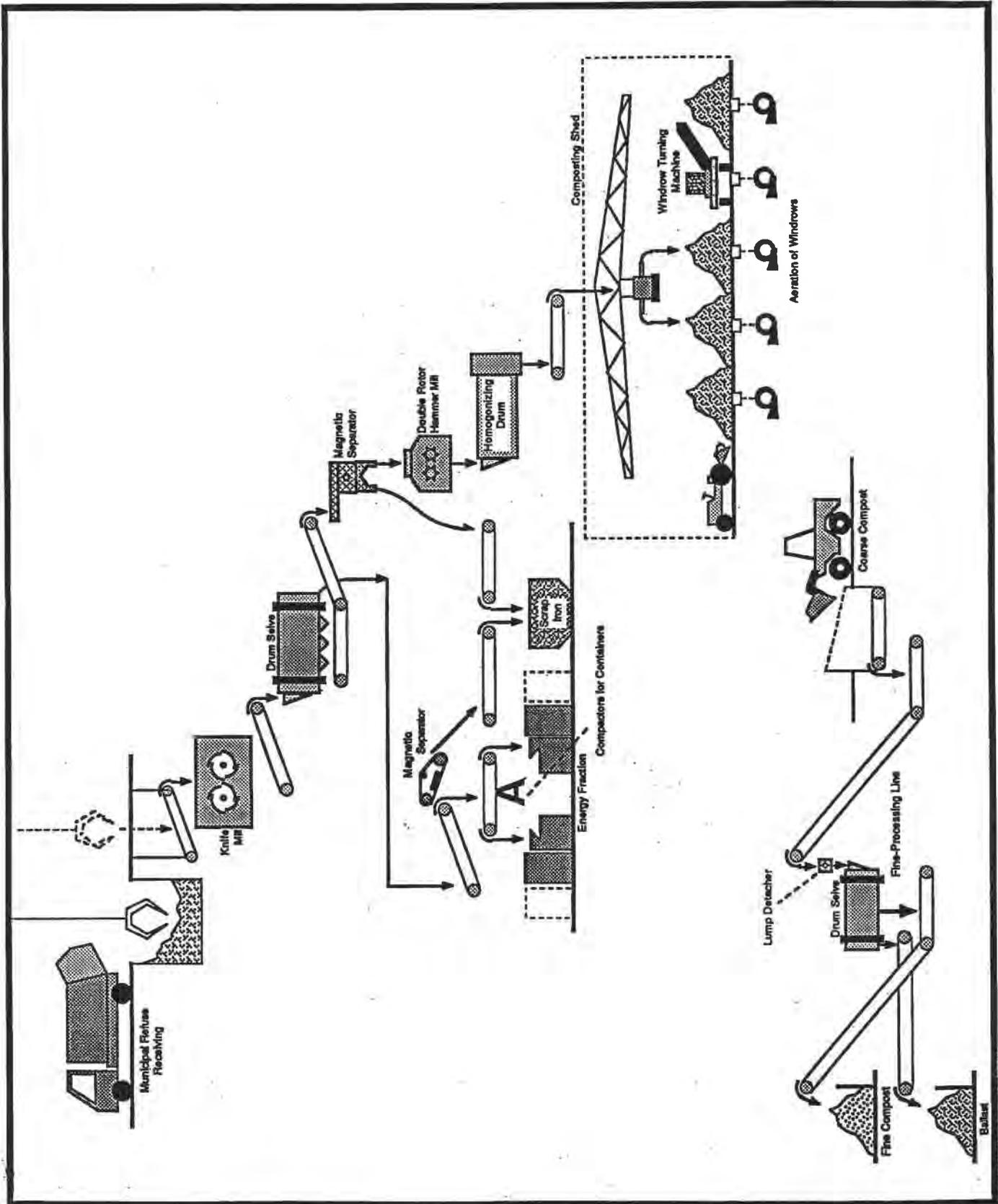
MSW Composting

MSW composting is widely used for solid waste stabilization and disposal in many parts of the world. In assessing the potential for this type of program, consideration must be given to the diversity of the waste stream and the present cost and environmental issues related to its disposal. The basic steps for MSW composting are:

- Pre-processing - includes size reduction of waste by shredding or grinding, materials separation to eliminate noncompostibles, and mixing to produce homogeneous feed materials;
- Composting - utilizing one of four methods: windrow, dynamic bin, static pile, or in-vessel reactors to facilitate the composting activity;
- Post-composting - the curing, grinding, and screening processes used to produce the finished product.

The composting methods most commonly used may be classified as agitated (periodically turned while composting) and static (not turned or moved during the composting process). Windrow composting is the most common application of the agitated method. A diagram of this process is included as Exhibit 4-2. In this method, materials are placed in windrows and periodically agitated by a piece of mobile equipment, such as a windrow turner. The aerated static pile composting process is a common application of the static method. In this method, the material to be composted is piled over a grid of aeration piping (positive introduction of air) or exhaust piping (vacuum system), which provides oxygen to allow the biological composting process to take place throughout the pile, which may be about seven to eight feet

Exhibit 4-2 | MSW Windrow Composting



Job/Quotas/Cz Compost-422/83
EJH/EL

high. Screened compost material may be placed over the pile to provide odor control and insulation.

Co-Composting

Co-composting refers to the simultaneous composting of two or more diverse waste streams. Usually the two streams are MSW and wastewater treatment plant sludge or septage. Merging these two waste streams is beneficial because the high nitrogen content of the sludge adds to the value of the compost, while the MSW serves as a carbon source for the sludge. Furthermore, the low heavy metal content in the MSW can decrease the metal concentration in the final compost product.

Co-composting operations often use the “in-vessel” or “reactor” method in which the materials are put inside a vessel where the composting process takes place. A wide range of vessel types and associated mechanical systems for mixing and moving materials within the vessel are available through proprietary vendor systems. The primary advantage of an in-vessel system over the windrow or static pile composting systems is increased control over the biological process and greater odor control.

Vermicomposting

Vermicomposting employs earthworms to convert organic waste to compost or topsoil products. This technology is occasionally used in large-scale applications. Certain species of earthworms can consume organic materials rapidly and break them down into fine particles by passing them through the grinding gizzard. The fecal material or “castings” they produce is finely fragmented and suitable for crops. The earthworms require aerobic conditions (conditions where air is present) to live, and take the place of mechanical turning and aeration of the compost feedstock that is required for aerobic composting operations. A major challenge to vermicomposting is to carefully manage the system so that the organic materials do not overheat, since earthworms will not survive at temperatures above 35 degrees C (95 degrees F). Space is needed to accommodate shallow troughs or windrows, and piles must be kept ideally at 80 percent moisture. The process can result in a finished product in as little as four weeks.

Anaerobic Digestion

Anaerobic digestion takes place in the absence of air. It is a biological process in which human, animal, and agricultural waste, and the organic fraction of MSW, can be fermented to generate methane gas. In applying anaerobic digestion to MSW, the first step includes sorting and separating the organic fraction and shredding the material to be processed to reduce its size. The second step includes adding moisture and nutrients, blending, adjusting the pH of the mass, heating the mixture, and feeding the resultant slurry into a reactor vessel (tank) for the biological process to continue. Here, anaerobic bacteria digest the organic material to produce

methane, carbon dioxide, and a watery sludge. This digestion process may take several weeks to two months to complete. The third step includes capturing, storing, and processing the methane gas for fuel. Process residue consists of digested sludge, which requires dewatering and disposal. The separated water requires treatment prior to final disposal. Depending on the moisture content of the waste to be processed through anaerobic digestion, the volume of water to be added to the process can be significant and require a large reactor volume relative to the amount of MSW processed.

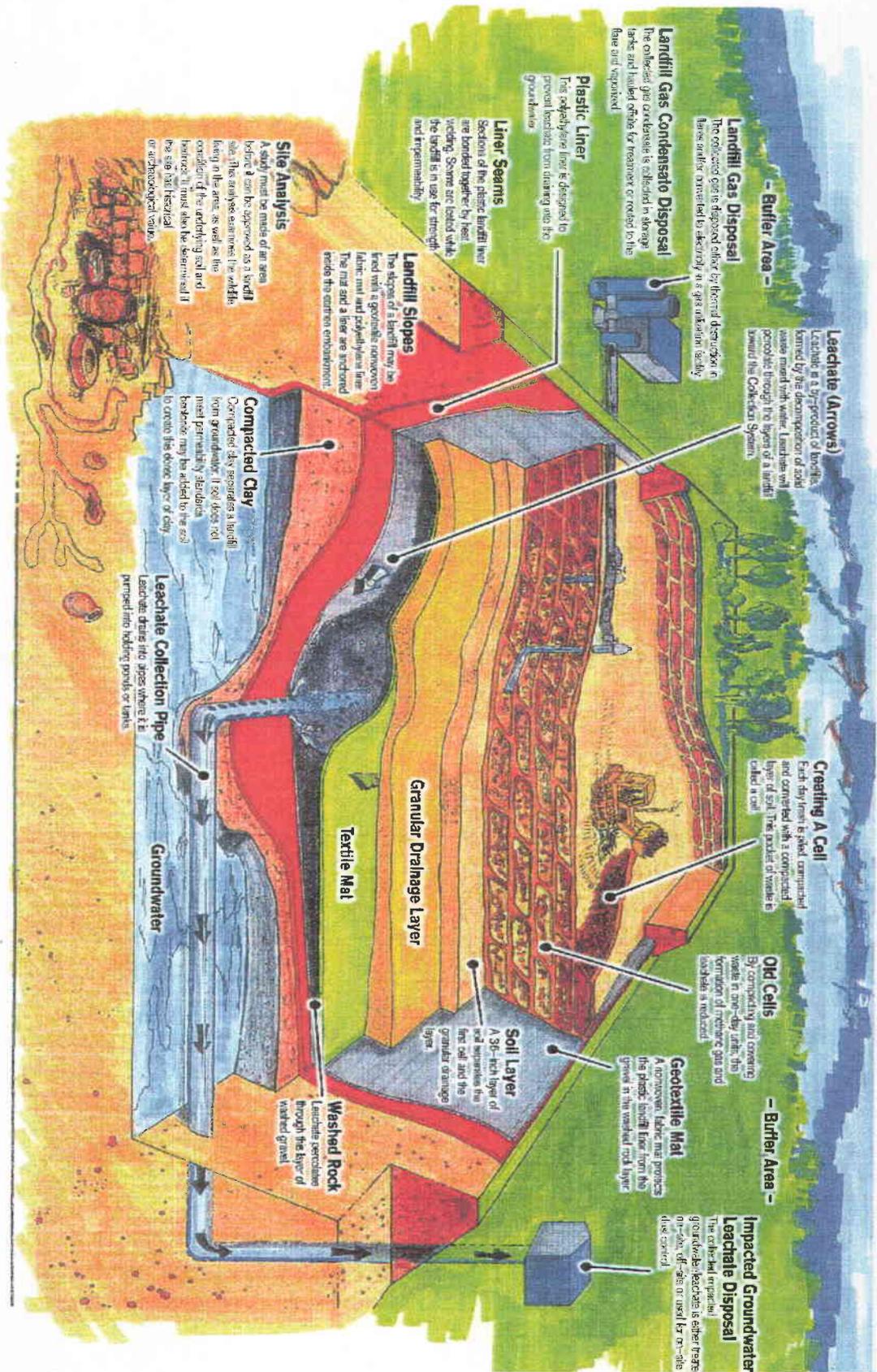
4.4 | Sanitary Landfills

Landfilling refers to the disposing of waste on land in a series of compacted layers and covering it, usually daily, with soil or other materials, such as compost. Many different engineering components or controls can be included in a landfill design to protect groundwater, control the explosive gases generated by waste decomposition, and improve health and safety conditions. These typically include liners, environmental monitoring systems, leachate collection systems, and gas venting or collection systems. The necessity for various engineering controls can vary given the hydrogeological and other conditions at a site. Exhibit 4-3 shows a configuration of selected engineering features at a typical MSW landfill. Engineering control features of modern sanitary landfills are discussed below.

4.4.1 | Liners

A liner provides a barrier between the waste materials and the groundwater underlying the site. Low-permeability liners are installed along the bottom and sides of a landfill to reduce the migration of leachate to groundwater beneath the site, as well as laterally. Native soil, if it contains low-permeability materials such as clay, is commonly used to underlie MSW landfills. In some cases, the materials are simply used as is. In other cases, native soil is compacted and remolded to increase strength and reduce permeability. Sometimes a low-permeability clay, such as bentonite, is added to the native soil to reduce permeability. Other times a composite liner, composed of an engineered soil layer overlain by a synthetic flexible membrane liner, is used. Synthetic liners are thin sheets, 0.3 to 0.6 centimeters thick, composed of materials such as rubber, polyvinyl chloride, or various polyethylenes. An important aspect of flexible membrane liners is the process by which the seams of the different liner segments are joined. Segments of a liner can be joined together in the factory by using solvent adhesives or dielectric methods, or in the field using various welding methods.

Exhibit 4-3 | Sanitary Landfill



4.4.2 | Covers

During the operating life of a landfill, earth cover is usually applied daily to control disease vectors and vermin, prevent odors and fires, and discourage scavenging. In general, about 15 centimeters of compacted earth is used. The type of soil used for daily cover does not appear to be critical. Many landfill operators are experimenting with alternative daily cover materials, such as processed green waste, dewatered sewage sludge, chipped tires, compost and foams and fabric covers that are placed on the disposed material temporarily. Once a landfill is full, a final cover is usually placed on top to reduce infiltration of water. The design of the cover considers various factors such as soil type, degree of compaction, surface slope, drainage, and water balance. Covers are typically designed in a similar configuration to the underlying liner. The type of soil used is important because highly organic soils (peat, for example) do not compact easily. Some final cover designs also include the use of a synthetic membrane cover.

4.4.3 | Leachate

Leachate refers to the liquids that percolate through a landfill (from rainfall or moisture in the waste itself), which can pick up and carry some waste constituents through the soil and toward the groundwater. Leachate collection and removal systems use pipes to collect the leachate and prevent it from migrating into the groundwater. A typical system consists of a series of perforated collection pipes, drainage layers and blankets, header pipes, and sumps. The pipes are placed above the liner in drainage layers filled with sand or gravel. In general, liners are designed with a slope so that leachate drains into a central collection point where it can be removed with a pump.

4.4.4 | Landfill Gas

Landfill gas (LFG) is produced during the decomposition of MSW. LFG is composed primarily of about equal parts methane and carbon dioxide, with trace chemicals (benzene, trichloroethylene, vinyl chloride, methylene chloride) also present. LFG typically has a calorific value of 15 to 20 MJ per cubic meter. LFG production begins once conditions in a landfill become anaerobic. The gas produced should be collected and either processed for energy recovery or flared. Otherwise it will escape into the atmosphere as well as move laterally underground. LFG is a significant "greenhouse gas" and is explosive in concentrations greater than 5 percent methane.

4.4.5 | Environmental Monitoring Systems

Modern sanitary landfills typically include environmental monitoring systems to measure the migration of LFG and contamination of the groundwater. LFG probes are installed below the

surface of the landfill for measuring the migration of LFG. A probe consists of a permeable shaft of gravel, which collects methane and feeds it into a vertical small-diameter PVC pipe enclosed in a slightly larger diameter PVC pipe. Should methane be migrating below surface, it can be detected by evacuating the air in the smaller diameter PVC pipe. Groundwater monitoring wells are installed upgradient and downgradient from the landfill. Liquid is extracted from the wells and tested for migrating chemicals from landfill leachate.

4.5 | Landfill Gas Recovery

LFG is comprised mainly of methane, carbon dioxide, and non-methane organic compounds. It contributes to the formation of smog and poses an explosion hazard if uncontrolled. Due to high methane concentration (typically 40 to 60 percent), LFG is both a valuable source of energy and an explosive greenhouse gas that should be controlled for environmental and safety reasons. Substantial opportunities exist to harness this energy resource and turn what would otherwise be a liability into an asset. Exhibit 4-4 shows a typical LFG-to-energy system.

4.5.1 | Electricity Production Technologies

The following four technologies are considered conventional and are currently employed in commercially viable projects: internal combustion engine, gas turbines, boiler/steam turbine, and boiler fuel. Fuel cell technology is considered somewhat experimental.

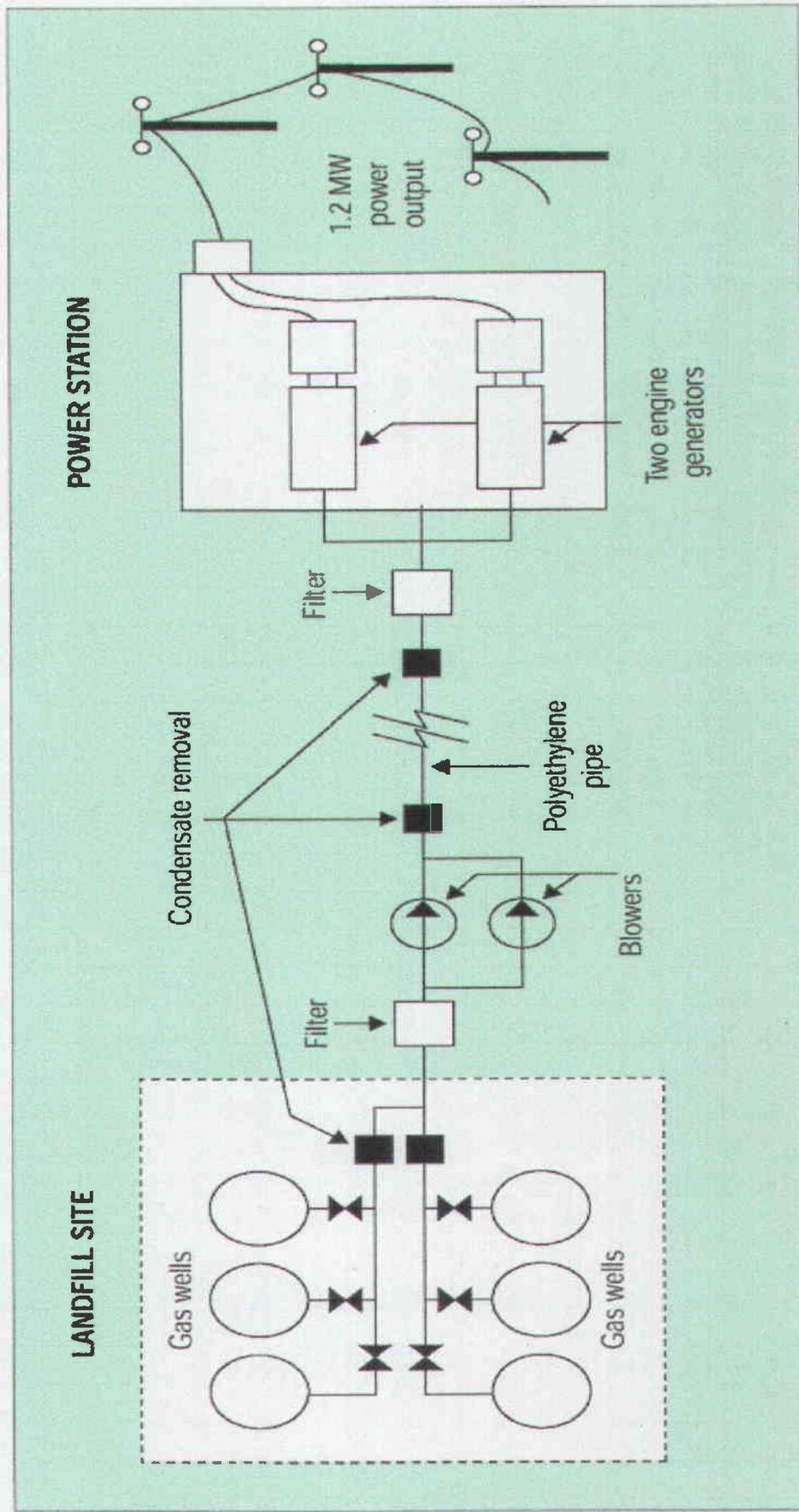
Internal Combustion Engine

The reciprocating internal combustion engine is the most commonly used energy conversion technology in LFG applications. These engines are stationary, similar to conventional automobile engines. Almost 80 percent of more than 150 LFG projects currently operating in the United States use this technology.

Gas Turbines

Gas turbines are typically used in medium-to-large LFG projects. The plant does not require a full-time operator, as the system is automated and normally requires a few hours per day of attendance. Unlike an internal combustion engine, a turbine requires significant energy to operate gas compressors that feed the turbine. Most LFG-to-electricity projects that do not utilize internal combustion engines employ gas turbines.

Exhibit 4-4 | Typical LFG-to-Energy System



Boiler/Steam Turbine

This technology is primarily applicable to large LFG projects. In addition to a boiler and a steam turbine generator, this system usually requires a complete water treatment and cooling cycle and an ample source of process and cooling water.

Boiler Fuel

LFG has been used as a boiler fuel for many years in a number of applications. LFG is fed into a boiler where it is combusted to create hot water or steam for driving of a turbine to generate electricity. Steam-driven turbine projects have large energy consumption requirements and thus require large amounts of LFG. These projects are not very common for this reason. More common are projects that use LFG to heat or preheat water for certain processes. These types of projects require much less LFG and are thus more practical. Combusting LFG requires a specialized burner in the boiler. Many existing boilers can be modified to accept and burn LFG.

Fuel Cells

A fuel cell is an electrochemical device that combines hydrogen and oxygen to produce electricity and thermal energy. In landfill applications, the source of hydrogen is the methane in LFG, which is reformed in the fuel processor section of the fuel cell to boost the concentration of hydrogen. The hydrogen-rich fuel and oxygen then feed into the power section. The power section includes a fuel cell stack, which is a series of interconnected thin electrode plates. An electrolyte material separates the anode and the cathode. The input fuel passes over the anode and oxygen over the cathode. A catalytic reaction produces DC electricity and by-products such as water and carbon dioxide. The output DC electricity is then converted to AC electricity in the power conditioning section. There are four primary types of fuel cells that are based on the electrolyte employed. Among these, phosphoric acid fuel cells (PAFC) are the only commercially available fuel cells for electricity generation projects using LFG. Fuel cells are modular in design and have a rapid load response. Unlike the three conventional generation technologies described above, which have been in use for quite some time, fuel cell technology for LFG projects is relatively new and has only recently begun to be utilized.

4.5.2 | Alternative Vehicle Fuel Technologies

The following technologies are all considered in the research and demonstration stage.

Compressed Natural Gas

LFG can be converted to compressed natural gas (CNG) for use as a vehicle fuel. The collected gas (with methane contents typically ranging from 40 to 60 percent) is compressed and purified through a multistage process. The gas is first compressed in a rotary vane blower. Gas pressure is further increased to several hundred pounds per square inch using reciprocating compressor stages, with heat-exchangers to reduce temperature. The gas then enters a carbon guard bed, which removes trace organics and moisture. Next, the gas is heated to prevent possible condensation and passed through purification membranes to remove carbon dioxide while rejecting methane. The residual product gas, now around 96 percent methane, goes on for further compression and storage. After leaving the membranes, an odorant is added to provide an early warning in the event of a leak. The gas is then compressed to about 500 psi for storage in pressure vessels. Underground piping usually carries the product gas to the gas dispenser.

Liquefied Natural Gas

LFG can theoretically be converted to liquefied natural gas (LNG) for use as a vehicle fuel using a process similar to the one described above. One attempt to produce LNG from LFG operated for a short time in the state of Texas. LFG consists of 40 to 60 percent methane, 30 to 45 percent carbon dioxide, 0 to 10 percent nitrogen, 0 to 2 percent oxygen, and 0 to 1 percent other contaminants, such as hydrogen sulfide. LNG gas is nearly 100 percent methane. The goal of the purification process is to remove every substance except methane from the gas. When the LFG enters the purification module, it is routed through a water separator to remove any free liquid from the stream. This is the first step in cleaning the gas and it protects the compressors from ingesting any free liquid. The gas is then compressed to obtain the pressure required for efficient utilization of the membranes at a later stage of the purification process. A compressor aftercooler is employed to remove the heat of compression and more moisture. After the gas pressure has been boosted by the compressor, the flow is routed through a regenerative guard bed where volatile organic compounds (VOCs) in the gas are removed. Besides cleaning the LFG, this purification action protects the membrane elements from the gas contaminants. Next, the gas is sent through membrane elements, which remove the bulk of carbon dioxide. The membranes also reduce the water vapor and remove about half of any oxygen in the gas. The flow exiting the membranes typically contains less than 2 percent carbon dioxide.

For the liquefaction process, the amount of carbon dioxide in the process stream must still be reduced well below this level. This is necessary to prevent the carbon dioxide from freezing in the cryogenic heat exchanger and plugging the flow passages. To remove the remaining carbon dioxide, the process stream flows through a regenerative molecular sieve. The sieve adsorbs carbon dioxide so that the exiting stream contains less than 10 parts per million. The process stream at this stage is clean, dry, and almost 100 percent methane. It is now ready for liquefaction. The output flow from the purification process is immediately routed through a heat exchanger where it is cryogenically cooled and liquefied. It subsequently flows through a cryogenic expansion valve where the pressure is dropped to the desired saturation pressure and temperature at which the operator wishes to produce, store, and dispense the LNG. From the expansion valve, the LNG flows into a cryogenic storage tank. A cryogenic pump is used to dispense the LNG into a vehicle via a cryogenic coupling connecting the vehicle tank to the storage tank.

Alcohol Production

Conversion of LFG to ethanol or methanol for use as a vehicle fuel has yet to be demonstrated on a commercial basis. The technology is still in the research phase.

4.6 | Incineration and Waste-to-Energy Technologies

Garbage has been burned for centuries. Until the last few decades and even now in many parts of the world, the burning typically was uncontrolled (i.e., in a dump, field or backyard drum or pit) or only marginally controlled. Now in industrialized countries, most MSW is incinerated in modern combustion systems, which recover energy and incorporate air pollution control devices. The earliest known waste-to-energy plant (WTE) was operated in Germany in the late 1800s. This waste management technology is now utilized extensively in Europe, Japan, and the United States. The goals of MSW combustion are to reduce waste volume and extract the caloric value in a useful form of energy. In addition, if combustion occurs with the proper temperature and residence time it will destroy pathogens and some toxic chemicals.

Three basic types of incinerators are used to burn most MSW:

- Mass burn systems are large facilities (usually over 200 tons per day) that burn mixed MSW.
- Refuse-derived fuel systems generally are large facilities that process MSW into a more homogeneous fuel that is then burned.

- Smaller, modular systems also combust unprocessed MSW. These systems consist of multiple modules manufactured at a factory and assembled on-site.

Other processes such as pyrolysis, gasification and acid hydrolysis are generally considered to be in the research and demonstration phase. Each of these systems is described below.

4.6.1 | Conventional Technologies

The three technologies discussed in this section account for most all of the commercial waste-to-energy facilities currently in existence.

Mass-Burn

Mass-burn systems process MSW “as is” without sizing, shredding, or separating prior to burning. The only preprocessing typically involved in mass burning systems is the removal of large bulky items and hazardous materials from the waste stream. The heat released during the combustion of the waste materials creates steam, which is used to produce energy. The steam can be used to power a turbine, which generates electric power. The steam can also be sold to industrial customers for heating and processing. Mass-burn facilities typically process 100 to 3,000 tons of waste per day. These systems have to be erected on-site, which is more expensive than modular (prefabricated) units, but the plants often last longer and may be more thermally efficient. Exhibit 4-5 is a typical cross-section of a mass burn plant.

Refuse-Derived Fuel

The refuse-derived fuel (RDF) process uses a two-part production-incineration system. RDF is the combustible portion of MSW, which is separated from the noncombustible portion through shredding, screening, and air classifying. The material that results is a relatively homogeneous product, which can be burned in a boiler located on-site to produce steam or electricity or marketed as a fuel to outside users (utilities or industries). In general, RDF systems must be large to achieve the economies of scale necessary to pay the additional cost of front-end processing equipment. While systems of less than 1,000 tons per day exist, the majority are over 1,000 tons per day. Exhibit 4-6 shows a typical RDF system with a dedicated boiler.

Modular Systems

Modular systems are similar to mass-burn facilities, but are usually smaller in size. These plants are prefabricated and can be assembled quickly on location. Modular systems can process waste quantities in the range of 5 to 100 tons per day. When multiple units are used, modular systems can reach capacities of up to 600 tons per day. Exhibit 4-7 is a typical cross-section of a modular incineration system.

Exhibit 4-5 | Mass Burn System

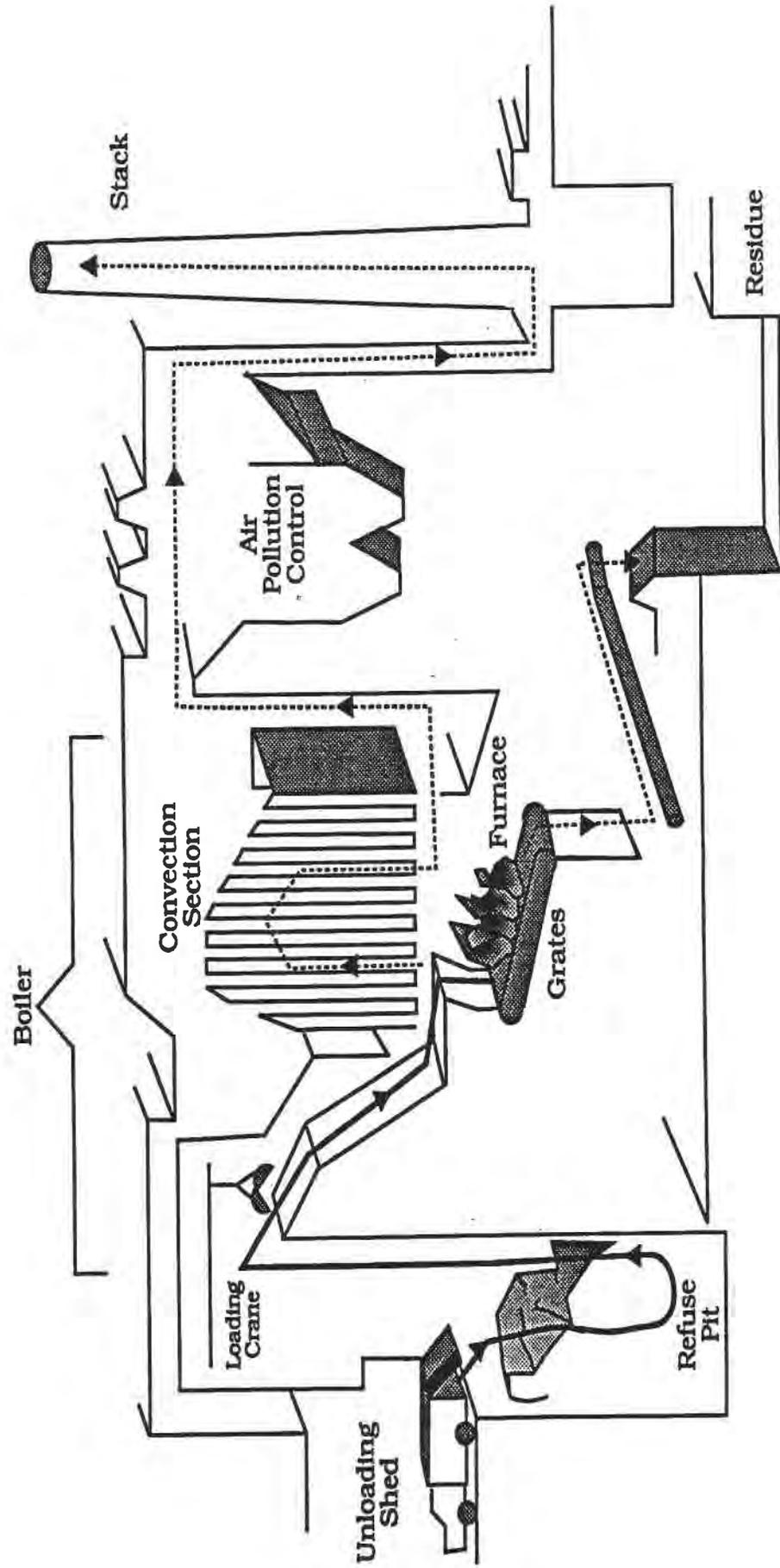


Exhibit 4-6 | RDF with Dedicated Boiler System

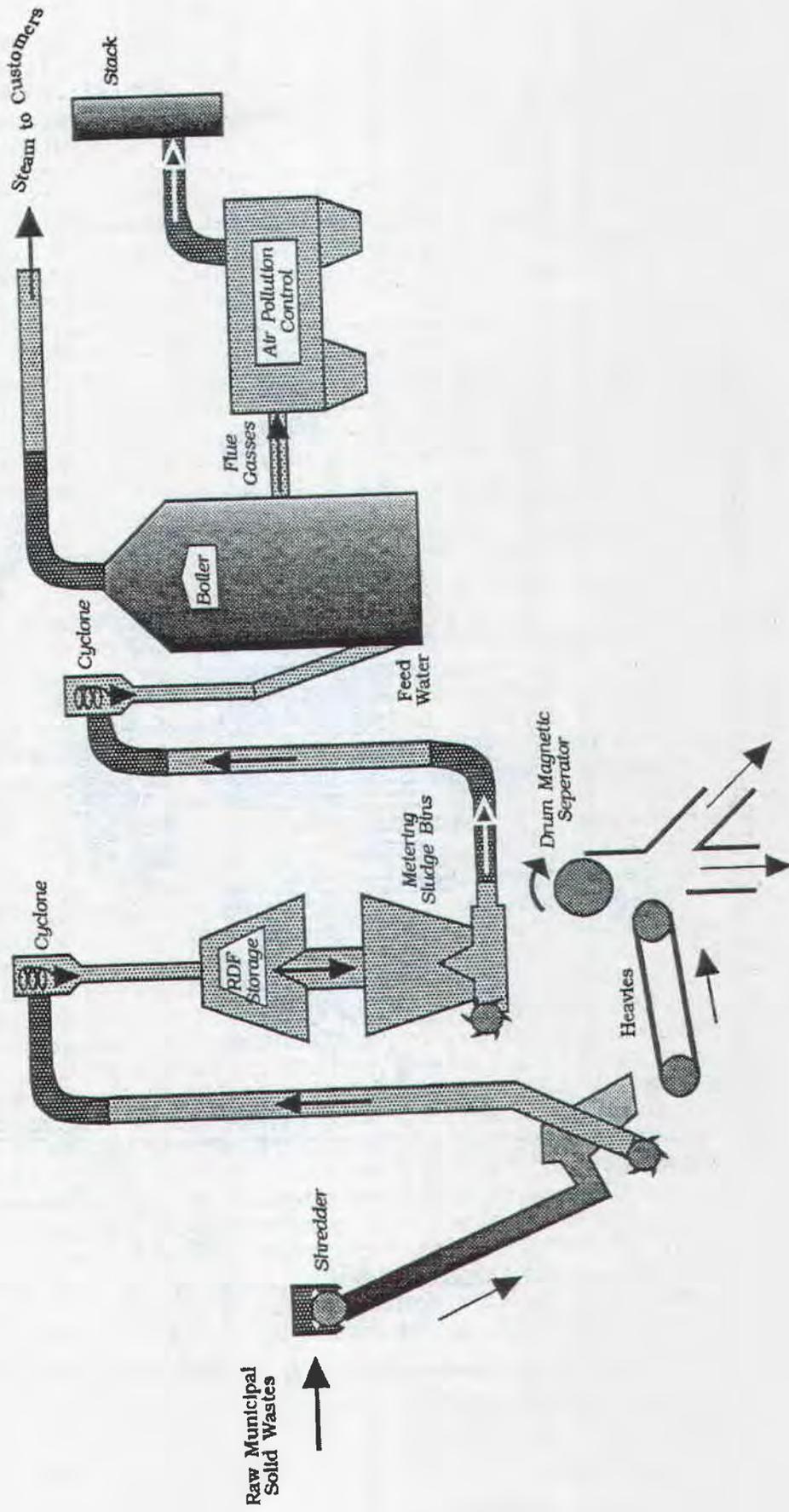
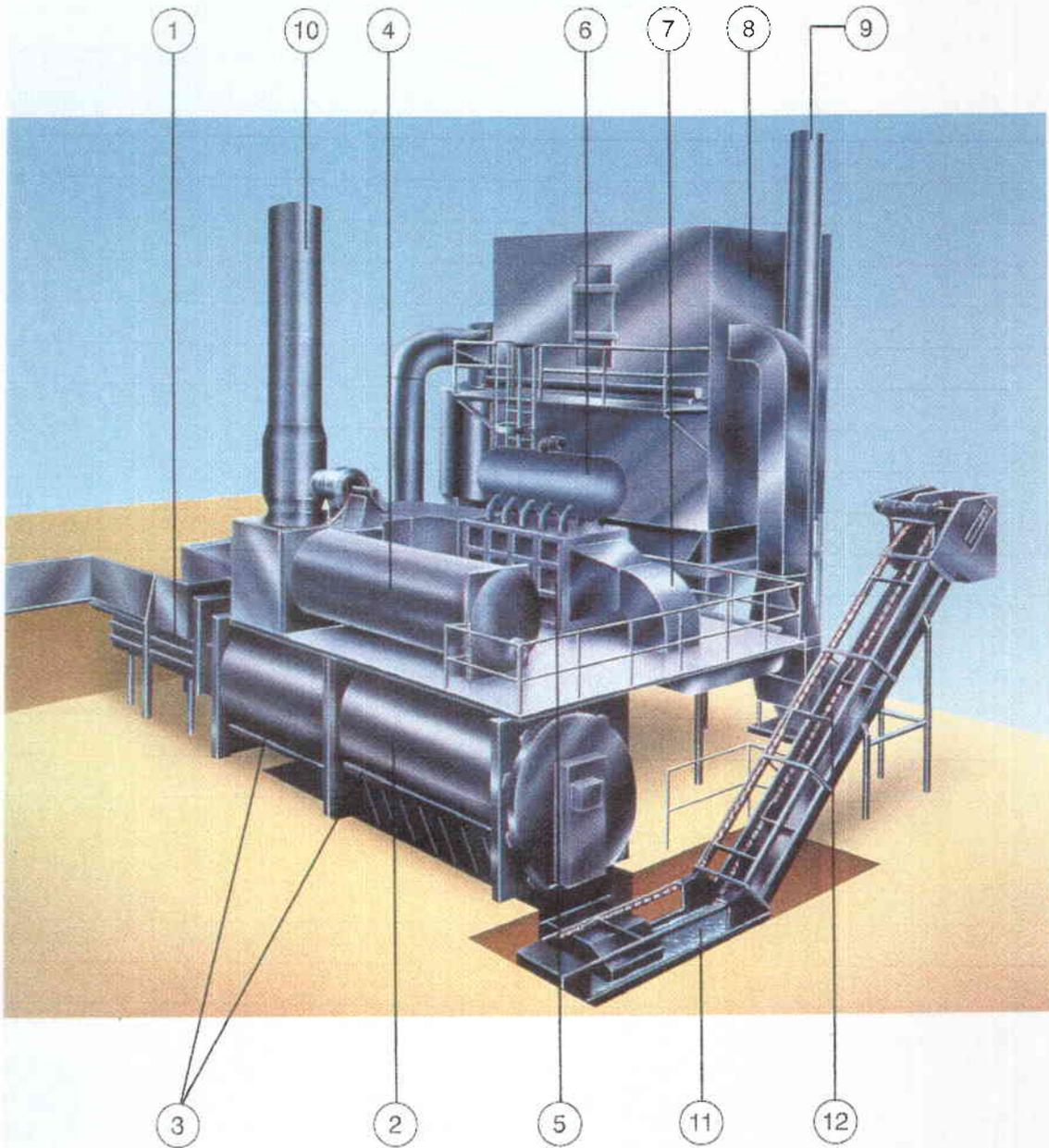


Exhibit 4-7 | Modular Incineration System



- 1. Automatic Feed System
- 2. Primary Chamber
- 3. Transfer Rams
- 4. Secondary Chamber

- 5. Steam Generator
- 6. Steam Separator
- 7. Energy Duct
- 8. Emissions Control System

- 9. Exhaust Stack
- 10. Emergency By-Pass
- 11. Wet Ash Sump
- 12. Ash Conveyor

4.6.2 | Experimental Technologies

The following three technologies are considered mostly experimental in nature. While several demonstration projects are operational, no commercially viable ongoing operations exist.

Pyrolysis

Pyrolysis is an experimental thermal processing of the organic fraction of the waste stream in the absence of oxygen. While several demonstration projects have been built, no commercially viable projects exist. The waste is subjected to high temperatures (approximately 760 degrees C or 1,400 degrees F), and the process relies on an external heat source. Combustion does not occur and the organic waste is thermally reduced to products including solid carbon and a gas consisting of hydrogen, methane, carbon monoxide, carbon dioxide, and other gases. At lower temperatures, volatile liquids such as oil may also be formed. In theory, gases and/or oil may be cleaned and burned as a fuel or used in industrial processes. The solid carbon may be processed to make activated carbon, which is used in many industrial processes.

Gasification

Gasification of MSW is an experimental process. The gasification process includes partial combustion of a carbon-rich fuel to produce a combustible fuel gas rich in carbon monoxide, hydrogen, and methane. The resulting fuel gas can be combusted in an internal combustion engine or boiler. The three most common types of gasifiers are vertical fixed bed, horizontal fixed bed, and fluidized bed. Gasification systems for transformation of MSW would likely require a uniform, homogeneous fuel supply, such as densified RDF, to be effective.

Acid Hydrolysis

Acid hydrolysis is an experimental technology that converts a portion of the waste stream into fuel, usually alcohol. Many waste components, such as paper and green waste, are composed of organic material, primarily cellulose. This process uses acid to break the material down into simpler compounds, such as sugar. The sugar, or other simple compounds, may then be converted to useful fuel by a number of processes. Ethanol may be generated through fermentation using selected strains of yeast. Methane, produced from solid waste by anaerobic organisms, may be converted into methanol. Separation of the high cellulose waste fraction prior to the hydrolysis process may be accomplished by procedures similar to those used to prepare RDF.

4.7 | Medical Waste Management

Medical waste (MW) consists of both MSW and pathological waste that requires special handling, biohazardous or infectious waste, and sharps. Infectious waste is defined as capable of producing infection.

Generators of infectious waste include the health care industry (hospitals, doctors' offices, and clinics); academic and industrial research laboratories, the pharmaceutical industry (production and testing); veterinary facilities; and food, drug, and cosmetic industries.

MW management should address segregation of the infectious waste stream, handling of the infectious waste, packaging and transport, treatment techniques, and disposal methods.

4.7.1 | Medical Waste Separation and Handling

In many communities throughout the world, government regulations require special handling for MW. MW is generally collected in color-coded plastic bags (infectious waste in red bags). The waste is then transported for internal or external processing. "Sharps" include hypodermic needles, syringes, scalpels, and other instruments that have been used in a medical procedure and are capable of puncturing a plastic bag or other waste container. Sharps are collected in rigid plastic containers that can be disposed of in their entirety. Empty plastic water jugs are sometimes an inexpensive alternative container for sharps.

4.7.2 | Infectious Waste Treatment

The purpose of treating infectious waste is to change its biological character by any method, technique, or process to render the waste non-hazardous and safe for disposal. Four general types of treatments are suitable for treating infectious waste: heat (steam sterilization or autoclave), chemical treatment, irradiation, and incineration.

Steam Sterilization or Autoclave

In this scenario, equipment applies heat of 120-135 degrees C (250-275 degrees F) to sterilize the waste, which can then be disposed of as MSW. Spore kill time varies inversely with temperature. This method is suitable for relatively small waste quantities and has a relatively low capital cost. The effectiveness of the treatment depends on the type of waste, packaging materials, and the volume and configuration of the waste load.

Chemical Treatment

This method consists of applying chemical disinfectants to the waste material, thus disinfecting rather than sterilizing. Not all types of waste can be effectively treated with chemicals, and this method is not suitable for large volumes of waste. Because of the type of action involved and many variables that affect treatment, chemical treatment should be reserved for use in special cases.

Irradiation

This method, widely used in Europe and Canada, uses ultraviolet rays, gamma rays, and accelerated electrons to sterilize the waste. Its major disadvantage is the high cost requirements for safety shielding during the treatment process.

Incineration

This method burns the waste at sufficient temperatures of 870-980 degrees C (1,600-1,800 degrees F) to transform the waste into sterile ash suitable for disposing in MSW landfills. This method can handle large quantities of waste and is widely used throughout the world. Incineration has moderate to high capital and operating costs and requires monitoring and control of air emissions.

Section 5 | Jijel Waste Management Improvements

Introduction

Although many different technologies exist to collect, recycle, transport, and dispose of MSW and MW, only a few of these are appropriate for Jijel. In addition, several of the technologies presented have not been commercially demonstrated on an ongoing basis. These technologies have not been considered appropriate for Jijel.

There are numerous ways to utilize the referenced technologies in developing an integrated approach to waste management for Jijel. Factors such as waste quantity and composition, location, available and appropriate vehicles and equipment, environmental considerations, workforce, climate, culture, and economy all play a role and must be considered when identifying solutions and recommendations. The waste composition study completed at the dump site at Mezraitine indicates that there is a large portion of organic material to be addressed in a new management scenario. The City currently provides waste hauling services for residents and commercial areas. There is also some self-haul. Some materials are being scavenged and salvaged for recycling or reuse. A new, properly engineered sanitary landfill is being strongly considered at a site 17 kilometers south of Jijel to replace the current site.

From our review of possible waste management improvement alternatives, Jijel has chosen the following five measures: 1) replacing collection equipment with new modern equipment, 2) closure and rehabilitation of the existing Mezraitine dump site, 3) siting and development of a controlled and compacted sanitary landfill for municipal solid waste with an adjacent vermicomposting operation, 4) developing an alternative method for the disposal of slaughterhouse waste (i.e., meats and organs), and 5) air pollution control devices for the medical facility waste incinerator.

5.1 | Replacement of Collection Equipment

5.1.1 | Existing Collection Equipment and Practices

Existing Equipment

Waste from residential, commercial, and street sweeping is collected from ten city zones, either door-to-door, or from neighborhood collection points. Waste is deposited at the Mezraitine dump site located approximately 8 kilometers southwest of the City. Informal recycling occurs by way of individuals or scavengers who recover recyclable materials for resale either prior to the refuse arriving at the dump site or at the dump site itself. Numerous illegal dump sites exist in Jijel and throughout neighboring areas.

Section 2 describes the equipment currently utilized by the City of Jijel for its solid waste operations. Ten vehicles owned by the City collect waste in ten City collection zones. Eight SNVI brand vehicles (models K 66 and K 120) are used in collection Zones 2, 3, 5, 6, 7, 8, 9, and 10 to collect refuse door-to-door, as well as refuse from centralized collection locations. SNVI is an Algerian industrial vehicle manufacturer located in Algiers. These are flatbed vehicles with sidewalls and vehicles with removable bins. Loading is done by hand. These vehicles do not compact materials.

Two SNVI brand vehicles (model K 120) handle the steel debris boxes in collection Zones 1 and 4. These vehicles are able to place empty debris boxes at the collection points, retrieve full boxes, and transport them to the dump site where they are emptied by hand. These vehicles are similar to the roll-off vehicles described in Exhibit 5-1. In addition to these ten vehicles, one Isuzu brand compactor vehicle is also used to densify waste. It is equipped with a top loading mechanical device that automatically empties trash cans.

Jijel currently collects about 50 tons per day (although approximately 80 tons per day is generated by Jijel, only 50 tons per day is available for collection by City vehicles; the remainder is self-hauled by businesses and the public) with these 10 vehicles; this averages to about 5 tons per vehicle per day. For Jijel's particular situation, a modern compactor truck can handle about 6 to 10 tons per load, approximately doubling the current efficiency. Jijel's current 10-vehicle fleet could be reduced to five or six modern compaction vehicles.

In addition, the majority of City collection vehicles delivering waste to the dump site are open bed vehicles with no coverings. All loads should be covered according to Algerian law. Collection vehicles typically have a crew of one driver and two loaders, and bagged garbage is loaded by hand.

Lastly, street sweepers utilize agricultural tractors equipped with trailers in collection Zones 1 – 4 to load materials gathered with the 18 wheelbarrows and the trash bins.

Existing Practices

Two methods of waste collection are employed in Jijel. The primary means is door-to-door waste collection, in which waste is placed in front of the house or building and near the street, primarily in plastic bags purchased by waste generators. These bags come in different sizes and capacities. In some cases, residents set their refuse out in trash cans.

Some collection zones utilize a second method of collection that involves gathering waste in centralized locations. In these zones, residents place their waste in metal cans (made from half of a steel drum with handles welded to the side), steel debris boxes (which require more effort on the part of the loaders), or concrete-walled neighborhood deposits to await collection.

In either case, with the exception of some debris-boxes (which are mechanically loaded using roll-off vehicles), the collection crew manually loads the solid waste into the top of open flatbed vehicles with sidewalls.

5.1.2 | Proposed Collection Equipment

Based on the solid waste and collection disposal practices observed during our field visit to Jijel between March 25 and April 4, 2000, we have listed several types of collection vehicles and storage containers appropriate for Jijel. These vehicles are summarized in Exhibit 5-1.

Side-Loader/Rear-Loader Vehicles

Manual Loading

Because of the non-homogenous nature of set-outs by the generators in Jijel (bags, cans, etc.), some number of manual rear or side loaded compactor vehicles will be required. Manually loaded vehicles can vary in body capacity, front, rear or side loading, body size and shape, and level of compaction capability. Exhibits 5-2 and 5-3 illustrate two types of rear-loader vehicles and Exhibit 5-4 shows a side-loader, all of which are manually loaded by the collection crew.

Semi-Automated Loading

In areas where generators set out similar cans or carts semi-automated collection vehicles that are side-or rear loading may be more efficient. A semiautomatic collection vehicle is equipped with a mechanical tipping mechanism that would grab, lift, and dump standardized carts as well as allow for manually loading bags or other non-standard customer containers. Exhibit 5-5 shows the tipping mechanism lifting a standard sized cart, and Exhibit 5-6 illustrates how the mechanism allows for both semi-automated and manual loading of the collection vehicle.

Exhibit 5-1 | Collection Vehicles, Methods and Storage Containers

Vehicle Type	Size Compartments Available	Loading Method	Compatible Customer Containers	Service Conditions
Side-loading or rear-loading compactor vehicle	Approximately 32 to 50 cubic meters	Manual	Customers provide plastic bags, non-standard boxes, tanks and bins	Smaller size vehicles for narrow streets and alleys
Front-loading compactor	Approximately 32 to 50 cubic meters	Automated forks lift bins over front of vehicle and dump into top opening	Standardized bins on wheels (1.3 to 10 cubic meter sizes available) provided by operator	Bins for large volume generators with adequate storage space for carts and vehicle access
Modified front-loading compactor with bin permanently mounted on front forks and bin equipped with cart tipping devices	Approximately 32 to 50 cubic meters	Allows for manual loading of plastic bags and semi-automated loading of standardized carts. Bin mounted on front is emptied same as above	Customers provided containers or operator provided standardized carts serviced on same collection route	Can be used for service areas where customers have both bags and carts, larger bins could not be effectively serviced with modified front-loader vehicle
Roll-off vehicle	Services drop-boxes	Vehicle mechanically lifts drop-box and hauls to disposal site	Standardized drop boxes provided by operator (13 to 50 cubic meter sizes available)	Drop-boxes for very large volume waste generators, or could be used for centralized collection for multiple customers

Exhibit 5-2 and 5-3 | Rear-Loaders



Exhibit 5-4 | Side-Loader



Exhibit 5-5 and 5-6 | Tipping Mechanism



Front-Loader Vehicles

Some service areas in Jijel, particularly those areas with a high concentration of commercial or industrial waste generators (slaughterhouse, tannery, public cork manufacturer, private cork manufacturer, shirt manufacturer, restaurants, stores, etc.) can be more efficiently served using front-loader compactor vehicles for waste collections. This system would require the customers to use standardized bins that are compatible with the vehicle's hydraulically operated front forks that lift and dump waste from the bins. The size of the bin and the number of collections per week would be based on the amount of waste generated by the customer. Standardized bins range in U.S. sizes from about one to six cubic yards, which would accommodate those large-volume commercial customers generating approximately 1.2 to 8 cubic meters of waste per pickup. These bins are mounted on wheels and can be pushed by the

helper(s) into position for dumping. The bin would normally need to be placed on a flat surface at the customer's site so it can be manually pushed into position to allow the vehicle to access it. A front-loader commercial bin collection system would require customers to use standardized bins, since manually loading bags or smaller containers would not be compatible with the vehicle design. Exhibits 5-7 and 5-8 show different styles of front-loaders for handling bin pickups.

Exhibit 5-7 and 5-8 | Front-Loaders



Modified front-loaders, with a bin permanently mounted on the front forks, have been used for collecting materials from generators with non-homogenous set-outs (bags, cans, bins, etc.). Exhibit 5-9 shows such a system, which uses a bin with cart tippers permanently mounted on the front forks. The driver can manually load customer bags into the bin or use the cart tippers for heavy carts.

Roll-Off Vehicles

For handling large amounts of solid waste generated by an industrial or commercial establishment, another alternative that may be considered is using a large drop-box or debris box in conjunction with a roll-off vehicle. These types of large capacity containers range in sizes of 10 to 40 cubic yards in the United States, or the equivalent of 7 to 30 cubic meters, and usually hold 4 - 6 tons of waste. A roll-off vehicle would collect the box when it is full and replace it with an empty box. This system would only be appropriate if the customer site has adequate space for the vehicle to get positioned in front of the drop-box. With a roll-off vehicle and drop-box system, each load would be picked up and directly hauled to the processing or disposal site. Many roll-off routes in the U.S. can achieve five to eight loads per day, depending on travel distance to the transfer or disposal site. Jijel currently has two of these types of vehicles in service. Exhibit 5-10 shows a large capacity drop-box on a roll-off vehicle.

Exhibit 5-9 | Modified Front-Loader



Exhibit 5-10 | Roll-Off Vehicle



Collection Containers

Solid waste storage containers can vary significantly depending on the type and amount of waste generated by the customers. Based on the observations made during our field visit to Jijel, we found that a variety of plastic bags are used to hold refuse. These are purchased by the waste generators and are most commonly used for storing residential and commercial waste. Hard plastic trash cans, metal cans (made from half of a 55-gallon steel drum), and steel debris boxes are also used on occasion. These bags and various sized smaller tanks or bins are manually loaded into the collection vehicles unless self hauled to the dump site.

Under the circumstances, a combination of different collection containers should probably be employed in Jijel. For example, a system based on plastic bags for waste storage may be desirable for routes in the residential areas, and a different system utilizing standardized wheeled carts may work better for areas with adequate storage space and customers with larger storage containers. In cases where commercial waste generators have adequate waste storage areas and require multiple pick-ups each week, a front-loader bin system may prove to be much more cost-effective than either plastic bags or the various types of storage containers currently used by those establishments. In some cases debris boxes with roll-off vehicle service

system. It is necessary to consider different collection containers that would optimize collection in Jijel. Exhibits 5-11, 5-12, and 5-13 show some of the types of storage containers available for commercial waste and recyclables.

Exhibits 5-11, 5-12, and 5-13 | Commercial Storage Containers



5.1.3 | Proposed Collection Equipment Plan

Selecting Collection Vehicles and Containers

Minimum standards for vehicles should be required for any collection system. The range in price, body size, capacity, and loading devices will make some vehicles more or less appropriate for selection. In addition, vehicles should be evaluated for their ability to handle

the necessary operations that will be required. Such functions include: the ability to handle streets and routes, and the ability to automatically load standard storage containers. Minimum standards for waste storage containers to be used and accepted should be specified. These minimum standards may include: type of containers allowed (plastic bags, wheeled carts, bins, compactors, drop-boxes, etc.); composition of containers (metal and/or plastic); other container requirements (leak proof construction, attached lids, wheels for bins, etc.). Finally, the City should specify whether the use of waste storage containers is to be optional or required as a basic service, and whether the City will charge an additional customer fee for providing such containers.

Collection Equipment Recommendations

Vehicles

Jijel's current solid waste collection infrastructure consists of waste that is generated and left for collection in one of three ways: 1) residents dispose of waste throughout the City using plastic bags, cans, or bins at the curb or a fixed centralized collection point, 2) commercial and industrial business set out moderate to large amounts of waste that require multiple weekly pick-ups, and 3) waste is deposited in movable debris-box containers at certain collection points throughout the City.

To improve collection operations efficiency, a different type of waste collection vehicle should be utilized in each of these three scenarios. To collect residential wastes in bags and cans, a rear-loader collection vehicle is most efficient. To collect commercial and industrial business waste, a front-loader collection vehicle is most efficient. To collect the debris boxes, a roll-off vehicle works best.

In reviewing the amount of waste generated by the City, it is clear that residents generate the largest amount of waste. We are recommending the purchase of four rear-loader compaction vehicles to handle this waste. One front-loader compaction vehicle is recommended to handle the City's commercial and industrial businesses. One new roll-off vehicle is recommended for collection of the City's debris boxes. In addition, it is recommended that the City retain two to three of their current collection vehicles as back-ups including one roll-off vehicle.

BVA contacted several waste collection vehicle vendors. This report reflects information that we have received from two of these companies; Heil Environmental Industries, Ltd. (Heil) and Oshkosh Truck Corporation (Oshkosh). Heil offers suitable front-loader and rear-loader waste collection vehicles. The Heil Durapack Half/Pack Full Eject Model is a front-loader compaction vehicle with a 30 cubic meter (40 cubic yard) total capacity. The Heil Formula 4000 is a mid-range capacity rear-loader compaction vehicle. This vehicle has a 19 cubic meter (25 cubic yard) capacity.

Oshkosh offers all three vehicle types proposed for Jijel, including front-loader, rear-loader, and roll-off collection vehicles. The Oshkosh MTM Standard Front-Loader is an appropriate front-loader compaction vehicle. This vehicle has a 30 cubic meter (40 cubic yard) total capacity. The rear-loader compaction vehicle offered by Oshkosh is the MTM XC Rear Loader. This vehicle has a total capacity of 25 cubic meters (32 cubic yards). The roll-off container offered by Oshkosh is the MTM Roll off. This vehicle has a 27,000 kg (60,000 pounds) total carrying capacity with a capability of collecting most standard debris boxes.

Any of these vehicles makes or models would work well for Jijel. Vendor brochures, specifications and cost information on each of these vehicles are included in Appendix E.

Containers

To operate the commercial and roll-off collection routes efficiently, new bins and debris boxes are recommended. We recommend that the City purchase 10 – 1.2 cubic meter bins, 30 – 2.3 cubic meter bins, and 10 – 4.6 cubic meter bins. In addition, we recommend that the City purchase 10 – 23 cubic meter roll-off boxes.

BVA has provided refuse container information from one company. Capital Industries, Inc. offers a variety of refuse containers for industry and solid waste. Containers are available for front-loader collection vehicles, as well as debris boxes for roll-off vehicles. Containers are available in numerous sizes, shapes and colors. Capital Industries has recommended a series of 'stackable' containers that can be packaged and shipped at the lowest cost. This container is similar to the Capital Container, found on page six of the Containers Industrial and Solid Waste brochure and is available in 1.5, 2, 2.6, 3, 4 and 6 cubic yard (1.2 to 4.6 cubic meter) sizes.

Vendor brochures, specifications and cost information on each of these containers are included in Appendix E.

5.2 | Mezraitine Dump Site Closure

5.2.1 | Introduction

Collected solid waste is currently being hauled to the Mezraitine dump site approximately 8 kilometers southwest of Jijel. The dump site is open seven days a week, including Friday (the Islamic holy day). Because it has neither a gate nor an entrance station, formal operating hours are not applicable. BVA observed it to be used (open) from the early morning until late afternoon. There are no environmental controls such as liners, leachate collection, groundwater monitoring or gas controls. There is no scale, information of depth, age, and

quality of refuse filled at the existing site. The deposited waste is scattered about rather than being uniformly filled and animals feed on raw waste scattered. It appears that the waste quantities are relatively low and the depths relatively shallow. BVA observed that numerous portions of the dump site are on fire. Unstable incinerator wastes, or hot loads, taken from the hospital ignite waste refuse (primarily cork waste) upon arrival at the dump site.

This facility requires proper closure and rehabilitation for the following reasons: the wastes at the dump are neither compacted nor covered with any daily cover, the dump has no environmental control measures; it is on fire; seagulls and cows graze on the deposited refuse and could therefore spread potentially dangerous illnesses to the general population. BVA recommends that this dump site be properly closed and secured.

Closure of the Mezraitine dump site should occur in several phases; 1) developing a closure plan which includes the identification of the limits of wastes, a waste consolidation plan and a final cover soil placement plan, 2) developing and implementing an operations and facilities transition plan, 3) implementing the actual dump site closure activities, and 4) long-term maintenance of the dump site after closure (post-closure).

5.2.2 | Closure Plan

A proper closure plan should include the following:

- Identification of the limits of waste placement;
- Development of a waste consolidation plan and final grading plan;
- Development of a final cover soil placement plan; and
- Identification of specific closure details.

Limits of Waste Placement

The initial phase of the closure should be to identify the limits of waste placement at the Mezraitine dump site. This is best achieved by a thorough field investigation and may be combined with subsurface exploration if wastes have historically been buried or overgrown with vegetation at the perimeter of the dump site. Discussions over an extended time with personnel who are familiar with the dump site would be helpful prior to initiating the field survey. If waste placement has historically been buried or is overgrown with vegetation, the use of a series of shallow (approximately one to two meters deep) trenches should identify the presence of these wastes. Depending on the size of the dump, approximately ten shallow trenches, spaced evenly surrounding the dump area will typically reveal the extent of buried wastes. If the trenches reveal wastes beyond the extent of the trenches, additional trenches should be excavated to the outermost limits of the waste. The location of the trenches should be surveyed using horizontal geometry to properly map the location of the waste area. A map

should be prepared that illustrates location of limits of waste. The map should also identify the topography of the wastes in relationship to the limits of wastes. This should be the basis for the preparation of a waste consolidation and final grading plan.

Waste Consolidation and Final Grading Plan

Using the limits of waste map described above, a waste consolidation plan should be prepared. The purpose of the waste consolidation plan is to identify where wastes should be efficiently relocated to minimize the movement of wastes preferably into one mass for the placement of final cover soils. The purpose of the waste consolidation plan is to reduce the size of the open dump area into a central location thereby minimizing the volume and effort in placing the final cover soils. A final grading plan should also be prepared, showing how the existing random piles of loose waste should be compacted to a firm and unyielding condition to be capable of supporting the placement of soils on the wastes without the soil raveling into the waste.

Final Cover Soil Placement

The final cover soil should ideally consist of the placement of a multi-layered soil cover system installed over the entire waste area or footprint. If low permeable soils are not available, an attempt to secure a geo-composite clay liner (GCL) or a geomembrane should be considered. If the cost of securing these materials is too high, the placement of a thickened native soil cap should be implemented. The design of the final cover system should be directed by a registered civil engineer or certified engineering geologist familiar with waste management operations. The final cover system (from bottom to top), should consist of:

Foundation Layer

A 60mm thick foundation layer that consists of clean fill soil free of waste or other inert material capable of sustaining construction equipment and providing long-term support for the overlying components of the final cover system. The uppermost portion (lift) of layer will be compacted to the maximum density possible at the optimum moisture content using methods in accordance with accepted civil engineering practice. Soil used to construct the foundation layer will be obtained on site.

Low-Permeability Layer

If available locally, a low-permeability layer of soil approximately 30 mm thick consisting of a native soils that demonstrate approximately 1×10^{-5} or lower cm/sec permeability or a manufactured geosynthetic clay liner (GCL) or a geomembrane should be placed on top of the foundation layer. A GCL or geomembrane could provide a similar level of protection if adequate supplies of low permeability soil in the region prohibit its placement. The GCL

should provide for a minimum permeability of that for a 30 mm thick low permeability soil layer.

Vegetative Layer

A minimum of a 30mm thick vegetative soil layer should be placed over the low permeability layer. The vegetative soil layer should be rich in organic content so as to support the vegetative growth of grasses. On-site topsoil should be selectively excavated and stockpiled for the later construction of this layer.

Other Closure Plan Details

Closure Cost Estimate

Closing the dump site could be costly. It is important to budget funds so the project may be completed as conceived by the design engineer. The closure cost estimate should include the following:

- Waste limits identification,
- Waste consolidation, shaping and compaction,
- Modifications to the existing dump roads to allow for continued disposal while waste consolidation and compaction occur,
- Soil cover identification, excavation placement, and compaction,
- Surface water drainage improvements,
- Environmental control (landfill gas monitoring, venting or collection and destruction),
- Leachate sump construction,
- Groundwater monitoring,
- Site security,
- Engineering, management, and associated administrative activities, and
- A contingency for unforeseen circumstances.

Estimated Time of Closure

The closure of the existing dump site should be calculated depending on the capability of the operator to perform the various tasks associated with closure which include waste identification, consolidation, shaping, compacting, soil placement, etc. Closure of the entire dump site will likely require several years. However, the development of a new landfill will likely require a similar amount of time before it is ready to accept waste. Consequently, the timing of closing the existing dump site should be coordinated with the development of the

new landfill so that a disposal facility is always available to the City (see Operations and Facilities Transition Plan below).

As an alternative to the phased closure timeframe, the City may attempt to seek funding for a contractor to perform the closure activities under an accelerated timeframe. The accelerated closure will require the same essential components as discussed above. Consequently, the accelerated closure should be calculated depending on the number and performance capabilities of the contractor. The accelerated closure should also be scheduled with the development of the new landfill to assure a facility is capable of accepting wastes. We recommend the City evaluate the capability of acquiring appropriate funding of both the closure costs and the new landfill development costs and the capabilities of contractors in the region to determine the viability of closing the dump site under an accelerated timeframe.

Ancillary Facilities

A plan should be developed that describes the closure of ancillary facilities at the dump site including structures, roads, and environmental control facilities. Final roads will need to be developed for movement around the closed facility.

Locating Cover Soil

Prior to placing cover soil on the dump site, it will be necessary to locate a source of nearby cover soil. Preferably, the soil should be excavated from the dump site. The proximity of the soil is critical to completing the closure in a cost-effective manner. Hauling cover soil long distances is costly and may add time to closing the dump site. Ideally, locally available low-permeability soils may be identified that could be used for the low-permeability soil layer.

5.2.3 | Operations and Facilities Transition Plan

Jijel should anticipate an operation and facilities transition period during which the Mezraitine dump site will be used during construction and after the opening of the new landfill site. A transition plan should be prescribed to provide the optimal schedule for the transition of the various landfill functions from the old site to the new. Because the Mezraitine dump site cannot close until a new landfill is developed, short-term improvements can be made in the interim. There are a variety of improvements that can be made to the Mezraitine Dump Site during the interim period before a new landfill is opened. These recommendations are described in Section 7.

5.2.4 | Dump Site Closure

The described closure plan should be followed for closure of the Mezraitine dump site. The major tasks shall be:

- Implementing the waste consolidation plan by placing and compacting the wastes into a coherent mass with defined surface grading features;
- Implementing the placement of final cover soils over the surface of the compacted waste area;
- Securing the area with fencing.

Details describing closure procedures are included in Section 7.

It will be necessary to develop a program of quality assurance methods for controlling construction during closure operations. Quality assurance methods will detail the procedures that measure to what extent the contractor or equipment operator is placing the soil cover materials in accordance with the final closure plan, and how the closed dump site is to be tested and monitored during closure operations.

5.2.5 | Long-Term Dump Site Post-Closure Maintenance

Although the Mezraitine dump site will be closed to MSW loads, long-term restoration and rehabilitation of the site may be required for 15 to 20 years. Section 7 outlines long-term operations and maintenance procedures for the closed dump site.

5.3 | Development of a New Sanitary Landfill

A new sanitary landfill needs to be developed that will provide the environmental and health controls needed to protect the citizens and surrounding community and environment. Jijel is considering this option at a 12-hectare site located approximately 17 kilometers south of the City. We recommend further investigation into development of this site as a sanitary landfill for Jijel. The new sanitary landfill should be designed to include:

- Liners to aid in the protection of the groundwater and collection of leachate;
- Leachate collection system to prevent groundwater contamination;
- Gas recovery system planning for the future installation of monitoring and collection systems;
- Groundwater protection and monitoring, including wells;
- Adequate quantities of soil to provide daily cover soil and final cover soil needs;
- Effective operations to include a organized plan for cell management and vehicle traffic control;

- Trained personnel to conduct and manage landfill operations and oversee any other waste management activities at the site such as the planned vermicomposting operation;
- Equipment necessary to move, deposit, and compact incoming waste and manage other landfill activities.

In addition to these landfilling activities, Jijel is considering implementing a vermicomposting operation adjacent to the new landfill to take advantage of the large amount of organic materials in the waste stream. The vermicomposting operation is discussed in further detail below.

5.3.1 | Sanitary Landfill

The City should retain an experienced qualified solid waste engineering firm to develop a master plan and design and construct a new landfill. The firm will propose their own innovative ideas and methods to manage specific land and site criteria for the Jijel landfill. Therefore, instead of dictating the details of how a private company will construct the facility, we recommend that Jijel set minimum standards for the company and allow the company itself to propose specific facility characteristics.

Development of a new sanitary landfill should take place in three phases: engineering analyses, planning, and landfill construction. These phases are summarized below.

Engineering Analyses

The chosen firm should perform a wide variety of engineering analyses to support the design effort and to meet any requirements set by the City. Preliminary analyses describe initial planning of the site layout that should be completed prior to construction. The following preliminary analyses should be prepared:

Landfill Preliminary Design Plans

These plans should be prepared and used only as planning level drawings. The purpose of this level of planning drawing is to determine the economic viability of the project. The drawings will not be detailed enough to be used as construction documents but should be accurate for calculation purposes. The plans should include enough detail to perform need analyses such as drainage system design, the quantity of excavated soil needed for the site, the location of supportive features such as the leachate holding pond or the sedimentation pond, perimeter fencing, environmental control features, including:

- Site Plan showing the location of all improvements on the site including traffic circulation patterns, key features, fencing, entrance gate house facility, landfill disposal areas, environmental monitoring features and related improvements.
- Excavation and Stockpiling Plans showing the location of potential borrow soils, soil stockpile locations and a general plan of the sequencing of soil movement on the site.
- Base Preparation/Liner plans showing the location of the extent of waste placement divided into sequential modules or cells.
- Site Access/Site Roads Plan showing access to the site from the nearest public access road.
- Drainage Plan showing drainage features to direct surface water tributary to the site around the waste placement areas and drainage features to direct surface water from the landfill to a sedimentation basin.
- Fill Sequencing Plan showing how the filling activities will occur over time in a sequential pattern.
- Final Grading Plan showing the ultimate grade of the landfill when it has received the maximum quantity of wastes.

Landfill Drainage System

A drainage analysis should be performed for the entire landfill site to calculate the size of all drainage structures and the sedimentation basin. Drainage at the site must be modified to direct surface water runoff from the intended landfill area to a sedimentation basin located at the lowest point of the site. Surface waters tributary to the site should be directed around or away from the waste placement area to avoid contact with the waste materials. The location and sizes of the drainage features should be illustrated on the Preliminary Design Plans noted above.

Leachate Generation Calculations

The amount of leachate expected to be generated at the new landfill should be estimated (using a standard model). A sump or access point should be located at the lowest point of the landfill to allow for the extraction of leachate from the landfill. The estimated quantities should be used to size the leachate collection system and an appropriately sized evaporation or storage pond.

Landfill Gas Generation Calculations

The volume of landfill gas generation should be calculated using a gas generation model. The resulting data can be used for designing the landfill gas collection system and planning the eventual installation of a landfill gas destruction device.

Soil Erosion Analysis

The universal soil loss equation should be used to estimate the amount of soil loss, which could occur at the landfill over a one-year period. This information should be used to aid in the selection of the type of erosion protection such as planting vegetation on the landfill side slopes.

Site Capacity Analysis

Volumetric calculations of the landfill including an analysis of the excavation and final grading plans should be made to calculate gross capacity. The analysis should include a calculation of the quantity of soil needed for both daily cover and final cover materials. The necessary volume of soil should be capable of being excavated from the site over the operating life of the landfill. For estimating purposes, the volume of soil needed at a typical sanitary landfill should be approximately one-quarter to one-third of the total landfill volume. If a soil deficit is calculated for the site, an alternative site should be considered.

Operations and Maintenance Costs Estimates

An estimation of costs for the entire project will prevent delays during construction. Cost estimates are typically used to establish the required amount of financial assurance funds.

Planning

The planning stage will consider factors that determine the layout of the new landfill. There are many factors to be considered, including:

Landfill Capacity

The landfill should be designed to contain at least 20 years of waste from the tributary population. Based on the current waste stream of approximately 70 tons per day, and accounting for population growth, Jijel is estimated to generate approximately 1.2 million cubic meters of waste requiring disposal. The new 12-hectare site being considered by Jijel should be able to adequately handle this capacity.

Availability of On-Site Soils

One of the key components of locating an appropriate site for a landfill is identifying the availability of adequate on-site soils. Of critical concern is the condition of the soil from the standpoint of soil ripability and use as the daily soil cover and final cover material.

Use of Existing Groundwater

The use of the existing groundwater should be considered when selecting a landfill site. Since liners may leak, the likelihood of degrading the quality of the existing groundwater should be evaluated.

Landfill Construction

Construction of the landfill should adhere to the drawings and plans compiled during the analyses and planning stages. This section describes common construction methods.

Landfill Module Design

After the overall landfill capacity has been determined and the necessary quantity of soil has been calculated, the landfill areas should be broken into a series of modules. Each module should contain the volume of waste for approximately two to four years of waste capacity. The purpose of identifying individual modules is to develop a plan for the sequential excavation and stockpiling of soil from each module. Also, the sequential filling of each module will allow the subsequent sequential closure of each module thereby reducing the exposure of wastes for access from vectors.

Module Excavation and Soil Stockpiling

Prior to placing wastes in a module, the module should be excavated to the appropriate depth and stockpiled. The depth and slope of the excavation should be accomplished in accordance with the leachate liner plans. The soil removed from the module should be stockpiled in accordance with the stockpiling plan. Stockpiled materials should be placed in piles next to the developing cells and used for daily cover soil.

Base Preparation and Liner

The bottom of the excavation should be properly prepared and lined. The liner should consist of a layer of low permeable soil (as described in the cover soil layer above), a geo-composite clay liner material (GCL), or a geomembrane. The purpose of the liner is to restrict the flow of leachate from the bottom of the landfill into the ground, preventing degradation of groundwater quality. Liners should be placed in a bowl shape to contain liquids and should therefore extend up the excavated walls of the landfill module. After the liner is completed, a layer of operations soil (approximately 30 to 60 mm thick) should be placed to protect the liner from damage when wastes are placed in the module.

When the module is ready for waste placement, wastes that do not contain large, heavy, or sharp objects that could damage the liner should be identified. Examples of wastes that could

damage the liner include construction demolition materials, large stumps, or hot incinerator wastes. The initial layer of waste should be residential waste.

Equipment and Staffing

Equipment should be acquired for moving, depositing, and compacting incoming waste. At a minimum, the landfill equipment should consist of the following equipment and staffing:

- A bulldozer for pushing wastes and compacting wastes,
- A front end loader for moving and placing daily cover soil,
- An equipment operator to operate the bulldozer and loader, and
- A gate attendant to direct incoming waste vehicles to the appropriate disposal location.

Scales and Monitoring Systems

Scales should not be needed for the new Jijel site, as the majority of waste will be delivered by City vehicles. A gate house and gate house keeper should be used to monitor and direct loads to certain areas of the landfill or vermicomposting operation. Monitoring systems for cell management and vehicle traffic control should be set up according to initial plans.

5.3.2 | Vermicomposting Improvements

Results of a waste characterization study show that the total waste stream of Jijel is estimated to contain approximately 70 percent compostable materials, including food waste, clean wood, natural textiles and soiled paper, landscape debris from gardens, parks and street trees. This percentage of material does not include synthetic textiles, composite organics, bone, and construction waste. Approximately 85 percent of the total organic portion of waste materials is food waste. Vermicomposting, a low-tech composting method capable of decomposing a large proportion of food waste, has been chosen because food waste accounts for such a large portion of the Jijel waste stream. Vermicomposting in windrows (long piles approximately 1 to 1.5 meters in height x 0.5 meters in width x any length) is recommended because it is relatively inexpensive, though more labor intensive, compared to high-tech composting technologies using more costly equipment. Piles are of a manageable size for standard tools and labor and decomposition generally occurs more quickly than in conventional thermophilic composting. Examples of windrow composting are shown in Exhibits 5-14 and 5-15.

Vermicomposting employs earthworms, normally the *Eisenia foetida* or red wiggler, to convert organic waste to compost or topsoil products. This method is occasionally used in large-scale applications. Certain species of earthworms can consume organic materials rapidly and fragment them into much finer particles by passing them through a grinding gizzard. The fecal

Exhibits 5-14 and 5-15 | Windrow Vermicomposting



material or castings they produce is much more fragmented and suitable as feedstock for crops. The earthworms require aerobic conditions to live, and take the place of mechanical turning and aeration of the compost feedstock that is required for aerobic composting operations. A major challenge to vermicomposting is to carefully manage the system so that the organic materials do not overheat, since earthworms will not survive at temperatures above 35 degrees C (95 degrees F). Space is needed to accommodate windrows, and these piles must be kept ideally at 80% moisture. A finished product can result in as soon as four weeks. The worms will thrive and produce compost as long as the correct environment is maintained. The population will adjust itself naturally to the amount of feedstock provided and can double its population in 60 to 90 days in ideal conditions.

Vermicomposting can be implemented on a small or large scale depending on the amount of organic waste being processed. Composting systems vary from modern technology such as the automated continuous feed reactor to the more basic windrow variation. Vermicomposting can still be somewhat low-tech, not necessarily requiring machinery, yet it remains somewhat labor intensive (less expensive if labor is abundant). Vermicomposting requires a fair amount of monitoring and trouble-shooting as does any composting program in order to develop ideal management practices and feedstock combinations. Patience and an ability for flexibility and process adjustments are vital at the beginning stages.

It is assumed that the City will retain its own vermicomposting consultants to initiate the process and provide technical assistance at beginning stages. These experts will propose their

feedstock combinations. Patience and an ability for flexibility and process adjustments are vital at the beginning stages.

It is assumed that the City will retain its own vermicomposting consultants to initiate the process and provide technical assistance at beginning stages. These experts will propose their own innovative ideas and methods to manage specific materials and site criteria for the City's composting facility. Therefore, instead of dictating the specific details on how to operate the facility, we recommend that the City use the following descriptions as a basis to build from.

Bedding

Bedding is the material placed at the bottom of a pile as the first layer that provides a home for the worms. It is a mix of materials, some of which are slow to decompose, providing bulk at the base for better aeration and which also absorb natural leachate. Cork dust, cow or sheep manure, straw, dry leaves and small branches, mature compost, clean soil and shredded paper are examples of bedding ingredients.

Feedstock

Worm composting feedstock can consist of any cooked or raw food scraps, tea and coffee grounds, tree trimmings, paper pulp, soiled paper or other biodegradable material. Meat, bones, fatty foods, and dairy products are degradable but can cause some nuisance in slow degradation. These materials should be kept to a minimum or avoided altogether at the beginning stages of composting program development. Depending on the size of the facility, yard trimmings like as branches can be fed to worms if shredded and they can also be used as a first layer. Worms can be fed as regularly, after determining how efficiently they process the feedstock. Chopping materials before feeding them to the worms will decrease the time it takes worms to break them down. Food scraps should be buried under about an inch of insulating material: straw, light branches, grasses, mature compost, or cork dust.

Windrows and the Wedge Method

Windrows, in this case short composting piles, can be made on the ground, generally increasing to a height of 0.5 meters and maintaining a width of 1 to 1.5 meters. Length is only constrained by the amount of available land. It is best to layer the materials in the windrow applying information published by INORA, the Institute of Natural Organic Agriculture:

First layer: 5-7 centimeters of hay, dry leaves, and cork dust.

Second layer: 5-7 centimeters of fully decomposed cow dung/worm compost (used as bedding).

Third layer: worms.

Fourth layer: 15-20 centimeters food waste and other feedstock.

Fifth layer: 1.5 centimeters cork dust or grasses; burlap (used as compost cover/insulation).

The wedge method is an extension of the windrow method and provides a simpler system for harvesting finished compost. When the first windrow has reached a height of about 0.5 meters, new feedstock is added directly next to the original pile so that they are touching. The worms will gradually move to the new pile. The new pile is then constructed to accommodate one new layer per week of approximately 5 to 8 centimeters until a height of 0.5 meters is once again reached. (See description from Yelm Worm Farm, Appendix F).

The previously mentioned fifth layer is an extra barrier to help retain moisture and protect the piles from excess moisture or vectors. It is possible to cover windrows with a tarp, scrap plastic sheets, or natural burlap. A breathable material is recommended. A shading roof may also be constructed to serve as a weather barrier.

Worms

There are many different types of worms, but the *Eisenia foetida* or red wiggler, is the most commonly used composting worm. Southern and tropical regions will often use a different variety. In ideal composting conditions, the *Eisenia foetida* feeds within the top layers of soil or a compost, up to 30 centimeters below the surface. Generally, one-quarter square meter of surface area is required for every kilogram of food scraps or organic matter to be composted per day. Another guideline is to use 2 kilograms of food per one-half kilogram of worms per week, one kilogram can contain 2,000 to 2,500 worms. This ratio will help determine the number of worms and size of windrows needed for Jijel. Worms can be purchased and shipped for US\$30 to US\$40 per kilogram.

Moisture and pH

Worms prefer 65 to 85 percent moisture content in their environment. The piles should be kept moist but should not be soggy on the bottom. Ideal pH levels are between 6 and 9. Highly acidic conditions will decrease the productivity of the worms. It is therefore best to always combine a variety of materials into a feedstock in order to prevent any one overload on the whole system.

Harvesting Compost

It takes about three months for the worms to decompose the first pile, but once a worm population is established, only half of this time might be needed in subsequent cycles. Using the wedge method, worms will continue to feed as long as there is something to eat in the original pile, but the population will move gradually toward fresh feedstock leaving finished

compost behind. Finished compost can be screened to remove any remaining large pieces of organic matter and then stored under a protective cover until marketed.

Developing and Promoting Compost Programs

A successful composting program relies on the cycle between producers of organic waste, separating, collecting and processing organic waste, and locating end users to accept the compost. There are many strategies that have been taken by cities throughout the world that have led to successful composting programs.

The natural by-product of vermicomposting is a highly desirable dark, crumbly material called castings or vermicompost. It is considered much more nutrient rich and valuable than a compost generated without worms and is best used blended with other soils and composts as an enhancement.

Compost is largely composed of humus, an earthy smelling, nutrient-rich material that supports and enhances soil biological processes. Compost can be used as a soil enhancer in agriculture, landscaping, and indoor plant pots. It can be used in parks and public recreation areas, and along freeways and roads. Compost aids plants in resisting disease, helps control erosion, balances pH, supports essential bacteria, stops nutrient loss through leaching, and acts as a buffer against toxins in the soil. Possible end users for compost are residents, landscapers, highway maintenance personnel, students and researchers, and farmers.

Local government agencies can develop procurement programs to create new and expanded markets for compost products, educate potential users about the benefits of using compost, and connect end users with compost. One way to locate users of compost is to offer free advertising on a voluntary list. A city compost program could also support research to help to promote the use of compost and hold educational outreach days, demonstrating the benefits of compost to farmers.

5.4 | Slaughterhouse Waste Disposal

5.4.1 | Existing Practices

The slaughterhouse produced approximately 679 kilograms of meat waste and 2,071 kilograms of organ waste in 1999 and estimates that it produced approximately 368 kilograms of these wastes in the first quarter of 2000. We understand that these wastes never made it to the dump site. It is reported that meat and organ wastes were dumped directly into the Mediterranean Sea. The effects and environmental hazards associated with dumping slaughterhouse waste organs and meats are numerous, including severe water contamination that threatens aquatic

ecosystem and human health. The practice of dumping slaughterhouse wastes into the Mediterranean should end as soon as another system is established.

5.4.2 | Proposed Practices

The slaughterhouse waste is currently self-hauled and disposed in the sea. Either the generator will be required to haul their waste to the dump site or the City will need to separately collect this waste and charge the slaughterhouse. The City may need to organize an alternative collection system for slaughterhouse waste using City collection vehicles or other designated collection vehicles.

After the slaughterhouse waste is delivered to the dump site, special disposal methods should be employed. A distinct site for the burial of slaughterhouse wastes will be selected at the new sanitary landfill in Jijel. An isolated cell, or mono cell, will be built similarly to the other MSW landfill cells. However, this cell will be smaller in size and will not receive MSW loads. The description of landfill cell construction outlined in Section 5.3 of this report can be used for development of the slaughterhouse waste mono cell.

Another possible consideration would be to send these wastes to a rendering plant where soaps, shampoos, and other usable materials can be produced. We are not aware of any existing rendering plants in Jijel, so separate collection and disposal of the slaughterhouse waste is recommended until a rendering plant can be located or developed. Blood liquids from slaughterhouse operations could be sent to a water treatment facility, such as the one located at the tannery. An agreement would need to be arranged between the slaughterhouse and the tannery for use of their water treatment system.

5.5 | Medical Waste Incinerator (MWI) Improvements

5.5.1 | Existing MWI System

A relatively large amount of medical waste (MW) is generated in Jijel. There is one hospital, two clinics, four care rooms, and one laboratory in Jijel that generate medical wastes. The mix of needles, syringes, expired medication, and placentas is currently incinerated on-site at the Jijel Hospital. The MW is incinerated using two dual fuel- fired (fuel oil and natural gas) Guernod incinerators that have a rated capacity of 60 to 90 kilograms per hour. One was purchased in 1983, the other in 1990. They were last inspected and serviced in November 2000. It has been estimated that approximately 225 to 285 kilograms per day of MW are generated from all sources in Jijel. The ash and residue of the incinerated hospital waste are

disposed at the existing Mezraitine dump site. This waste is still hot and after disposal at the dump site, catches other combustible materials, particularly the cork waste, on fire. This creates a nuisance with heavy smoke and affects the quality of air in the region. In addition, from observations at the Mezraitine dump site, some of the MW appears not to be fully incinerated. The ash still contains recognizable materials such as syringes, vials, etc. This is due either to: 1) improper "personnel" operation of the incinerators (not allowing the MW to fully combust at the specified temperature and for the specified time), or 2) a poorly operating incineration unit, which requires an inspection and tune-up.

The incinerators are not currently fitted with air pollution control devices. Combustion of MSW and MW can contain: dioxins and furans; lead (Pb); cadmium (Cd); mercury (Hg); particulate matter (PM); opacity; hydrochloric acid (HCl); sulfur dioxide (SO₂); carbon monoxide (CO); and fugitive ash emissions. These gases are emitted as fine aerosols or can combine with water droplets. Their effects include: reduced visibility, corrosion of metals, human health concerns, and the production of acid rain or fog.

Two MWI emissions linked to human health concerns are dioxin and mercury. Dioxin is a known human carcinogen linked to reproductive and developmental disorders and immune system damage. Dioxins are released when materials containing chlorine are burned. Dioxins are not produced from the burning of bacteria and viruses in medical waste, but from the packaging holding these wastes (plastics). One way of reducing dioxin emissions in medical waste incinerators is removing PVC and other chlorinated plastics from the hospital waste before incineration. Mercury is another pollutant that threatens human health. It is a neurotoxin known to interfere with brain development of fetuses and infants. Dioxin and mercury are especially difficult to regulate because the tests used to monitor them are time consuming and expensive. Special samples must be collected (usually three test runs of four hours each with a minimum of 6 cubic meters of collected stack gas) and sent to a laboratory for testing.

5.5.2 | Proposed Improvements

A three-step approach is proposed for Jijel's MW. The first step is to retrofit the existing MWI units with appropriate air pollution control devices to limit fugitive emissions. The second step is to segregate MW ash as it enters the Mezraitine dump site or new sanitary landfill and place it in a separate mono cell away from the other refuse. Each of these improvements is described below.

Air Pollution Control Devices

Air pollution control devices vary and must be properly matched to fit the size and type of each incinerator. The amount of medical waste being burned must also be factored in when purchasing these devices. Wet and dry scrubbers are the common technologies retrofitted to

MWI systems. For relatively smaller MWI systems, such as those at the hospital in Jijel, wet scrubbers are more commonly employed. This is mainly due to economics. Most dry scrubber systems are very expensive and are cost prohibitive at smaller sites.

Wet scrubbers can be used to reduce the amount of acid gases and particulates emitted into the atmosphere. Liquid solutions of caustic materials, such as sodium hydroxide are used to scrub and neutralize acid gases before gases are exhausted into the environment.

BVA contacted wet scrubber vendors for information on appropriate units. For these vendors to make proper recommendations, an emissions test from the MWIs must first be conducted. The emissions test should include information on flue gas composition, temperature, moisture, particulate size, etc. Using this information, the City will be able to issue a request for bids to these vendors for purchase and installation the units.

Ash Mono Fill

Ash produced by the MWI system needs to be segregated as it enters the Mezraitine Dump Site or new sanitary landfill and placed in a separate mono cell away from the other refuse. This will help to substantially reduce the current amount of fires at the Dump Site. The description of landfill cell construction outlined in Section 5.3 of this report can be used for MW mono cell development. In addition, no "recycling" or "beneficial uses" of MW ash residues (i.e., use in construction materials, road material, fertilizer) should be allowed.

Section 6 | Environmental Impacts and Regulatory Enforcement

6.1 | Background

A range of environmental protection laws and regulations exists, as described in Section 2 and Appendix A. This section summarizes existing environmental regulations especially relevant to the proposed projects and recommends additional regulatory and enforcement controls for Jijel's solid waste management system.

6.1.1 | General Enforcement and Monitoring

Among its other responsibilities, the national Department of Environment has been charged with enforcing environmental laws and regulations, as well as approving environmental permits and authorizations at the provincial level, since 1994. Within the Department of Environment, the Department of Pollution Prevention and Nuisances is responsible for industrial pollution control, urban environments, and clean technologies; and the Department of Regulation and Implementation is responsible for environmental impact studies, authorizations, and permits.

Environmental Inspection Agencies (EIAs) are responsible for environmental affairs at the provincial level. Their responsibilities include implementing provincial environmental protection programs in coordination with other appropriate government agencies, including city governments. EIAs also issue official environmental licenses, authorizations, and permits and institute environmental protection measures for the provinces.

Legislative Article 12 relating to Algeria's environmental laws, states that if the Environmental Inspector identifies and reports environmental regulatory violations, the city must take the necessary steps to manage the problem. If the violating party does not make the necessary corrections within an appropriate timeframe, they may be required to halt the activities leading to the violations.

6.1.2 | General Recommendations

The High Council of the Environmental and Sustainable Development (HCEDD) consists of national ministries in each major sector and has been charged with supervising environmental affairs on a national scale. Among HCEDD's responsibilities is regularly evaluating the implementation of environmental legislation and regulations and selecting additional, appropriate measures as necessary.

Jijel may eventually help influence national environmental strategies and policies. However, we anticipate that the City's most expeditious route towards improving environmental protection in the municipality would be to work with its provincial EIA. A general recommendation for Jijel is to work with the EIA to properly implement and enforce existing regulations. Because the City cannot comply with current regulations without being aware of them, the first step is to obtain copies of applicable environmental laws and regulations and distribute them or make them readily available to local officials, solid waste system administrators and operators, and waste generators.

With the EIA's assistance, the City should assess the aspects of the its solid waste system and pollution control practices that are not in compliance with the applicable laws and regulations. If the EIA lacks personnel to monitor the implementation of these regulations in Jijel, the City should consider employing personnel for this purpose. Once the regulatory violations have been identified, Jijel may work with the EIA and other involved parties to come into compliance.

6.2 | Waste Collection

Jijel plans to replace its existing collection vehicles and some of its refuse containers with more modern models and to improve the refuse collection system.

6.2.1 | Potential Environmental Impacts

Solid waste storage and collection may produce a variety of environmental impacts:

- **Vehicle air emissions:** motor vehicles, such as collection vehicles, are a source of mobile air emissions. Toxic air pollutants are generated by mobile sources through the incomplete combustion of fuel as well as through the evaporation of toxic components of the fuel. According to the United States Environmental Protection Agency (EPA), motor vehicles emit several air pollutants that are known or probable human carcinogens. Certain gases in vehicle air emissions also contribute to global warming and climate change. The type and extent of the air emissions depends on the type of

fuel used, the age of the vehicle, how the vehicle and engine have been maintained, and the air emission controls (if any) on the vehicle.

- Litter: refuse from collection vehicles can spill or be blown out of the holding compartment if the waste is not properly covered or tied down.
- Leachate¹ spillage: leachate from the refuse in collection vehicles may leak out of the vehicle's holding compartment if the compartment is not sealed properly.
- Public health and aesthetic impacts from improper waste storage: improperly contained waste being stored for collection may lead to a proliferation of potential disease vectors, such as vermin, flies, and other insects. Aesthetic impacts of improper waste storage include odors and litter.
- Worker health impacts from improper waste handling: collection workers who do not wear protective gloves while collecting waste may receive cuts and scratches from sharp object in the refuse. Workers also may suffer injuries if they improperly lift or carry heavy loads.
- Human health and environmental impacts from hazardous waste in the refuse: hazardous waste may be included in the refuse from all types of waste generators. Residential waste may include toxic products, such as household cleaners, personal products, automotive products, paint products, and garden products. Commercial waste may include toxic products related to the types of services provided by the waste generator, such as solvents from dry cleaning establishments, inks from print shops, cleaning solvents from auto repair shops, and paints and thinners from painting businesses. These hazardous wastes have an adverse impact on human health and can contaminate leachate and soils.

6.2.2 | Applicable Regulations, Enforcement, and Monitoring

The Ministries of Local Affairs, Local Organizations, and Environment have been responsible for regulating methods of waste storage, transport, and treatment since 1994.

- Decree number 84/378, issued on December 15, 1984, addresses cleaning, collection, and treatment of urban solid waste.
- Article 2, applicable to the first chapter of decree number 84/378, addresses domestic waste.
- Law number 85/05, issued on February 16, 1985, addresses the protection and promotion of public health.

¹ Leachate is the liquid that filters through solid waste and accumulates biological materials and chemical constituents as it comes in contact with the waste.

No specific information is available regarding how these regulations are enforced and monitored.

6.2.3 | Recommendations

Some of the potential impacts can be addressed by implementing proper operational procedures, as described in Section 7. We also recommend that Jijel pass ordinances or work with the EIA to implement the following policies and regulations pertaining to the more serious impacts associated with solid waste storage and collection. Proper oversight and monitoring must accompany the existing and recommended policies and regulations to ensure that they are effective in achieving their goals.

Vehicle Air Emissions Control

- Vehicles should use fuels that produce a minimum of harmful air emissions. Lead in gasoline, sulfur in diesel fuel, and other toxic compounds should be limited or prohibited from use.
- New vehicles should use catalytic converters, which reduce emissions of hydrocarbons, diesel particulate matter, and air toxics.

Proper Waste Storage

Waste generators must properly store refuse that is awaiting collection in a container of sufficient capacity to hold all of the waste generated between pickups. The container should have a tight-fitting lid that prevents vermin, flies, and other potential disease vectors from gaining access to the refuse.

Hazardous Waste Separation

Jijel should establish a program to specifically collect hazardous waste from residential and commercial customers. These hazardous wastes should be properly treated or disposed of.

6.3 | Mezraitine Dump Site Closure

Jijel plans to close the existing dump site.

6.3.1 | Potential Environmental Impacts

Closed landfills and dump sites continue to pose environmental hazards after they have been taken out of service. In the United States, landfill owners are required to attend to their closed

landfills for 15 to 30 years (depending on particular state regulations) following their official closure. Some of the environmental hazards posed are:

- Ground and surface water contamination from leachate: leachate from municipal landfills often contains toxic chemicals from the inclusion of regulated hazardous wastes in the waste stream, as well as common wastes including paint solvents, oils, cleaning compounds, degreasing compounds, pesticides, and other substances. The degrading of these and other substances may produce toxins that may be more harmful than the original substances, and these toxins accumulate in the leachate. According to a 1998 study from Texas A&M University in the United States, chemicals in leachate from municipal waste may cause cancer, birth defects, and genetic damage. Leachate from uncovered and unlined landfills (both in operation and closed), can contaminate ground and surface water.
- Landfill gas: improper management of the landfill gas produced in landfills (both in operation and closed) can lead to uncontrolled emissions of methane (CH₄) and carbon dioxide (CO₂). Uncontrolled emissions of these volatile gases can lead to explosions and can also contribute to global warming.
- Health and Sanitation: improperly sealed landfills may allow vermin and other potential disease vectors to proliferate.

6.3.2 | Applicable Regulations, Enforcement, and Monitoring

Law number 83/17, issued on July 16, 1983; and order number 96/13, issued on July 15, 1996; address the water code. This code may apply water quality standards for facilities including closed landfills.

No specific information is available regarding how this regulation is enforced and monitored.

6.3.3 | Recommendations

Some of the potential impacts can be addressed by implementing proper operational procedures, as described in Section 7. We also recommend that Jijel pass ordinances or work with the EIA to implement the following policies and regulations pertaining to the more serious impacts associated with landfill closure. Proper oversight and monitoring must accompany the existing and recommended policies and regulations to ensure that they are effective in achieving their goals.

Post Closure Monitoring

Require that landfill owners must actively monitor closed landfills for at least 10 to 15 years following the closure.

Leachate Management

Require landfill closure activities to include provisions for leachate control. An effective final landfill cover that reduces the filtration of rainfall into the solid waste will lessen leachate generation. However, some volume of leachate will continue to be produced due to the continued decomposition of waste. This leachate must be properly drained, collected, and treated before discharge. Treated leachate should meet regulated effluent standards (see Exhibit 6-1).

Require periodic ground and surface water quality monitoring to identify leachate leakage from the closed landfill.

Landfill Gas Management

Require landfill closure activities to include provisions for landfill gas management for as long as the landfill produces landfill gas. Management methods may involve installation of landfill gas extraction, collection, and destruction (typically flaring) or utilization (typically energy recovery) systems. Require periodic air quality monitoring to identify landfill gas leaks from the closed landfill.

6.4 | New Landfill and Vermicomposting Operation

Jijel plans to develop a new, controlled, sanitary landfill. A vermicomposting operation will be included at the landfill site.

6.4.1 | Potential Environmental Impacts

- Ground and surface water contamination from leachate: see discussion of ground and surface water contamination from Section 6.3.1.
- Landfill gas: see discussion of landfill gas from Section 6.3.1.
- Noise: noise levels around the facility will increase both during facility construction and normal facility operations.
- Air quality: vehicles on unpaved roads, outdoor tipping areas, waste load-out activities, and other operations can produce dust that impacts ambient air quality. Composting operations are at risk for creating unpleasant odors due primarily to anaerobic decomposition of organic feedstock.
- Health and sanitation: see discussion of health and sanitation impacts from Section 6.3.1.

Exhibit 6-1 | Industrial Effluent Limits

Parameter	Unit	Maximum Level
Temperature	°C	30
pH	-	5.5 to 8.5
MES	mg/l	30
DBO ₅	mg/l	40
DCO	mg/l	120
Nitrogen	mg/l	40
Phosphates	mg/l	02
Cyanide	mg/l	0.1
Aluminum	mg/l	5
Cadmium	mg/l	0.2
Chrome 3 ⁺	mg/l	3.0
Chrome 6 ⁺	mg/l	0.1
Iron	mg/l	5
Manganese	mg/l	1
Mercury	mg/l	0.01
Nickel	mg/l	5
Lead	mg/l	1
Copper	mg/l	3
Zinc	mg/l	5
Oils and Greases	mg/l	20
Hydrocarbons	mg/l	20
Phenols	mg/l	0.5
Organic Solvents	mg/l	20
Active Chlorine	mg/l	1.0
PCB	mg/l	0.001
Detergents	mg/l	2
Surface-active anion	mg/l	10

6.4.2 | Applicable Regulations, Enforcement, and Monitoring

- Section 8 of this report summarizes existing regulations pertaining to landfill siting.
- Law number 83/17, issued on July 16, 1983; and order number 96/13, issued on July 15, 1996; address the water code. This code may apply water quality standards for facilities including active landfills.
- Article 3, applicable to the third chapter of decree number 84/378 issued on December 15, 1984, states that local popular assemblies are responsible for treatment of urban solid waste in their territories. The assemblies must also provide a landfill for disposal of their territories' refuse and they must condemn illegal waste dumps.
- Legislative Article 7 relating to Algeria's environmental laws, mandates that treatment sites must a) be surrounded by a fence with a minimum height of two meters, b) have entry and exit portals or gates that are supervised during facility operating hours and closed during non-operating hours, c) be designed such that vehicles may easily move about within the site, and d) be constructed in accordance with existing legislation regarding operations and public health. The Article also states that the maximum landfill height is 10 meters for small landfills and 50 meters for large landfills.
- Legislative Article 8 relating to Algeria's environmental laws, defines stationary installations as all established industrial or agricultural operations, including factories, work yards, quarries, storage places or warehouses, retail establishments, and manufacturing establishments. Solid waste management operations are likely to be included under this definition.
- Legislative Article 9 relating to Algeria's environmental laws, states that the emission of gas, smoke, dust, odor, or particles from stationary installations cannot exceed the concentrations set by the regulations.
- Legislative Article 10 relating to Algeria's environmental laws, gives environmental inspectors the authority to periodically test stationary facilities for compliance with air emissions standards.
- Legislative Article 11 relating to Algeria's environmental laws, states that the Ministry of Environment has the authority to set the procedure and schedules associated with the periodic testing.

No specific information is available regarding how these regulations are enforced and monitored.

6.4.3 | Recommendations

Most of the potential impacts can be addressed by implementing proper operational procedures, as described in Section 7. We also recommend that Jijel pass ordinances or work with the EIA to implement the following policies and regulations pertaining to the more serious impacts associated with new landfills and composting operations. Proper oversight and monitoring must accompany the existing and recommended policies and regulations to ensure that they are effective in achieving their goals.

Leachate Management

- Require sanitary landfills to include proper liners that prevent the migration of leachate into underlying soils. Develop minimum standards for landfill liners.
- Require sanitary landfills to install leachate extraction, collection, and treatment systems. Develop minimum standards for these systems. Treated leachate should meet regulated effluent standards (see Exhibit 6-1).
- Require periodic ground and surface water quality monitoring to identify leachate leakage from operating landfills.

Landfill Gas Management

- Require sanitary landfills to install landfill gas extraction, collection, and destruction or utilization systems. Develop minimum standards for these systems. Landfill gas destruction or utilization methods should achieve a minimum standard of eradication of harmful compounds.
- Require periodic air quality monitoring to identify landfill gas leaks from the operating landfill.

6.5 | Slaughterhouse Waste Disposal

Jijel plans to accommodate slaughterhouse waste at the new landfill. This waste may include meats and organs, as well as blood.

6.5.1 | Potential Environmental Impacts

Impacts associated with the disposal of slaughterhouse wastes at the new landfill are the same general landfill impacts listed previously. However, due to the higher concentration of organic matter in slaughterhouse waste, vermin, flies, and other disease vectors may be more problematic in the area designated for slaughterhouse waste disposal.

6.5.2 | Applicable Regulations, Enforcement, and Monitoring

No regulations appear to be in place to regulate the disposal of slaughterhouse waste.

6.5.3 | Recommendations

Some of the potential impacts can be addressed by implementing proper operational procedures, as described in Section 7. We also recommend that Jijel pass ordinances or work with the EIA to implement the following policies and regulations pertaining to the more serious impacts associated with disposal of slaughterhouse waste. Proper oversight and monitoring must accompany these policies and regulations to ensure that they are effective in achieving their goals.

Prohibit Uncontrolled Dumping

Prohibit generators of slaughterhouse waste from uncontrolled dumping into the Mediterranean Sea.

Proper Treatment of Liquid Waste

Require all blood waste not beneficially utilized to be properly treated before discharge. Use of a local water treatment facility should be arranged. Discharged effluent should meet regulated effluent standards (see Exhibit 6-1).

6.6 | Medical Waste Incinerator – Air Pollution Control Devices

Jijel plans to install air pollution controls on the medical waste incineration facility.

6.6.1 | Potential Environmental Impacts

- Contaminated wastewater: wet scrubbers transfer pollutants from the air to water phase. According to the U.S. Environmental Protection Agency, hazardous waste incinerators that use wet emissions control equipment will generally result in waste water with pollutant profiles similar to those of the feedstock. Materials incinerated at the existing medical waste incinerator include bandages, anatomical waste, and laboratory cultures. It is likely that syringes, needles, paper, plastic, glass, and fabric are also feedstock components. Air scrubbers can remove or neutralize dioxins, furans, hydrogen chloride, sulfur dioxide, nitrogen oxide, and heavy metals such as lead,

cadmium, and mercury, from medical waste incinerator emissions. However, harmful pollutants will remain in the resulting waste water.

- Contaminated solid waste: dry scrubber technologies neutralize acid gases and remove metal particulates in two stages. The resulting waste is a dry powder containing potentially hazardous or toxic metals.

6.6.2 | Applicable Regulations

- Article 1, applicable to the first chapter of the third title of law number 83-03 issued on February 5, 1983, regulates air emissions of smoke, gas, dust, odors, and particles from stationary facilities that are likely to harm the public health, environment, or cultural sites.
- Ministerial decree number 93/165, issued on July 10, 1993, regulates atmospheric emissions of smoke, gas, dust, odor and particles from stationary facilities.
- Based on the information we received, applicable limits for atmospheric emissions are those set by the World Health Organization, as shown on Exhibit 6-2.
- Law number 83/17, issued on July 16, 1983; and order number 96/13, issued on July 15, 1996; address the water code. This code may apply water quality standards for facilities including incinerators.
- Decree number 93/161, issued on July 10, 1993, sets standards for industrial waste water effluent. Table 6-2, from the Official Journal of July 14, 1993, shows limits for various discharge parameters.

6.6.3 | Enforcement and Monitoring

Legislative Article 13 relating to Algeria's environmental laws, states that cities have the authority to take all necessary measures to manage air pollution problems from stationary facilities.

6.6.4 | Recommendations

Some of the potential impacts can be addressed by implementing proper operational procedures, as described in Section 7. We also recommend that Jijel pass ordinances or work with the EIA to implement the following policies and regulations pertaining to the more

Exhibit 6-2 | Atmospheric Emission Limits

Pollutant	Limit for Average Emissions	Duration
SO ₂	500 micrograms/m ³	10 minutes
	350 micrograms/m ³	1 hour
	125 micrograms/m ³	24 hour
	50 micrograms/m ³	1 year
PES	125 micrograms/m ³	24 hour
NO _x	400 micrograms/m ³	1 hour
	150 micrograms/m ³	24 hour
Ozone	150-200 micrograms/m ³	1 hour
	100-120 micrograms/m ³	8 hour
CO	100 milligrams/m ³	15 minutes
	30 milligrams/m ³	1 hour
	10 milligrams/m ³	8 hour
Lead	0.5-1 microgram/m ³	1 year

serious impacts associated with air pollution controls for incineration facilities. Proper oversight and monitoring must accompany the existing and recommended policies and regulations to ensure that they are effective in achieving their goals.

Air Pollution Limits

Review current limits for concentrations of air pollutants. If necessary, modify these standards to apply to medical waste incinerators. Mandate that at a minimum, all incineration facilities control their air emissions to meet the required standards.

Waste Water Contamination

Review current limits for waste water discharges. If necessary, modify these standards to apply to discharges from medical waste incineration facilities. Mandate that at a minimum, all incineration facilities control and treat their waste water to meet the required standards.

Solid Waste Contamination

Set limits for concentrations of specified contaminants in solid waste from medical waste incineration facilities and mandate that all incineration facilities properly treat their solid waste to meet the required limits.

Section 7 | Operation Plans for Waste Management Improvements

Introduction

This section describes operation plans for each of the five selected waste management improvements.

7.1 | Waste Collection Operations Plan

7.1.1 | Revised Routes and Zone Changes

To optimize the efficiencies gained from purchasing new collection equipment, existing routes and zones will need to be revised. By purchasing the new compacting collection vehicles, a significant amount of waste pick-up capacity will be added to each vehicle, allowing vehicles to remain on routes for longer periods of time. In addition, by selecting three different vehicle types for collection (front-loader, rear-loader, and roll-off vehicles), zones and routes will need to be revised to optimize vehicle use.

The City currently utilizes ten waste collection zones. With the purchase of six new collection vehicles, the City should reduce the number of zones to six larger zones: one zone for each of the new vehicles. Since four of these vehicles will be rear-loader types, designed for the collection of residential wastes, the City will need to divide its residential areas into four separate zones. The one front-loader vehicle is designed to handle large commercial and industrial business waste. Accordingly, the fifth zone should encompass commercial and industrial businesses that do not use debris box/roll-off service. The last zone would be for the collection of waste from the City's large debris boxes. This zone may not be defined by an isolated physical area, as these debris boxes are located throughout the City, but will be defined more as a route. In summary, the new six zones/routes would include:

- Four zones/routes for residential collection (some smaller commercial accounts may also be serviced).
- One zone/route for commercial and industrial businesses using new larger waste storage bins.
- One zone/route for debris box customers including larger commercial and industrial accounts and public drop boxes.

7.1.2 | Vehicle Operations and Maintenance

Rear-Loader Vehicles

Rear-loader vehicles are utilized optimally in the collection of bags and small cans or containers of waste, such as the waste generated and set out by residents. A crew of one driver and two loaders, as is currently employed in Jijel, should be used for these routes. The driver should slowly drive down a street stopping near residences for waste pick-up. The loaders, walking down the street, will place the waste into the back of the vehicle. The driver will compact the load once the rear hopper is full. Once the vehicle is full, about 6 to 10 tons, it will proceed to the dump site or landfill for disposal. To maintain the vehicle in optimal working condition, it should be washed daily, and lubricated with oil changed every two to four weeks.

Front-Loader Vehicles

Front-loader vehicles are utilized optimally in the collection of small to medium sized waste bins (1.2 to 8 cubic meter), such as the waste generated and set out by commercial and industrial businesses. A crew of one driver and one loader should be used for these routes (although it is possible to operate with the driver only). The driver typically pulls up to a full waste bin; the loader will position the bin (which is on wheels) in a manner that allows the vehicle's two front forks to fit into the slots on the sides of the waste container. The driver will then drive slowly forward until the bin is attached to the forks. The driver then activates the mechanical lift that transports the bin into a hopper located on top of the vehicle. After the waste is loaded into the vehicle, the bin is lowered, the driver slowly extracts its forks from the bin, and the loader moves the bin back to its original location near the business. The driver will compact the load once the hopper is full. Once the vehicle is full, about 6 to 10 tons, it will proceed to the dump site or landfill for disposal. To maintain the vehicle in optimal working condition, it should be washed daily, and lubricated with oil changed every two to four weeks.

Roll-Off Vehicles

Roll-off vehicles are utilized in the collection of large debris box containers (8 to 30 cubic meters), such as those generated and set out by larger commercial and industrial businesses. These debris boxes are also located throughout the City in centralized public areas. A crew of one driver should be used for these routes. The driver typically backs up to a full debris box; attaches a cable from the vehicle to the box and then mechanically lifts/pulls the box onto the back of the roll-off vehicle. Once the box is loaded, it is locked into place, and the vehicle can then proceed to the dump site or landfill for disposal. To maintain the vehicle in optimal working condition, it should be washed daily, and lubricated with oil changed every two to four weeks.

7.1.3 | Collection Containers

The majority of the City will be serviced by four of the new collection vehicles that collect waste from residents in plastic bags or small cans and containers. Fifty bins of 1.2 to 4.6 cubic meter capacities will be purchased by the City and distributed to commercial and industrial businesses. These bins will be picked up weekly or more frequently as necessary. Ten large debris boxes, with approximately 23 cubic meters of capacity will be placed in neighborhoods where waste is gathered in centralized collection zones. They should be set out in place of the steel debris boxes, or concrete-walled neighborhood depots. Maintenance of waste collection areas should be monitored by the City to keep areas clean of spillage and litter and to reduce negative aesthetic impacts.

7.1.4 | Miscellaneous Operational Protocols

Hours of Collection Operations

Hours for collection activities should be specified in order to ensure that route trucks have access to the landfills during normal receiving hours. In addition, reliable collection schedules will reduce unnecessary self-hauling and waste generators will be less likely to dispose of garbage on the streets and highways.

In addition, collections may be prohibited during peak traffic hours in certain heavily congested downtown areas in order to minimize traffic delays associated with the collection activities.

Operating Vehicles

In general, the operator of collection vehicles should be required to operate in compliance with Algerian law for safety and environmental requirements. The standards could specify additional requirements for truck safety equipment (back-up alarms, fire extinguisher,

emergency traffic flares/reflectors, two-way radios, absorbents for spills) as well as special requirements for handling solid waste (leak-proof bodies, tarps for open-top trucks). All loads shall be covered or fully contained within vehicles at all times. In addition, the contractor's name (if applicable) and local telephone number should be prominently displayed on the sides of all vehicles.

Record Keeping and Reporting

The City should write monthly, quarterly, or annual reports to document and track information about the number of customers receiving services, tonnage information on refuse and recyclables, and other information. The reporting will depend on the information that should be reported to and reviewed by the City in its official capacity.

Customer Service

The City should establish a local office and maintain customer service staff to handle customer inquiries and complaints. The office should be open during established hours so the public can have ready telephone access. Minimum standards could be set for handling complaints about missed pick-ups (for example, customer waste must be picked up within 24 hours of the time a missed collection is reported to customer service).

Vehicle Maintenance

Minimum standards should be established for maintaining the vehicles. These would include periodic inspections, oil changes, tune-ups, smog checks, etc. This will make sure vehicles operate as efficiently as possible and control air emissions to the environment. Maintenance records of all vehicles should be kept. In addition, a supply of spare parts should be stocked for emergency purposes.

Frequency of Service

A minimum number of waste pick-ups per week should be specified in order to prevent waste from accumulating too long at the customer's storage area and creating health and safety problems. In many U.S. cities with cool or moderate climates, residential waste is required to be collected only once per week. In areas with warmer climates, collection twice per week is common. In almost every U.S. city, residential as well as commercial customers are required to use rigid leak proof storage containers with lids. The number of commercial waste pick-ups per week is typically established between the hauler (which is the City in this case) and customer, based on the quantity of waste generated, size of customer container selected, and pricing structure for multiple pick-ups per week.

Due to the climatic conditions in Jijel and the extensive use of plastic bags for waste storage and collection, a minimum standard of two or three pick-ups per week may be required for any

commercial customers generating food waste or other putrescible waste. For those customers provided with leak-proof storage containers with attached lids, the minimum number of pickups per week could be fewer.

Employee Uniforms

Employees should be provided with uniforms or vests, or use other ways of identifying themselves as collection crew members so customers can easily identify workers as part of the officially recognized solid waste system.

Employee Safety and Health Care

Standards for employee health and safety should be maintained. The City may require, for example, that all collection crews be provided gloves, hard hats, boots and other appropriate safety gear. Workers should be trained how to lift heavy loads properly.

Hazardous Wastes

The City needs to educate its residents and businesses about the proper use, storage, and disposal of hazardous wastes, such as paints oils, batteries, and pesticide. The City will need to provide convenient options for disposal of these wastes (product exchange programs, specific collection days, permanent collection sites).

7.2 | Mezraitine Dump Site Closure Plan

7.2.1 | Current Dump Site Operation Improvements and Closure

Preparation for Closure

Although preparations are being made for the City's new landfill site, Jijel will need a disposal site in the interim while the new landfill is being developed. The City needs to implement certain improvements to current waste management procedures at the existing dump site in order to prepare the closing of the Mezraitine site. BVA recommends the following operational improvements to prepare for closure of the Mezraitine dump site:

- Consolidation and compaction of waste,
- Separation of incoming wastes (primarily incinerator wastes from all other wastes), and
- Proper filling and covering of waste.

In order to implement this plan, the dump site will require several full-time employees. The site will need a supervisor, a spotter, and an equipment operator. At a minimum, two

employees are needed to fill these positions. These employees will be required to work at the dump site before, during and after operating hours as needed in order to sustain dump site operations.

Consolidation and Compaction of Waste

Currently, the waste is thinly placed over the entire dump site. The amount of area occupied by the current waste is extensive for the amount of waste and needs to be reduced. By reducing the amount of area occupied by the waste, the closure area is reduced and the amount of materials required and cost of closure is reduced. This is accomplished through waste consolidation.

Consolidation should begin at the lowest section of dump site, the westernmost section. It is necessary to move this waste toward the upper section of the dump site to provide an area for a sedimentation basin and/or leachate collection pond and a permanent road outside the waste footprint. Once the waste is consolidated, it will require compacting to maximize the available area.

Waste should be compacted in a series of lifts. A lift consists of spreading waste over a given area, a depth of approximately .5 meters, whose length and width depend on the layout of the dump site. For the Mezraitine dump site, the waste within 25 meters of the current limit of waste should be removed and placed towards the upper section of the dump site. This will establish a new limit of waste. Any waste on fire should be extinguished, as described later in this section, before being mixed with other wastes. All hot loads need to be placed away from the other wastes. The cork waste (that is not on fire) should be placed off the face of the dump site and stockpiled for later use as daily cover. The first lift will begin at the new limit of waste. Using an area of approximately 20 meters by 20 meters, available waste is spread over this section of the dump site using the bulldozer. The waste the waste of the lift is then compacted with the bulldozer following the compaction procedures outlined in later in this section.

The next lift will be consolidated and compacted in the same manner. It should begin approximately 3 meters from the edge of the first section. Consecutive lifts will be developed in the same manner, eventually working up towards the top of the dump site. As each lift is completed, the section of the lift not overlapped by the new lift should be covered with intermediate cover consisting of native soils. This soil will need to be collected from available sources.

As the consolidation and compaction practices begin, future waste should be added to new lifts within the current dump site area, following the procedures discussed below. Daily cover is to be applied once all the collected waste for the day has been placed in the dump site.

Separation of Incoming Waste

All waste currently disposed of at the Mezraitine dump site is disposed of together. The waste stream needs to be separated by type and utilized in a different manner. Three types of waste need to be separated:

- Incinerator waste from the hospital,
- Cork waste from the cork industrial facilities,
- Other, to include municipal solid waste.

These wastes should be separated within the confines of the dump site. The incinerator waste should not be allowed to mix with other waste at the site, but kept in a separate section of the dump site. This will help to reduce fires. Cork waste should be stored off the active dump site and kept for use as daily cover.

Fill and Cover of Wastes

A landfill operations and fill sequence plan should be developed to enable the dump site operators to perform filling operations at the Mezraitine dump site safely and efficiently. Optimal filling activities can be performed if the following issues are addressed:

- Safety of all personnel and equipment at the site,
- Maximum compaction of waste materials,
- Minimum use of costly imported materials.

The objective of this operations and fill sequence plan is to guide the dump site operators to achieve these goals. To accomplish this objective, the report should include the following sections:

- Fill Sequencing,
- Daily Fill Operations,
- Safety Procedures.

As the waste stream changes over time, occasional revisions to this operations guide will be necessary.

Fill Sequencing

Fill Area Delineation: Filling within the dump site will be accomplished by establishing a daily disposal area to be broken into specific filling areas for daily purposes. Each daily filling area will be approximately 20 meters by 20 meters. These daily-filling areas will probably fluctuate depending on the quantity and composition of the waste on any given day of

operation. However, the waste should initially be deposited in the vicinity of the lowest portion of the dump site (tipping area), not at the top. The purpose of restricting the disposal area is to reduce the need for imported cover or alternative daily cover and to limit the amount of waste required to be moved by the bulldozer. The road leading to the tipping area will need to be widened in order to accommodate two-way traffic for the disposal vehicles.

Fill Area Sequencing: Fill Areas described above will be filled in to a depth of approximately two meters per filling phase. The filling sequence will most likely be as follows:

- Prepare a circulation and tip area on the initial area to allow adequate vehicular maneuverability
- Fill the initial area to a depth of two meters
- Fill the adjacent area to a depth of four meters, or as allowable based on difficulty of pushing
- Prepare a circulation and tip area on the adjacent area
- Fill back over the initial area to a depth of four meters
- Prepare a circulation and tip area on the new elevated initial area
- Fill the adjacent area to a depth of an additional four meters,
- Continue repeating the filling process, filling each area approximately two to four meters in depth and staging the filling activity to allow for a tip area and adequate pushing distances for necessary compaction of each active area to reach the design grade.

Access Road and Turn-Around Preparation: During all seasons, an access road to the specified tip area needs to be prepared and functional. Areas along the specified access route are to be compacted, covered with sand, cork or other available cover, and where necessary in areas of pumping surfaces, covered with stones or broken concrete. The operator may use tree branches or similar material to bridge weak or pumping subsurface areas. At no time should soft material (such as packing material, foam pillows) or material difficult to compact (such as nesting pipes, large tree trunks, tires) be placed in potential access routes.

Daily Fill Operations

Delineation of Staging Areas: To properly compact waste materials, the materials must be placed in a certain sequence. This sequence is necessary for these reasons:

- Protection of track mounted equipment from cable, wires, and pipes,
- Optimization of compaction of each material type,
- Prevention of vectors,

- Minimization of imported sand,
- Optimization of alternative cover materials.

Adjacent to the identified daily filling area, the spotter will be responsible for identifying and staging incoming materials for unloading in certain areas according to the following material types:

- Incinerator waste from the hospital,
- Cork waste from the cork industrial facilities,
- Other, to include municipal solid waste.

Spotter Waste Staging Guidelines: The spotter's responsibilities are as follows:

- Follow Health and Safety unloading procedures (see below)
- Follow the Hazardous Waste Screening provisions (see below)
- Become familiar with incoming waste vehicles so that the spotter can identify which of the three waste material types (incinerator, cork waste, other) the vehicle contains.
- Gain contact with the driver of the vehicle and confirm waste material type
- Direct the vehicle to the appropriate unloading area
- Direct those vehicles that will be unloaded manually (which require additional time) to locations which do not delay the automatic unloading vehicles
- Direct vehicles so waste piles form a line pointing to the daily waste placement area
- Direct vehicles to another area if the waste piles exceed three piles in a row.

Bulldozer Pushing Sequence: Bulldozer operations are as follows, in this specific sequence:

- Push industrial waste materials onto designated daily waste disposal area.
- To the extent possible, push waste to depth of less than .5 meters depth.
- To the extent possible and depending on the composition of the waste, compact the industrial wastes by passing over the material five times.
- Compact waste extensively by passing over each area of the waste material at least five times
- Continue this sequential operation throughout the day using discretion to protect the operating equipment and to obtain maximum compaction.
- At the end of the day, after all waste materials have been received and the gate has been closed, push cork waste materials onto the daily fill area in layers not exceeding approximately 15mm in depth (ensuring the cork and incinerator waste is not mixed).

- Compact waste by passing over the cork waste material by passing over each area at least five times.

The tightly compacted cork waste materials act as the daily cover for this fill area. These materials will preclude the access of vectors in a similar manner as soil cover.

Bulldozer Compaction Guidelines: Although the aforementioned sequence should be followed to obtain maximum compaction, certain guidelines should be considered to prevent damage to equipment or potential harm to workers at the active filling area. These guidelines include:

- Awareness of the location of spotters or waste delivery personnel and making sure to delay any activity until all people are out of danger.
- Avoiding excessive pushing or compacting effort on cables, large quantities of wires, or other materials that could damage the tracks.
- Reducing equipment speed when waste material compacting creates plumes of dust or ash.
- Clearing the active unloading area of tracked waste materials between pushing activities.
- Tracking walk and back drag areas of pumping soil conditions.
- Avoiding pushing cork waste onto the daily fill area unless necessary to cover items of excessive odor or risk to workers, or to cover difficult to manage industrial waste materials (non-incinerator materials).
- Pushing large trees, tires, foam pillows, or other materials that are difficult to compact, to the outer edge of the cell.

Alternative Daily Cover Guidelines: Alternative Daily Cover (ADC) is the application of materials other than soil, as a vector avoidance management system, to cover the waste materials. With the increasing cost of environmental control systems such as liners, leachate management systems, covers, and groundwater management systems, we need to manage the valuable airspace within the dump site. When used properly, ADC can save as much 40 percent of most landfill's airspace. The use of ADC has become a standard for many landfills in the United States. California is encouraging the use of ADC and has recently passed laws allowing either compacted green waste, tarps, commercially developed foams, and digested sewage sludge to be used as the ADC.

As discussed in the compaction guidelines above, at the end of the day the finished fill area will consist of compacted cork waste overlying domestic and non-incinerated industrial waste. Daily cover soils are typically used to prevent vectors (rodents, birds, and bacteria) from accessing waste material. However, the excessive quantity of cattle poses a unique problem at

this dump site. Cattle can dig easily through the cork layer and gain access to the refuse. It is recommended that the cattle be kept off-site to prevent them from gaining access to the waste. Fencing could help eliminate this problem.

To accomplish effective usage of ADC, the following should be performed:

- Stage waste materials at the dump site unloading area as described in the delineation of staging areas and spotter waste staging guidelines above.
- Compact the waste in accordance with the pushing sequence section above, taking special care to save the cork waste until the end of the day.

Hazardous Waste Screening

The Mezraitine dump site should not accept hazardous waste materials. This section is directed to the dump site operators to assist in identification of hazardous materials. In brief, hazardous materials include the following:

- Oil
- Flammable chemicals or fuel
- Antifreeze
- Batteries
- Paint
- Solvents
- Insecticides
- Herbicides
- Acids
- Bases

Current dump site operations do not allow for close observation of loads. The load contents are first observed when it is being unloaded at the dump site. To identify these materials, the dump site spotters will need to look through the waste materials as they are dumped at the site. When the spotters identify hazardous waste materials, they should perform the following:

- Stop the bulldozer from pushing or compacting the waste,
- Observe the container more closely to confirm that the material is a hazardous waste,
- If the material poses an immediate risk, evacuate the area immediately,
- Notify the site manager,

- Retain the driver of the vehicle to ask if he/she is aware that the delivery contained hazardous wastes and seek the driver's assistance to identify and extract the wastes from the disposal area,
- Document the vehicle license number and driver name for reporting,
- Remove the materials from the active filling area,
- Complete a reporting form,
- Separate the materials in the storage area according to the following categories: flammable, corrosive, reactive, and toxic.

Safety Procedures

To protect the health and safety of all employees and visitors to the site, the following general safety procedures are to be followed:

Safety Meetings: The site superintendent will conduct daily safety meetings. These meetings are to occur at the beginning of each workday. The meetings will include a review of all of the specific safety procedures of each worker and an overview of the general procedures.

At the end of each month, the site superintendent will conduct a summary health and safety meeting that all members of the operational team must attend. Safety meetings will include a review of all items discussed in this manual including these general procedures, spotter safety procedures, and heavy equipment safety procedures. A list of necessary improvements and documentation of monthly site safety meetings will be included on the attached safety form.

Bacterial Risk Management: The presence of bacterial organisms at the dump site is substantial. Bacteria are generally acquired by physical contact but may also be acquired by airborne exposure. Bacteria may cause illness ranging from mild flu to death. Consequently, all workers are not to touch refuse without wearing proper protective gloves. Even with protective equipment, workers must wash their hands with soap and water prior consuming food. All workers are required to wash with soap and water prior to eating lunch and at the end of the day prior to leaving the site.

Scavenging: Workers are strictly prohibited from scavenging from the dump site. If a recycling facility is developed in the future, recovery of some materials may be acceptable if approved by the site superintendent. However, under the existing conditions, absolutely no scavenging is allowed.

Heavy Equipment: The operation of heavy equipment may cause risk to both the equipment operator and other people in the area. People at the site should be aware of the location and direction of movement of heavy equipment and avoid putting themselves in dangerous positions. This requirement supersedes all other safety requirements at the dump site.

Fire: Dump site fires occur for a variety of reasons. The primary risks to dump site workers are equipment fires, hot loads, and occasional subsurface fires. For the purposes of this report, we will focus on fires caused by hot loads. Hot loads result when burning embers are placed in domestic refuse and delivered to the site or when they are mixed with materials on-site. When hot loads result, the following steps should be taken:

- Move all personnel away from the fire and out of danger,
- Remember that fire consists of three components: fuel, heat and air, and that removal of any one element will extinguish the fire,
- Isolate fuel sources to prevent them from expanding to other areas by clearing material away from the fire,
- If water is available, use it (from a groundwater pump, for example) to remove heat from the fire,
- If water is not available, use soil to remove air from the fire (do not use cork for this purpose),
- If neither water nor soil is available, remove personnel and equipment from the fire and try to contain the location of the fire to the smallest area possible.

Spotter Safety Procedures

This section is directed to the spotter and provides specific guidelines for avoiding risk and increasing worker safety. The following list of procedures should not be considered a complete list. As dump site operations grow and change, this list should be updated and modified to represent current dump site conditions.

Personal Protection Equipment: All spotters are required to wear the following personnel protective equipment:

- Orange vest or orange jumpsuit,
- Hard hat,
- Boots,
- Leather gloves (to be worn when encountering solid waste objects, but leather gloves do not protect the wearer from some sharp objects or from liquid chemical or bacterial contamination),
- Rubber gloves (to be worn when handling liquids),
- Dust mask,
- Ear protection (if appropriate).

Incoming Waste Delivery Trucks: As discussed above, the spotter is to make contact with the driver of the incoming waste delivery vehicle and direct the vehicle to an appropriate disposal area. However, spotters need to direct vehicles with caution, keeping themselves out of danger. The spotter should take the following precautions:

- Keep on the driver's side of the vehicle.
- Maintain eye contact with the vehicle driver directly or in the rear view mirror.
- Avoid walking backwards over rubbish or debris (tripping may cause spotters to fall out of the eyesight of the driver).
- Maintain awareness of the direction of backing vehicles and keep out of their paths (this is especially important when soft soil conditions make vehicles speed in reverse).
- Maintain awareness of the bulldozer and other dump site equipment.
- Avoid assisting with vehicle unloading procedures (assistance puts spotters at risk for injuries that the dump site is not responsible for).

Dump Site Operating Equipment: Spotters must always remain aware of heavy dump site equipment activities to avoid endangering themselves. Spotters should perform the following safety procedures:

- Anticipate the bulldozer or loader operations stay out of their paths.
- Avoid standing adjacent to heavy equipment when loader buckets are extended to avoid falling debris.
- Avoid standing adjacent to heavy equipment when it is compacting bulky or unstable material as the bulldozer may shift rapidly.
- Do not stand down grade (below) any equipment operating on a slope.
- Do not stand below any equipment traveling on potentially unstable slopes.

Equipment Safety Procedures

This section is directed to the operators of the heavy equipment at the dump site and provides specific guidelines for avoiding risk and increasing worker safety. This list of procedures should not be considered a complete list. As dump site operations grow and change, this list should be updated and modified to represent current dump site conditions.

Heavy equipment poses the greatest risk to spotters and others at the dump site. Consequently, the heavy equipment operator must take the most precautions to avoid risking worker safety. If at any time the equipment operator feels a worker is in danger, the operator is to stop work immediately. If a worker is not complying with appropriate safety standards in the work area in the opinion of the equipment operator, the operator is to discontinue work and contact the site superintendent.

This list of procedures is not an operation guide to equipment performance. The operator should become familiar with the equipment operations manual for operations procedures.

Spotter Location: As discussed above, the operation of heavy equipment poses the greatest risk to spotters and others at the dump site. The equipment operator should follow these guidelines:

- Be aware of spotter locations,
- Look in the direction of travel (especially when backing up),
- Identify blind spots in the field of vision and inform spotters of these areas so they will avoid them,
- Do not process if in doubt of safety,
- Keep all glass windows clean,
- Do not hang fabric or other materials from cabin roof, as they will hamper vision.

Waste Delivery Vehicles: Although the spotters will be directing the backing up of waste delivery vehicles, the equipment operator must be aware of the location and path of these vehicles and passengers. In addition to following the previous guidelines addressed to spotters, the equipment operator should perform the following procedures:

- Avoid assisting with vehicle unloading procedures (assistance puts spotters at risk for injuries that the dump site is not responsible for),
- Keep the unloading area track walked and back bladed to prevent soft soil conditions that encourage waste delivery vehicles to speed in reverse.

Pushing and Compacting: When pushing and compacting waste debris, the equipment operator should be aware of the following:

- The operator should wear a seat belt at all times to avoid injury when sudden equipment motions occur,
- A hard hat is necessary in the event the equipment makes sudden movements,
- Buried stumps or other dense materials may cause abrupt motions of the equipment,
- Equipment should be protected by avoiding excessive handling of cables, long steel pipes, large stiff debris, and steel banding.

Final Cover Placement

The final cover shall be placed as described in Section 5 of this report. The cover must be effective in its design and placement to reduce the amount of rainfall that filters through the waste and generates additional leachate. The cover should also seal the wastes properly to prevent vermin and other disease-carrying vectors from proliferating at the closed site.

7.2.2 | Long-Term Dump Site Post-Closure Operations and Maintenance

Although the Mezraitine dump site will eventually be closed to MSW loads, long-term restoration and rehabilitation of the site will be required (10 to 15 years). Since the closed facility could release uncontrolled contaminants into the environment that could affect public health and the local environment, minimum standards should be specified and followed for post-closure maintenance. The following list of post-closure measures should be followed once the dump site is closed:

- Develop a reporting program,
- Conduct annual tests and inspections,
- Develop an emergency response plan,
- Conduct ongoing operations and maintenance activities (see below).

Operations and Maintenance Activities

Environmental Monitoring Facilities: Environmental monitoring facilities are necessary to ensure that the integrity of the dump site is maintained with respect to the release of uncontrolled release of any contaminants into the environment. The monitoring facilities that should be chosen can be used to track the movement of any dump site emissions to the water, air, and soil environments.

Maintaining Dump Site Grade: Surface Water and Drainage Maps: Once closed, the dump site must be designed to control run-on and runoff of surface waters as well as preventing groundwater from penetrating the dump site liner. Drainage should be designed to: collect and route surface waters off the dump site in the shortest possible distance; channel waters at adequate velocities to avoid deposition; maximize runoff while minimizing surface scour; and make materials available to replace drainage features as the dump site settles and/or needs repair. In order to control surface water and drainage, dump site grade (eroded slopes) and storm water control features around the facility must be maintained.

Dump Site Gas Control and Monitoring Features: Once closed, the dump site will continue to release gases, produced from the decomposition of the organic fraction of MSW. Some of these gases are harmful to human health, the local environment, and the surrounding soil. The closed dump site will need to develop control systems for trapping and/or recovering these gases. Typical landfill gas control facilities include extraction wells, collector and transmission piping, and gas flaring and/or combustion facilities.) Gas monitoring is also used to assess the degree of biological activity at the dump site. Also, gas management systems including ambient air sampling are used to detect dump site gas compounds in the air.

Leachate Management: When liquid from external sources enters and moves through the dump site (rainfall, groundwater, surface drainage), it collects dissolved and suspended materials. This liquid, known as leachate, must be collected and removed to prevent it from contaminating groundwater and underground aquifers and presenting health risks. A leachate collection system should include placement of collection and drainage channels and pipelines and locating holding facilities for removed leachate. The leachate should be retained in a pond or container and allowed to evaporate. The surface of the leachate holding container or pond should be covered to prevent birds or wildlife from accessing the leachate.

Soil: Cover soil that has eroded must be replaced periodically to ensure the underlying wastes are not exposed. The dump site surface should be inspected several times per year and areas that indicate the cover soil is being eroded should be repaired.

7.3 | Operations Plan for a New Sanitary Landfill with Vermicomposting Facilities

7.3.1 | Sanitary Landfill Disposal Operations Plan

This section outlines a plan to operate the new landfill once it is opened. Many of the operating proceeding described in the previous section (Mezraitine dump site closure) apply to operations of the new landfill.

Once the general layout of the landfill site has been established, a placement method must be selected for filling the solid waste cells. Characteristics of the site, including the topography, amount of available material, the local hydrology and geology must be considered when choosing the specific filling method. The filling sequence should be determined so landfill operations are not effected by unexpected conditions or unusual weather. There are several common methods used for landfilling waste (excavated cell/trench method, area method, canyon/depression method).

Once customers have disposed of refuse at the unloading areas, the bulldozer pushes the waste to the working face in layers approximately half a meter thick. The bulldozer then makes repeated passes over the working face to thoroughly compact the refuse. The working face is sloped to a gradient from 3:1 to 5:1 (horizontal to vertical) to achieve maximum compaction.

Once waste has been spread to the appropriate thickness, the waste is compacted at the active face to minimize voids in the daily refuse cells, inhibit vector propagation, and maximize site capacity. The bulldozer will typically pass over the thin layer of waste a minimum of three times to assure the waste is compacted to a maximum level. After the wastes have been

compacted, the bulldozer will push another layer of waste of an approximately half meter thickness and repeat the compaction process described above.

Some waste received at the site may require special handling, such as the occasional load of bulky waste. Bulky wastes can include demolition debris (used on-site for wet weather deck construction) large tree trunks, and oversized agricultural field plastic or other difficult material.

Rain and/or high winds are the predominant inclement weather conditions that may cause the operator to adjust on-site waste handling and disposal procedures. Vehicle access to the unloading areas is provided by paved or tightly compacted dirt roads. The unloading area may be treated with some type of inert material to further aid in vehicle access. When heavy rains cause the unloading area to become muddy and unusable, operations are moved to a designated wet weather area to provide continuous operation during inclement weather. Stockpiles of soil material should be maintained near the working face and the designated alternate unloading area to provide an adequate supply of cover material.

When high wind conditions occur, the unloading area is typically reduced in size. The front-end loader and bulldozer can be utilized to expedite the spreading and compacting of the refuse as soon as it is unloaded. Cover operations may also begin earlier in the day to reduce the area of exposed waste on the working face.

The purpose of daily cover soil or compacted green waste is to provide a suitable barrier to the emergence of flies, prevent windblown trash and debris, minimize the escape of odor, prevent excess infiltration of surface water, and hinder the progress of potential combustion within the landfill. Daily cover in the form of soil material or a similar alternative should be placed over all exposed refuse at the end of each working day to a minimum compacted thickness of six inches.

Intermediate cover is cover material in areas where additional cells are not anticipated to be constructed for an extended time or if the daily cover soil has not provided adequate protection for vectors, odors, blowing litter, scavenging and drainage. For example, the outside slopes of the landfill should receive intermediate cover soils as the landfill height increases.

Hours of Operation

The landfill should be open only during determined working hours. During open hours, gates, scales, employees, and tractors should be operating. Landfill maintenance should be conducted during closed hours to avoid operation delays. During closed hours, gates or fences should be locked to prevent illegal dumping. In many U.S. cities, hours of operation range from 7 am to 5 pm.

Record Keeping and Reporting

The City should write monthly, quarterly, or annual reports in order to document and track information about the tonnage information entering the landfill. Reporting will depend on the information the City requires for reviews in its official capacity.

Employee Safety and Uniforms

Employees should be provided with uniforms or vests, or use other ways of identifying themselves as crew members so they can be easily identified. Standards for employee health and safety should be maintained. Jijel may require, for example, that all collection crews and staff working at the landfill wear gloves, hard hats, boots, and other appropriate safety gear. Minimum standards for provision of health care may also be set.

Environmental Monitoring

Environmental impacts must be considered when operating landfills. At a minimum, landfill operators must meet the applicable environmental regulations. In addition operators must mitigate any impacts from air emissions, dust, odors, noise, aesthetics, and run-off.

7.3.2 | Vermicomposting

Vermicomposting will be employed at the new sanitary landfill as organic wastes account for the greatest portion of waste in Jijel. Separation of organic wastes from the municipal solid waste system will be required to prepare a clean feedstock for compost operations. Separation is required to produce an acceptable compost product. A formal separate collection program for organic materials may be required in the future for operations to grow.

Materials Recovery

Organic wastes will be separated for vermicomposting at the City's new landfill. It is likely that recovery will take place at the new landfill by capturing municipal solid waste loads with a high organic waste content and diverting these loads to the vermicomposting operations at the landfill. Several industries and commercial businesses (restaurants and markets) produce wastes suitable for vermicomposting. Before these loads are placed in the worm bins for vermicomposting, non-organic waste should be removed. The City should employ sorters at the landfill for this purpose.

Managing Vermicomposting

Worm bins should be located where there is plenty of ventilation and where the temperature remains below 80 degrees F. If the bins are kept in the dark, the worms will stay near the

surface and eat more quickly. The environment inside the bin should be kept moist but not soggy.

The first castings can be harvested in two to four months, depending on the size of the materials added. To remove the castings, the worms will need to be moved to one side of the bin and the finished compost beneath them removed. New bedding can then be added to the empty half. For the next month or two, food scraps should be buried only in the new bedding and the worms will migrate to the new side.

Managing Nuisances

If the composting system becomes too acidic, it may attract flies. Sprinkling powdered limestone (calcium carbonate, as opposed to slaked or hydrated lime) into worm bins can neutralize this acidity. To prevent acidic conditions from re-occurring, the composting system must not be overfed and must be kept at the appropriate moisture levels.

Managing Odor

Composting operations can create unpleasant odors due primarily to anaerobic decomposition of organic feedstock. Anaerobic conditions are created when the system is inadequately aerated or contains excess moisture. Although enough water should be added to completely moisten the pile, over watering should be avoided. If odors occur, turning (aerating) the composting piles or adding absorbent material such as wood chips or sawdust may be sufficient to correct anaerobic conditions.

Anaerobic conditions can also result when feedstock is stored for lengthy periods before being introduced into the system or when feedstock is already in the system but sits for a lengthy period before the worms to begin decomposing the material. Finding an equilibrium at which the rate of feedstock additions equals the amount of organic composting that occurs and properly landfilling excess feedstock can solve this problem. System operators may also adjust certain environmental factors in the composting system to accelerate the rate at which organics are processed into compost, thus increasing the rate at which the feedstock can be composted.

Proper site operations, such as installation of odor control systems or methods (similar to air emissions controls), in areas where waste handling is concentrated can minimize odors.

Developing and Promoting Compost Programs

A successful composting program relies on the cycle between producers of organic waste, separating, collecting and processing organic waste, and locating end users to accept the compost. There are many strategies that have been taken by cities throughout the world that have led to successful composting programs.

Compost Applications: Finding End Users

The by-product of vermicomposting is a dark, crumbly material called compost. Compost is largely composed of hummus, an earthy smelling, nutrient-rich material that supports and enhances biological soil processes. Compost can be used as a soil enhancer in gardens, lawns, and indoor plant pots. It can be used in parks and public recreation areas and along freeways and roads. Compost aids plants in resisting disease, helps control erosion, balances pH, supports essential bacteria, stops nutrient loss through leaching, and acts as a buffer against toxins in the soil. Possible end users for compost are residents, landscapers, highway maintenance personnel, students and researchers, and farmers.

Local government agencies can develop procurement programs to create new and expanded markets for compost products, educate potential users about the benefits of using compost, and connect end users with compost. One way to locate users of compost is to offer free advertising on a voluntary list. A city compost program could support research and help to promote the benefits of compost, and hold educational outreach days, demonstrating to farmers to learn the benefits of using compost.

7.4 | Slaughterhouse Waste Collection and Disposal Plan

7.4.1 | Collection Plan

The slaughterhouse waste currently being dumped into the Mediterranean Sea will need to be collected and delivered to the Mezraitine dump site or newly developed sanitary landfill site when available. The slaughterhouse needs to either self-haul the waste to the dump site or the City will need to collect the waste and transport it to the dump site. In either case, a City representative needs to discuss a collection approach with a slaughterhouse representative. The plan should include type and frequency of pick-ups and a plan for handling liquid wastes such as blood. Blood may be able to be stabilized through use of an existing water treatment facility. Other slaughterhouse waste may be taken to rendering plants.

7.4.2 | Disposal Plan

A separate area or mono cell will need to be developed at the dump site to accept slaughterhouse wastes. All slaughterhouse wastes arriving at the disposal site will need to be redirected to this mono cell. Particular care should be taken in burial of these wastes, including proper cover that prohibits vermin from reaching and accessing these materials.

7.5 | Air Pollution Control Devices

7.5.1 | Medical Waste Incinerator (MWI) Operations Plan

Medical waste incinerators fit with air pollution control devices require continuous and long-term management. The fly ash collected from medical waste incinerators can become increasingly toxic when capturing higher levels of toxic metals and dioxin. Air pollution control devices pose threats to workers and others that are directly exposed, especially when the devices are emptied and cleaned. For these reasons, medical waste incinerators should be operated by trained personnel and management plans should be made to determine operating parameters.

Trained Operators

Given the complexity of operating a medical waste incinerator (MWI) and the emissions that could result from only a momentary upset, trained personnel should always be on duty or on-call. Operating personnel should be trained in waste prevention and waste handling. They should be able to read and understand emission tests and results and understand the emission levels determined in the waste management plan for the incinerator. They should know all rules associated with operating the incinerator and how to perform equipment maintenance. The incinerator operators should ensure that the ash from the incineration process is completely cooled prior to disposal in the landfill to prevent the combustion of other disposed waste.

Waste Management Plans

A waste management plan should outline operating parameters for the MWI. Operating parameters should specify levels of allowed emissions of each MWI pollutant. Permitted emission levels should be decided early in the life of air pollution control devices. Operating parameters should also include charge rate, secondary chamber temperature, and bypass stack temperature. Waste management plans should describe all tests and reports that will be performed and a time line for when they will be conducted. Reports should document the results of all performance tests and inspections, and show whether actual emission levels are in compliance with allowed level of emissions for each pollutant.

Testing and Monitoring Pollutants

Numerous tests are required for monitoring emission levels of the incinerator. All tests should be conducted at times when fully representative waste streams are being burned. Because the combustion conditions of MWIs change considerably with age and are gradually degraded by hydrochloric acid and other materials, the incinerator should be inspected and tuned regularly for efficient operations. Some necessary tests and inspections include:

Annual Tests: An annual stack test for regulating pollutants (particulates, carbon monoxide, hydrochloric acid, dioxin/furan, lead, cadmium, mercury, and opacity) should be performed and report good combustion and efficiency.

Continuous Emissions Monitoring (CEM): If economically viable, CEMs should be required for carbon monoxide, hydrochloric acid, sulfur dioxide, nitrogen oxide, and oxygen. CEMs help determine the efficiency of the incinerator.

Quarterly Testing: Because dioxin and mercury testing is time-consuming and expensive, tests should be conducted quarterly when feasible.

Equipment Inspections: All parts of the MWI, including meters and air pollution control devices, should be constantly inspected. Frequent replacement of key parts is required because exposure to air pollutants such as hydrochloric acid gradually degrades MWIs over time. An outline of equipment inspections should be included in the waste management plan.

By-Products of Air Pollution Control Devices

Dry scrubber technologies can produce a solid waste, which is captured and collected in the bag house (the bag house is a particulate emissions control device). The solid waste requires a stabilizing treatment to render it nontoxic and safe for landfill disposal. Similarly, wet scrubber technologies produce a toxic liquid as a by-product of its operation, which needs treatment prior to disposal.

Section 8 | Facility Siting

Background

A new landfill site, including an area for vermicomposting, has been proposed to accommodate the waste disposal of Jijel after the closure of the current landfill at Mezraitine. The proposed 12-hectare location is approximately 17 kilometers south of Jijel (as shown in Exhibit 2-4).

The commercial, industrial, and residential non-hazardous waste from Jijel will be transported to the landfill six days per week by individual vehicles, without extra handling at a transfer station or official materials recovery facility prior to delivery at the site.

For a private contractor to successfully develop the landfill and composting facilities, potential sites must meet specific siting criteria and the contractor must meet all applicable government siting regulations.

This section provides an overview of the siting criteria that generally apply to these facilities, a summary of the results of a land survey, and a summary of applicable facility siting regulations.

8.1 | General Siting Criteria

Facility developers of a landfill or composting site typically consider the following criteria in choosing an optimal site:

Location

The site must be located in an area zoned for industrial use and with a relatively low population density, thereby reducing any potential impacts to local residents and businesses, or at least 200 meters from the nearest activity or establishment.

Size of Land Parcel

The site must be large enough to accommodate the facility and all associated support structures, equipment, and activities.

Dimensions of the Land Parcel

The shape of the site must allow traffic to enter and exit. The site layout must address all operational requirements.

Topography

Topography requirements or limitations vary by facility. Generally flat or gently sloping sites are preferred for landfills to aid in structural stability.

Geology and Soils

Certain soils are better than others for supporting building and equipment loads. It is recommended that the site be located outside of a floodplain (although various measures can mitigate the potential flood impact to facilities).

Water Resources

Proximity of rivers and other bodies of water must be taken into consideration. Groundwater and water wells should be identified and any affects on them mitigated.

Parcel Ownership

The current owner should be willing to consider selling or leasing the land parcel to the facility developer.

Surrounding Land Uses

Surrounding land use should be compatible with the facility under consideration. Establishments such as schools, hospitals, religious institutions, and residential areas may be considered incompatible with solid waste facilities. Potentially incompatible sites should be relatively distant from the site. Future land uses must also be compatible with the facility under consideration.

Accessibility

The site must permit easy access for all waste collection and delivery vehicles. The site should be located in close to a major thoroughfare.

Major Land Uses Along the Access and Transportation Routes

Major land uses along the access route to and from the site must be suitable for the heavy and potentially noisy or malodorous vehicular traffic that will be accessing the site.

Availability of Utilities

The site must be able to be serviced by all required utilities, which may include electricity, fueling capabilities, water utilities, and wastewater treatment capabilities.

Cost

The cost of purchasing or leasing the site must be reasonable.

8.2 | Solid Waste Facility Siting Regulations

Solid waste facilities in Algeria are required to follow certain government requirements for siting. Siting of solid waste facilities falls under articles 4, 5, 6, and 15 of the legislation addressing Algerian environmental laws. Solid waste facilities include landfills and composting facilities (see Section 6).

Article 4: Besides the general and specific measures concerning protection of the environment, the governing body of Jijel regulates the choice of siting for waste treatment facilities. It requires an impact study and feasibility study as well as all useful information relating to the effect of projects projected out fifteen years.

Article 5: An impact study shall be conducted for the chosen site, taking the following conditions and issues into consideration: location, proximity to inhabitants and protected water sources, urban growth, resource recovery and recycling, and groundwater.

Article 6: Precautions that should be taken for the protection of the water table include: drainage of soil, leachate control through a liner, and leachate treatment prior to releasing into the environment.

Article 15: The content of the impact survey addressed in Article 5 regarding the conservation of the environment shall include:

- 1) Analysis of the initial condition of the site and its structural environment, notably on the natural wealth, the agricultural, forest, maritime, water and recreational areas, and the effects from the facility siting on these conditions.

- 2) Analysis of effects on the environment and in particular on sites and landscapes, fauna and flora, natural surrounding and biological balances, the convenience of the neighborhood (noises, vibrations, odors, smoke), or hygiene and the public health.
- 3) Reasons for which the subject project has been maintained.
- 4) Measures considered by the project planners to suppress, reduce, and remedy consequences of the project on the environment, as well as the corresponding expenses.

8.3 | Environmental Criteria

Environmental impacts must be considered when developing facilities. At a minimum, facility developers and operators must meet all applicable environmental regulations. State-of-the-art solid waste facilities include features that mitigate air, water, noise, and odor impacts on the surrounding environment. This is a key factor in gaining public support and approval for any new facility development. Please refer to Section 6 for more details.

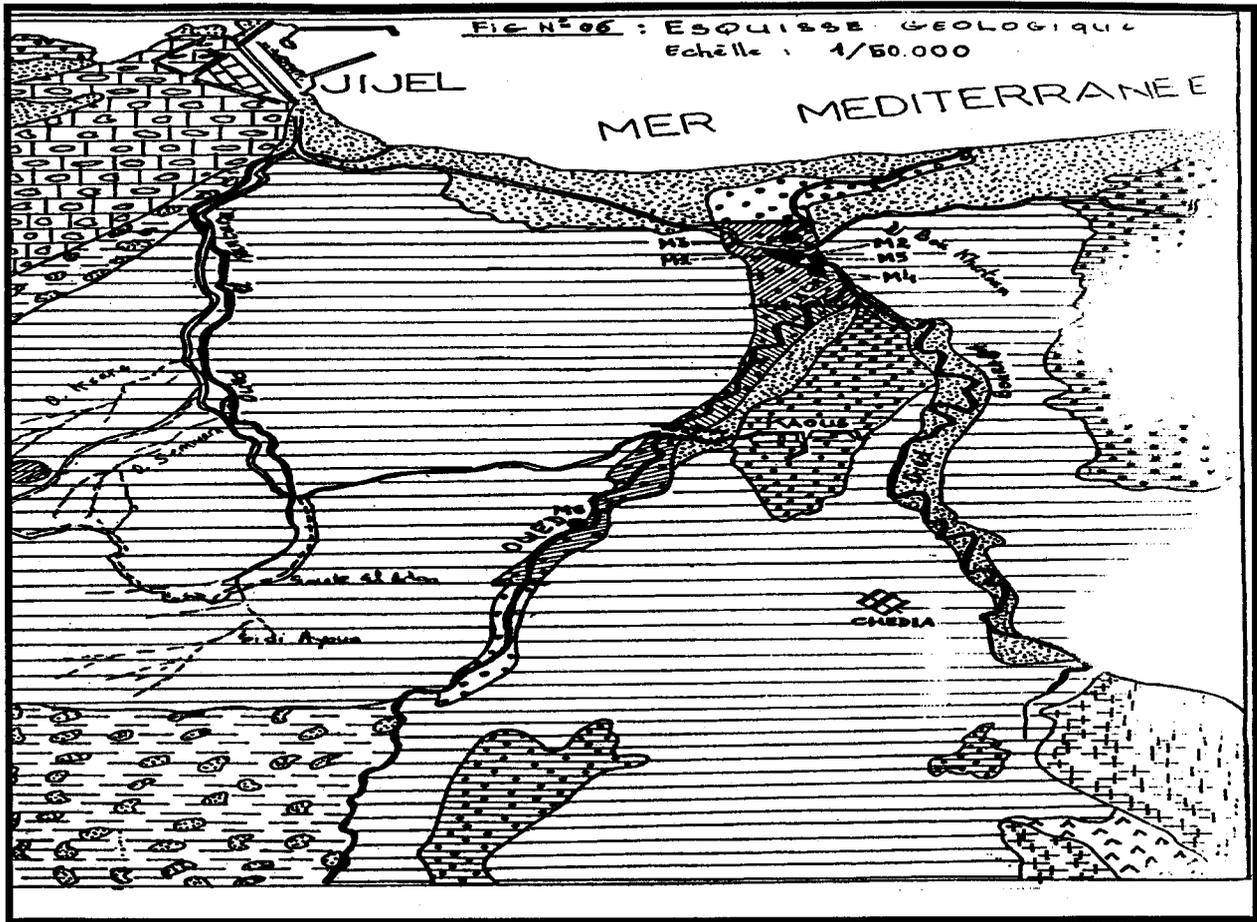
8.4 | Site Evaluation and Land Use Data

Jijel has completed initial environmental inspections addressing issues related to Article 15 in the environmental law, documenting the geology, flora, fauna, and some surrounding land use of the new landfill and composting site. Current land use must be compatible with or able to be converted to the proposed use, if not able to be removed or relocated. A site could be considered inappropriate if endangered species are present, if building the facility results in destruction of cultural, historical, or archaeological resources or if the facility significantly impacts critical or fragile lands or wildlife habitats. Careful selection of a site can prevent negative land use impacts. Appendix G includes detailed information in regards to the site evaluation, including information on the region's different birds and fish.

Geology

Geological studies have determined that the site is appropriate for a landfill and composting site due to the somewhat impermeable soil structure in this region of Miocene Burdigalien, characterized by the presence of mudstone, siltstone, calcareous clay, marl, chalky marl, small pebbles, and detrital limestones. Geological data is show in Exhibit 8-1.

Exhibit 8-1 | Geological Features Near Jijel



Legend

- Quaternaire (Périmétable) : Alluvions : blocs, galets, graviers, sable, limons-sableux, vases, dépôts marins.
 - Pliocène (Semi-périmétable) : Conglomérats à galets, micro-poudingues, sable et gros grains, limons sableux, blocs, sables bitumineux.
 - Miocène (Impérimétable) : Siltites argilites, argiles alcalines, marnes maracaleniennes, argilomesites à petits galets, gros graviers, calcaires dolomitiques.
 - Oligocène (très peu périmétable) : Grès quartzite fins et grossiers et même granuleux, argilites siltiteuses.
 - Eocène (très peu périmétable) : Conglomérats, micro-poudingues polygéniques et quadriges, marnes, argilites.
 - Paléozoïque (Impérimétable) : Roches métamorphiques, gneiss.
 - Paléozoïque (Impérimétable) : Roches volcaniques, rhyolites, basaltes.
- Zone d'exécution de puits pour exploitation des eaux souterraines.
- M4 Forages existants
 - Oueds
 - Routes principales et secondaires
 - Site de la décharge

Natural Resources

Downstream of the proposed site is a reservoir supplied by the Kasara River. All necessary measures must be taken to insure that the river is not contaminated. There are no wells present on the land or in the immediate surroundings. Jijel is nourished by three watersheds: the Mencha Oued, Oued Djen Djen, and Kissir.

The three forests near Jijel are the Mazritane, the Kissir oued and the state forest of Jijel.

Fauna

A total of 131 species of birds are present in the region of Jijel. Among these, certain species are protected (presidential decree number 83-509 of August 1983 and departmental order of January 1995). The animal species observed by the forest service include: boar, hare, rabbit, partridge, reptiles, mongoose, jackal and fox. The kestrel is listed as protected. No mention is made to any other endangered species. A total of 15 mammal species are present of which 11 are protected by the Algerian regulation. A fish inventory indicates at least 21 fish varieties in the region.

Flora

Flora at the proposed site includes a group of olive trees, dwarf palm, and brushwood.

Community

There are no communities at or adjacent to the proposed site, although the road to the landfill site passes by the towns of El Djerf, Ben Saber, and Djebra.

Climate

The climate of Jijel is humid with moderate, humid winters and hot, dry summers. The annual rainfall is around 1200 millimeters. The rainy season lasts from mid-October to mid-April. The hottest month is August and the coldest month is December. The average temperature is around 18 degrees C (approximately 64 degrees F). Dominant winds are from the northwest and northeast. Southerly winds are rare, but can occur in July and August.

Seismology

The seismic intensity of the Jijel region has been listed as average, or Zone 2, according to the Algerian regulations of 1983. Soils consist of very loose, alluvial matter and therefore are considered moderately sensitive to earthquakes.

Utilities

Utilities are not present at the proposed location. Water will be necessary to control dust and to maintain moisture levels in the compost. A fueling station is desirable for emergency situations and to efficiently run the equipment on-site. Both of these needs can be met by installation of above-ground storage tanks.

8.4.1 | Summary

The initial environmental impact survey summary suggests that if the facility is monitored well, there will be no negative impact on the environment. No alternative sites have been mentioned, nor have any remediation of potential impacts been acknowledged. According to the report, soil structure appears to be appropriate for the siting. It has been reported that fauna will move elsewhere, if displaced. If, however, the site is left uncontrolled, dangerous illness could arise from the presence of vectors and undesirable pests. As already mentioned, the Kasara River must be specially protected and monitored to avoid contamination. There was limited information regarding other nearby land uses.

8.5 | Barriers and Opportunities

Barriers to new facilities may include public opposition and political resistance. Even if the facility developer follows all applicable rules and regulations for selecting a facility site, opposition from the public and politicians may arise. Strong public participation and appropriate notification programs during the siting process may help to mitigate this kind of resistance. Facility developers and appropriate local government representatives should allow adequate time to hear and respond to the public's concerns, as well as convey to the public accurate information regarding the environmental and design aspects of the proposed facility. Information should be made readily available to the public, including the rationale for site selection, possible impacts and risks to the surrounding communities, mitigation measures, maps, drawings, and any other material or references to help the public understand what is being proposed. In addition, developers should have a chance to describe some of the opportunities created by the facility, which may include new jobs at the processing site, better solid waste services, and subsequent health and welfare improvements for the community. It is helpful to identify political leaders, community representatives, formal and informal groups, and other citizenry who affect or are likely to affect decisions related to new solid waste facilities. These influential parties may include the following:

- Local governments
- Key public agencies
- Non-government organizations

- Religious groups
- Community leaders
- Experts in environmental issues
- School and university teachers and professors
- Prominent members of private sector institutions, including banks and businesses
- Members of national and regional organizations
- Minority groups and other groups not traditionally included in land use decisions

Developing a means of communicating and establishing relationships with these groups will facilitate the resolution of any problems that may arise during the facility siting process. Maintaining these relationships following the site selection process also can help to solve issues that arise as the facility is designed, constructed, and operated.

8.6 | Socioeconomic Factors

Displacement of workers or residents will not occur at the proposed site, as it does not currently undergo cultivation or provide a home to residents.

The City's waste management program is undergoing evaluation to create a more efficient collection and disposal system. The more clean and aesthetically pleasing an environment is, the more it appeals to tourists and tourist agencies. Jijel hopes to bring more commerce to the area and to improve the City's socioeconomic standing by building up its tourism industry.

The ideas of waste separation and composting may be new to many citizens of Jijel. Resource recovery and composting will give some value to their waste and should change community ideas that garbage is not valuable. Compost can be used for reinvigorating soils depleted from overgrazing, purifying contaminated soils, and generating soil amendments for landscaping, crops, fields, and floriculture. These amendments can have a positive effect on the sustainability of the regions farming and potential agriculture.

8.7 | Waste Transportation

8.7.1 | Road System

Only one main roadway leads from the City to the proposed new landfill and composting site, the CV3, via CW 150. The road's total distance is 17 kilometers. It is unevenly paved and needs to be prepared for the increased traffic the landfill will create. Speed limits and curves in

the road should be evaluated to determine any necessary safety precautions or new traffic controls or signs. The size of vehicles may also present a change to the road's normal accommodation of traffic, depending on the size of the road. Current information is not available regarding the average number of vehicles that travel this road. The waste management system will be more efficient when refuse collection crews are able to transport full loads of waste more often to the landfill, during the same collection period due to large capacity vehicles.

8.7.2 | Litter and Noise

According to Algerian regulation, the loading compartments of waste transport vehicles shall be fully covered to prevent littering during transportation. Residents along the road to the new site must be protected from the potential inadvertent litter that can result due to spillage during transportation.

The increased amount of vehicles on these roads will increase noise and dust in the area. However, with just 10 to 30 waste collection vehicles per day, there will not likely be much noticeable increase in these impacts.

Section 9 | Generator Opt-Out Conditions

Background

The residents of Jijel currently pay between 375 and 500 dinars (US \$4 - \$6) per year as part of their property tax for the solid waste management services the City provides. Commercial and industrial generators pay an annual tax of 1,000 to 4,000 dinars (US \$11- \$45) per year for solid waste services, depending on the size of business and location.

Implementation of a new waste management system will necessitate an increase in the service fee. If waste generators feel that the increased service fee is too high, they may wish to pursue alternative methods of waste disposal. To maintain and protect public health, however, Jijel should not allow waste generators to opt out of the standard solid waste system without submitting proof that they have found an appropriate alternative disposal method.

Furthermore, to retain as much revenue as possible within the solid waste management system, Jijel should strictly limit the number of waste generators allowed to pursue alternative waste disposal methods.

Although the majority of waste generators should participate and pay into the system, Jijel may also choose to offer a reduced rate for waste generators who are under particular financial hardship due to advanced age, physical handicaps, or limited income. Generators who wish to qualify for the reduced rate should be required to submit a request or application, with proof that they qualify for the reduced rate under one of the allowed conditions. The required proof may take the form of documentation that is available and appropriate in Jijel.

Recommendations

We recommend that the City establish a review and approval process for those waste generators who wish to circumvent the City's system. The City should monitor these exceptions closely. All waste generators who wish to opt out of the solid waste system should

be required to apply for a formal exemption. Valid conditions for such exemptions may include the following:

- The waste generator sells 100 percent of its waste to a recycler.
- The waste generator combines its waste with another generator, such as a neighbor, market complex, or store, and the waste service is paid for by the other waste generator.
- The waste generator self-hauls its waste directly to the City's landfill where it pays a fee in proportion to the amount of waste disposed.

Any waste generator seeking an exemption should complete and submit an official application form and application fee to Jijel. The application should require the applicant to provide proof that the waste generator qualifies for an exemption under one of the conditions listed above. Copies of sales receipts from recyclers purchasing the waste, a written agreement with another waste generator indicating that the waste is combined and paid for, or receipts from the City's landfill stating the waste generator's name and date of disposal are examples of such proof.

Jijel may approve or deny the applications. Applications may be denied for the following reasons:

- The waste generator has not adequately proven that it qualifies for an exemption.
- The waste generator was receiving service from Jijel prior to implementation of the improved waste management system, and has not demonstrated a change in business practices that would eliminate the need for continued solid waste services.

Waste generators who do not meet the established criteria should be required to use the improved waste collection system. This is essential if the City expects to rely on the customer-generated revenues for all or a significant part of its operating revenues. Requiring the use of the system is also a good practice for business, health, and safety reasons.

Enforcing this rule may involve levying an appropriate fine on waste generators who dump waste illegally or utilize the system without paying for it. The City may have to formulate additional penalties for waste generators who neglect to pay their fines. If appropriate, withholding other publicly provided utility services could serve this purpose.

Section 10 | U.S. Private Sector Capabilities

Introduction

A key goal of this project is to attract the interest of U.S. firms that specialize in waste management technologies and services and to encourage their participation in preparing competitive proposals during the procurement process. Other goals include exposing Algerian officials to modern solid waste technologies that may be implemented in Jijel (for the improvement of their solid waste system) and offering officials an opportunity to discuss alternative solid waste management practices with other local government officials.

To this end, BVA organized a study tour on November 13-16, 2000 in the Washington D.C. area for a delegation of Algerian officials from Jijel and Algiers. The study tour was planned in conjunction with the Maghreb Conference in Washington D.C. on November 15-16, 2000.

The Maghreb Investment and Development Conference was promoted by the U.S. North Africa Economic Partnership launched in 1998 to encourage closer ties between the U.S. and the Maghreb countries of Algeria, Morocco, and Tunisia. The conference provided information on project, procurement, and investment opportunities in these countries. Projects were presented on energy and power, telecommunication sectors, environmental initiatives, and transportation infrastructure. The conference brought together key project sponsors and representatives from major public and private financial institutions and U.S. companies in a deal-making environment. Attendees of the conference had access to senior project decision-makers and officials from the Algerian, Moroccan, and Tunisian public and private sectors.

BVA assisted Jijel in obtaining and coordinating financial sponsorship from TDA and NEE for this tour. Two Algerian representatives associated with the Jijel Project attended the study tour:

- Mr. Abdou Kheireddine, Vice President De L'APC De Jijel, APC De Jijel
- Mr. Bentir Mohamed, President Directeur General, Engineering Environment Consultant

10.1 | Summary of Events

Facility Tours - November 13 - 14, 2000

On November 13 and 14, 2000, BVA president Michael Brown joined Algerian officials on a tour of several Montgomery County, Maryland solid waste facilities led by Dr. Ramana Rao. The tour included the following facilities:

- **Education Center** - this facility is used to educate the general public about recycling and yard waste composting in Montgomery County. It includes various displays of recyclable materials and their end uses, as well as diagrams and videotapes of the recyclable material-processing center. Handouts are provided on a variety of recycling, composting, and HHW topics.
- **Recyclable Material Processing Facility** – the mechanized system separates co-mingled curbside recyclable materials collected from the approximately 250,000 people in the County. The facility is owned by the County and operated by a private contractor, (Maryland Environmental Services). The facility was built in 1991 at a cost of approximately \$8,000,000. The facility processes 80-85 tons per day of mixed recyclables plus 200-250 tons per day of recycled paper on a five-day per week basis.
- **Self-Haul Transfer and Recycling Facility** – self-haulers utilize a separate facility to drop off their recyclable materials and municipal solid waste requiring disposal. This facility includes disposal for household hazardous waste, (oil, batteries, paint, anti-freeze), as well as recycling drop off for computer parts and traditional recyclable materials. Municipal waste is deposited in containers which, when full, are delivered to the rail yard, for haul to the waste yard facility. The site also includes a designated area for the recycling of yard waste, white goods, and construction and demolition materials. The yard waste is ground and hauled by rail to the composting facility.
- **Transfer Station** – the Transfer Station compacts approximately 1600 tons per day of municipal waste into containers, which are delivered to the adjacent rail yard for shipment to the waste to energy facility. Non-burnable waste is segregated inside the Transfer Station, which are delivered by truck to a landfill in Virginia.

- **Oaks Landfill** – the Oaks Landfill operated from 1982 through 1997. Approximately 6 million tons were placed in the landfill during its lifetime. The facility is currently being closed in accordance with Federal and State regulations. The facility includes a leachate collection and treatment system, a landfill gas collection system, and an innovative leachate evaporation system utilizing the collected landfill gas.
- **Composting Facility** – yard waste from the Transfer Station is transported by rail to a composting facility located adjacent to the waste to energy plant approximately 30 miles away. Approximately 90 tons per day are composted on a paved surface area. The material is screened and sold in bulk or bagged on-site.
- **Waste To Energy Facility** – approximately 1200 tons per day of combustible waste delivered by rail from the Transfer Station is incinerated in this facility. The project was built and is operated by Ogden Martin and has been producing forty (40) megawatts of electric power since 1995. Air emissions from the facility have been closely monitored and have never exceeded regulations. The facility consists of 3 separate units and operates 24 hours per day 365 days per year.

Maghreb Conference - November 15 -16, 2000

The Maghreb Conference commenced on November 15, 2000 with an Opening Plenary including welcoming remarks from the Honorable J. Joseph Grandmaison, Director of the U.S. Trade and Development Agency, and a keynote address from the Honorable Stuart Eizenstat, Deputy Secretary of the U.S. Treasury.

Several presentations represented solid waste projects in the region. The Algerian representatives attended most of these solid waste project presentations, including:

Sidi Abdellah Solid Waste Project

Dr. Ahmed Hamidi, President, Sadat International, Inc.

Mr. Liess Hamidi, Director General, Sidi Abdellah New City

Sidi Abdellah Wastewater Treatment Plants

Mr. Liess Hamidi, Director General, Sidi Abdellah New City

Jijel Solid Waste

Mr. Mohamed Bentir, President, Groupe EEC Spa

Mr. Abdou Khireddine, City of Jijel, Algeria

Mr. Michael Brown, President, Brown, Vence and Associates

Fez Solid Waste Management

Mr. Jack Whitman, President & CEO, Edgeboro International, Inc.

Casablanca Solid Waste Management

Ms. Samia Benjelloun, Head, Town Planning and Environment Division, Wilaya of Greater Casablanca

Mr. Dale A. Rice, Vice President, Millenium Science & Engineering

10.2 | Tour and Conference Evaluation

In order to assess the representative's level of satisfaction with the study tour, each participant was asked to complete an evaluation form. The participants' evaluations judged the study tour as good to excellent. The responses they provided on their evaluation forms are summarized below. The numbers indicate how many responses fell under each rating.

Exhibit 10-1 | Overall Tour Ratings

	Excellent	Very Good	Good	Fair	Poor	Total
Agenda		1	1			2
Organization			2			2
Transportation			2			2
Accommodations			2			2
Tour leadership			2			2

Written comments included: "The visit of the installations of processing waste was beneficial to me for comprehension of solid waste management." The two suggestions for tour improvements were to "take into account all bound aspects directly or indirectly with the waste processing" and "to encourage other partners for the acquisition of the hardware who can help with improvement of the waste collection and processing."

The delegation was also asked to rate each of the study tour events. The results of their evaluations are summarized below.

Exhibit 10-2 | Tour Events Ratings

Event	Excellent	Very Good	Good	Fair	Poor	Total
Mahgreb Investment & Development Conference	1		1			2
Transfer Station		2				2
Recycling Facility		2				2
Landfill		2				2
Landfill Gas System		2				2
Compost Plant		1				2
Waste to Energy Facility			2			2

Tour participants felt that the concepts presented and technologies demonstrated over the course of the study tour were useful to their efforts in solid waste management improvements for Jijel. The participants wrote that the tour gave them a better understanding of waste management technologies and new ideas.

10.3 | U.S. Private Sector Participation

The Algerian delegates met with or attended presentations by TDA officials and other US representatives. Some of the conference representatives that were available to meet with the Algerian delegates included:

Mr. Vincent Le Guennou
Regional Director
AIG African Infrastructure Fund

Mr. Papa Madiaw Ndiaye
Director
AIG African Infrastructure Fund

Ms. Elizabeth Duff
Vice President
Bank of America, U.S.A.

Mr. John Bolden
Manager, International Marketing
Caterpillar, Inc.

Mr. Kenneth W Hansen
Partner
Chadbourne & Parke, LLP

Mr. Kamel Achab
Trade Specialist
Embassy of the United States of America

The Honorable Edward M Gabriel
Ambassador
Embassy of the United States of America

Mr. Robert Bosco
Associate
Export-Import Bank of the United States

The Honorable Gloria B. Cabe
Counselor to the Board
Export-Import Bank of the United States

Mr. Frank Graebner
Senior Business Development Officer
Export-Import Bank of the United States

Mr. Eric Steinhauser
Senior Engineer
GeoSyntec Consultants

Mr. Usama Amin
Research Associate
TERA, Inc.

Mr. Miray Kurtay
Research Associate
TERA, Inc.

Ms. Molly Williamson
Deputy Assistant Secretary for Africa and
the Near East
U.S. Department of Commerce

The Honorable Rust M Deming
U.S. Ambassador-Designate to Tunisia
U.S. Department of State

Ms. Kathy Kriger
Senior Commercial Officer
U.S. Foreign Commercial Service
American Consulate General

The Honorable J. Joseph Grandmaison
Director
U.S. Trade and Development Agency

Ms. Cybill Sigler
Country Manager
U.S. Trade and Development Agency

Mr. Henry Steingass
Regional Director
U.S. Trade and Development Agency

Ms. Lee Zak
General Counsel
U.S. Trade and Development Agency

The Honorable Stuart Eizenstat
Deputy Secretary
U.S. Treasury Department

10.4 | U.S. Sources of Supply

U.S. sources of supply for the projects recommended within this report are identified in this section by project type. Each project type may require the services of a consultant, contractor, and/or equipment vendor. These listings are not meant as a complete list of potential sources, but rather as a representative sample of U.S. sources available to Jijel. These sources should be considered in any procurement of services, supplies, or equipment relating to the projects listed within this report because the basis for costs, technical details, and specifications was derived from them.

10.4.1 | Collection Equipment

Consultants

To assist the City in preparation of bid documents, equipment vendor selection, contract negotiations, procurement of financing, route audit and revision of collection zones, and operator training, the following consultants have been identified:

Brown, Vence & Associates, Inc.
65 Battery Street, Suite 200
San Francisco, CA 94111-5528

Arcadis, Geraghty & Miller
1131 Bensfield Boulevard, Suite A
Millersville, MD 21108

Pacific Genesis
2211 Martin
Irvine, CA 92612

Contractors

Not required for this project.

Equipment Vendors

The following equipment vendors have been identified as suppliers of rear-loader, front-loader, and roll-off vehicles:

Heil Environmental Industries, Ltd.
International Group
P.O. Box 8676
Chattanooga, TN 37414-0676

Oshkosh Truck Corporation
2307 Oregon Street
Oshkosh, Wisconsin 54901

Leach International
E L Industries International Inc
Barrington, IL 60011

Crane Carrier Co.
1925 N. Sheridan
Tulsa, OK 74158

Dempster, Inc., A Waste Quip Co.
P.O. Box 1388
Toccoa, GA 30577

American Roll-Off
3 Tennis Court
Trenton, NJ 08638

G&H Mfg., Ltd.
P.O. Box 300
Mansfield, TX 76063

Galion Solid Waste Equipment, Inc.
P.O. Box 607
Galion, OH 44833

The following equipment vendors have been identified as suppliers of waste containers and bins:

Capital Industries, Inc.
5801 Third Avenue South
Seattle, Washington 98108

Toter Incorporated
P.O. Box 5338
Statesville, NC 28687

IPL
10 Forbes Road
Northboro, MA 01532

Zarn, Inc.
1001 Northeast Market Street
Reidsville, North Carolina 27320

Otto Industries, Inc.
12700 General Drive
Charlotte, NC 28241

Ameri-Kart Corporation
433 Industrial Road
Goddard, KS 67052

10.4.2 | Mezraitine Closure

Consultants

To assist the City in development of a closure and operations transition plan, operator training, site closure, and post-closure maintenance and monitoring plan, the following consultants have been identified:

Brown, Vence & Associates, Inc.
65 Battery Street, Suite 200
San Francisco, CA 94111-5528

Arcadis, Geraghty & Miller
1131 Bensfield Boulevard, Suite A
Millersville, MD 21108

Pacific Genesis
2211 Martin
Irvine, CA 92612

Contractors

To assist the City in closure of the Mezraitine site, the following contractors have been identified:

Geomatrix Inc.
180 Blue Ravine Road, Suite C
Folsom, CA 95630

Organic Waste Technologies, Inc.
7550 Lucerne Drive, Suite 110
Cleveland, OH 44130-6503

Equipment Vendors

Not required for this project.

10.4.3 | New Sanitary Landfill

Consultants

To assist the City in conducting an environmental analysis and development of a master plan and design, the following consultants have been identified:

Brown, Vence & Associates, Inc.
65 Battery Street, Suite 200
San Francisco, CA 94111-5528

Arcadis, Geraghty & Miller
1131 Bensfield Boulevard, Suite A
Millersville, MD 21108

Pacific Genesis
2211 Martin
Irvine, CA 92612

Contractors

To assist the City in development of the new landfill site, the following contractors have been identified:

Geomatrix Inc.
180 Blue Ravine Road, Suite C
Folsom, CA 95630

AGRU / AMERICA, INC.
700 Rockmead, Suite 150
Kingwood, Texas 77339USA

Stevens Geomembranes
9 Sullivan Road
Holyoke, MA 01040-2800

Equipment Vendors

Not required for this project.

10.4.4 | Vermicomposting

Consultants

To assist the City in training the operators and project start-up, the following consultants have been identified:

Brown, Vence & Associates, Inc.
65 Battery Street, Suite 200
San Francisco, CA 94111-5528

Arcadis, Geraghty & Miller
1131 Bensfield Boulevard, Suite A
Millersville, MD 21108

Pacific Genesis
2211 Martin
Irvine, CA 92612

Contractors

Not required for this project.

Equipment Vendors

The following equipment vendors have been identified as suppliers of vermicomposting equipment:

Rainbow Worm Farm
24700 County Road No. 95
Davis, CA 95616

Cascade Vermicomposting Systems
3431 Knollbrook Avenue
Corvallis, OR 97333

Yelm Earthworms and Castings Farm
c/o The Dirt Dept.
1477 Elliott Avenue W.
Seattle, WA 98119

VermiCo
P.O. Box 1134
Merlin, OR 97532

10.4.5 | Slaughterhouse Waste

Consultants

To assist the City in development of the mono cell design for proper disposal of slaughterhouse wastes, the following consultants have been identified:

Brown, Vence & Associates, Inc.
65 Battery Street, Suite 200
San Francisco, CA 94111-5528

Arcadis, Geraghty & Miller
1131 Bensfield Boulevard, Suite A
Millersville, MD 21108

Pacific Genesis
2211 Martin
Irvine, CA 92612

Contractors

To assist the City in development of the mono cell for proper disposal of slaughterhouse wastes, the following contractors have been identified:

Geomatrix Inc.
180 Blue Ravine Road, Suite C
Folsom, CA 95630

Organic Waste Technologies, Inc.
7550 Lucerne Drive, Suite 110
Cleveland, OH 44130-6503

Equipment Vendors

Not required for this project.

10.4.6 | Medical Waste Incineration

Consultants

To assist the City in conducting an emissions test, preparing bid documents, vendor selection, contract negotiation, and procuring financing, the following consultants have been identified:

Brown, Vence & Associates, Inc.
65 Battery Street, Suite 200
San Francisco, CA 94111-5528

Arcadis, Geraghty & Miller
1131 Bensfield Boulevard, Suite A
Millersville, MD 21108

Pacific Genesis
2211 Martin
Irvine, CA 92612

Contractors

Not required for this project.

Equipment Vendors

The following equipment vendors have been identified as suppliers of wet scrubber emissions control equipment:

Advanced Air Technologies, Inc.
3105 North Wilke Road, Suite X
Arlington Heights, Illinois 60004

Monsanto Enviro-Chem Systems, Inc.
14522 South Outer Forty Road
Chesterfield, MO 63017 USA

Sparkling Clear Industries- Clute
422 W. Plantation
Clute, TX 77531

Tennant Company, The
8204 Elmbrook Drive, #300
Dallas, TX 75247

10.4.7 | Train Staff Manager

Consultants

To assist the City in solid waste training of the appointed manager, the following consultants have been identified:

Brown, Vence & Associates, Inc.
65 Battery Street, Suite 200
San Francisco, CA 94111-5528

Arcadis, Geraghty & Miller
1131 Bensfield Boulevard, Suite A
Millersville, MD 21108

Pacific Genesis
2211 Martin
Irvine, CA 92612

Contractors

Not required for this project.

Equipment Vendors

Not required for this project.

10.4.8 | Public Education

Consultants

To assist the City in development of a public education program, the following consultants have been identified:

Brown, Vence & Associates, Inc.
65 Battery Street, Suite 200
San Francisco, CA 94111-5528

Arcadis, Geraghty & Miller
1131 Bensfield Boulevard, Suite A
Millersville, MD 21108

Pacific Genesis
2211 Martin
Irvine, CA 92612

Contractors

Not required for this project.

Equipment Vendors

Not required for this project.

Section 11 | Capital and Operating Costs

Introduction

The City spent about 44,255,422 dinars (approximately US \$500,000) in 1999 to implement its solid waste operations, including waste collection, street sweeping, landfill operations, and management of the City's overall system components. A breakdown of the City's solid waste expenses for 1999, including operating and amortized capital costs is illustrated in Exhibit 11-1.

Exhibit 11-1 | 1999 Solid Waste Management Expenses

Expense Type	1999 Cost in DA
Amortized Equipment	21,845,958
Staff	18,931,582
Insurance	146,121
Cleaning	365,995
Fuel	555,944
Lubricants	163,363
Pneumatics	158,706
Vehicle Maintenance	475,206
Vehicle Insurance	162,507
Vehicle Repairs	1,213,190
Uniforms	236,850
Totals	44,255,422

Of this amount, approximately 21,800,000 dinars (US \$240,000) or half of the annual costs can be attributed to payments on capital debt. Approximately 22,400,000 dinars (US \$260,000) can be attributed to operations costs.

Although the proposed solid waste implementation plan discussed throughout this report will increase operational efficiencies and reduce annual operations costs, additional funds will be required to cover the capital costs of these new improvements. These costs are discussed below by each individual proposed plan improvement.

11.1 | Capital Costs of Improvements

11.1.1 | Collection Equipment

The recommended plan includes the purchase of six new collection vehicles, 50 new collection bins, and 10 new roll-off containers. Including consultant assistance and contingency the estimated cost of this project is approximately 95,960,000 dinars (US \$1,100,000). Estimated costs are shown in Exhibit 11-2.

Collection Vehicles

As discussed previously, the six new collection vehicles should consist of four rear-loader compactor vehicles, one front-loader compactor vehicle, and one roll-off vehicle. We have received price quotations from Heil Environmental Industries, Ltd. of Chattanooga, Tennessee and Oshkosh Truck Corporation of Oshkosh, Wisconsin (see details in Appendix E). We have used the higher priced vehicle from each company to be conservative. Shipping was estimated separately.

Collection Bins

The proposed waste collection plan for the City's commercial and industrial businesses will require the front-end loader collection vehicle described above, as well as a certain number of collection bins. We have estimated that the City will need approximately 50 collection bins of various sizes. We are assuming the purchase of 10 – 1.2 cubic meter (1.5 cubic yard), 30 – 2.3 cubic meter (3 cubic yard), and 10 – 4.6 cubic meter (6 cubic yard) bins. Capital Industries of Seattle, Washington has provided budgetary cost estimates for each of these container types (see Appendix E). The 1.2 cubic meter and 2.3 cubic meter bins can be fit into one overseas shipping container. The 4.6 cubic meter bins will require a second overseas shipping container.

Roll-Off Containers

The shipping of roll-off containers overseas may be cost prohibitive, as each roll-off container will probably require the use of an overseas container at an estimated cost of 400,000 dinars (US \$4,500) each. This almost doubles the cost of a 23 cubic meter (30 cubic yard) container to about 720,000 dinars (US \$8,000) with shipping. It may be more cost effective to use a European source for these containers.

Exhibit 11-2 | Collection Equipment – Capital Costs

Item	Description	No. of Items	Estimated Per Item Cost (dinars)	Estimated Total Cost (dinars)
Rear-Loader Vehicle	Oshkosh MTM 24 cu meter (32 cu yard) XC	4	10,300,000	41,200,000
Front-Loader Vehicle	Heil Durapack 30 cu meter (40 cu yard)	1	14,000,000	14,000,000
Roll-Off Vehicle	Oshkosh MTM 27,000 kg (60,000 pound)	1	9,000,000	9,000,000
Vehicle Shipping	Overseas Containers	6	400,000	2,400,000
Collection Bins	1.2 cu meter (1.5 cu yard)	10	36,000	360,000
Collection Bins	2.3 cu meter (3 cu yard)	30	40,000	1,200,000
Collection Bins	4.6 cu meter (6 cu yard)	10	100,000	1,000,000
Bin Shipping	Overseas Containers	2	400,000	800,000
Roll-Off Containers	23 cu meter (30 cu yard)	10	320,000	3,200,000
Container Shipping	Overseas Containers	10	400,000	4,000,000
Consultant Assistance	Procurement, Negotiations, & Route Audit	1	6,300,000	6,300,000
Contingency	Approximately 15 percent	1	12,500,000	12,500,000
Totals				95,960,000

11.1.2 | Mezraitine Dump Site Closure

As discussed in Sections 5 and 7, it is recommended that the City modify its daily operational procedures at the Mezraitine dump site to include waste consolidation and cover. By implementing these operational changes the site can be prepared for closure. Additional costs for development of the closure plan, actual closure activities such as fencing and contractor assistance, and post-closure program plans will be required. This is assuming that: 1) cover material is available on-site, 2) no synthetic covers or liners are used, and 3) no gas system or leachate collection system is required. We also assume that the City retains ownership of the front-end loader and bulldozer at the site.

The estimated cost for preparation of the closure plan is approximately 4,500,000 dinars (US \$50,000). The estimated cost for fencing and contractors assistance in the actual closing is 9,000,000 dinars (US \$100,000). The estimated cost for preparation of the post closure maintenance and monitoring plan is approximately 2,700,000 dinars (US \$30,000).

To implement the new operational procedures, a skilled full-time equipment operator is needed (in addition to the existing site operator). Costs for this operator and additional equipment, fuel, and maintenance are discussed in the operations portion of this section.

Total capital cost for closure is estimated at approximately 16,200,000 dinars (US \$180,000).

11.1.3 | Development of New Sanitary Landfill and Vermicomposting Operations

New Sanitary Landfill

The City's new sanitary landfill will need to be developed while the Mezraitine dump site is still open and operating, so that operations can be easily transitioned to the new site. The City's existing landfill equipment and operators will not be available to develop the new landfill site. A consultant will need to be retained to investigate environmental impacts, develop a master plan, and create a landfill design. The cost for this is estimated at approximately 13,500,000 (US \$150,000). In addition, a contractor will need to be hired to develop the new site, which will include excavating the initial landfill cell, stockpiling soil, and installing a liner. The initial cell should have four to five years of capacity. We estimate that: 1) assuming tonnages described in Section 3 of this report (approximately 70 tons per day), 2) a compaction density of about 350 kg/cubic meter (1,000 pounds/cubic yard), 3) 25 percent intermediate and final cover, and 4) a trench depth of 3 meters, approximately 1.6 hectares (4 acres) of landfill area will initially be required. This would assume a landfill height of 10 to 12 meters. The cost to develop this area is estimated to be about 27,000,000 dinars (US \$300,000). If required, gas and leachate control devices can be installed at a later date.

Total landfill development costs are estimated to be approximately 40,500,000 dinars (US \$450,000).

Vermicomposting Operations

During initial implementation of the vermicomposting operation, specialized staff training will be required. This is estimated at approximately 3,600,000 dinars (US \$40,000). The landfill's front-end loader will be used to move materials. A compost harvester and screen and certain hand tools will be acquired and a watering system installed. The equipment, tools and watering system including a storage tank is estimated to cost about 12,500,000 dinars (US \$139,000). In addition, about 100,000 dinars (US \$1,000) of worms should be purchased.

Total initial cost for the vermicomposting operation with contingency is estimated to be about 16,200,000 dinars (US \$180,000). It should be noted that as the vermicomposting operation grows and expands, materials will need to be collected separately. Separate collection of organic materials will require additional equipment that has not been estimated at this time. The estimate included in this report is for initial operations.

11.1.4 | Slaughterhouse Waste

We do not anticipate that any additional capital costs will be required to implement waste collection at the slaughterhouse. Existing or newly purchased vehicles can collect waste from the slaughterhouse as required. However, to dispose of the materials in a separate mono cell, some costs will be incurred. A consultant will need to be hired to prepare the cell design and a contractor retained to develop the cell and place the liner. This project is estimated to cost approximately 3,200,000 dinars (US \$35,000).

11.1.5 | Medical Waste Incinerators – Air Pollution Control Devices

This recommended improvement calls for: 1) testing emissions from the medical waste incinerators, 2) procurement process for the equipment, 3) the purchase of an air pollution control device to be fitted to the existing medical waste incinerators, and 4) development of a mono cell to dispose of the ash properly. Testing of the emissions should cost about 450,000 dinars (US \$5,000). A consultant will need to be hired to conduct the procurement process. This is estimated to cost approximately 4,500,000 dinars (US \$50,000). As described previously, the unit will be sized and designed according to the emissions test information. However, for budget purposes, we have assumed a wet scrubber at approximately 13,500,000 dinars (US \$150,000), including contingency, shipping, and installation. A plan will need to be developed by a consultant for the ash disposal mono cell; a contractor will need to be retained to develop this cell. It is estimated that this will cost approximately 3,200,000 dinars (US \$35,000). Total cost for this improvement is approximately 21,650,000 dinars (US \$240,000).

11.1.6 | Other Capital Improvements

An initial step to implementing this plan is to appoint one person from a City department or agency to be responsible for carrying out the plan. The responsible entity should be trained in the United States or in another country that employs state-of-the-art solid waste management systems to learn about solid waste management through visiting facilities or taking classes. The cost of travel and training is estimated at approximately 2,700,000 dinars (US \$30,000).

Another recommendation is to implement a public education program. The estimated first year cost of this program is 3,600,000 dinars (US \$40,000).

11.1.7 | Total Capital Costs of Proposed Improvements

Total capital costs to implement the proposed measures are estimated to be about 200,010,000 dinars (US \$2,255,000). A breakdown is included in Exhibit 11-3.

Exhibit 11-3 | Capital Costs of Proposed Improvements

Proposed Improvement	2001 Cost in Dinars	2001 Cost in US Dollars
Collection Equipment	95,960,000	\$1,100,000
Mezraitine Closure	16,200,000	\$180,000
New Sanitary Landfill	40,500,000	\$450,000
Vermicomposting	16,200,000	\$180,000
Slaughter House Collection/Disposal	3,200,000	\$35,000
Medical Waste – Air Pollution Control Devices	21,650,000	\$240,000
Manager Training	2,700,000	\$30,000
Public Education	3,600,000	\$40,000
Totals	200,010,000	\$2,255,000

11.2 | Operating Costs of Improvements

11.2.1 | Collection Equipment

By reducing the number of operating collection vehicles, the number of drivers and helpers the City requires can be reduced. We estimate that four drivers and eight loader positions could be eliminated saving the City approximately 2,100,000 dinars (US \$23,000) per year. To lessen the impacts of job loss, some of the eliminated collection personnel can be utilized in the newly created landfill and vermicomposting positions described in this section.

We believe it is reasonable to continue the same level of funding for maintenance, lubricants, pneumatics, and repairs. Although the number of vehicles will be reduced, a more aggressive maintenance program will need to be initiated. We estimate that fuel usage could be decreased by one-third (180,000 dinars or US \$2,000) to about 376,000 dinars (US \$4,000) per year. Expenses for uniforms could also be reduced by about 80,000 dinars (US \$900) to 157,000 dinars (US \$1,800) per year.

An overall reduction in operating costs of approximately 2,360,000 dinars (US \$26,000) per year could be realized with the increased efficiency of the new solid waste collection system.

11.2.2 | Mezraitine Dump Site Operations and Closure

To effectively operate the Mezraitine dump site through closure, a skilled equipment operator will need to be hired. This will be in addition to the existing site manager/operator. The new equipment operator will be charged with operating the bulldozer (about 90 percent of the time) and the front-end loader (about 10 percent of the time). The operator should cost about 270,000 dinars (US \$3,000) per year. Additional funds to cover fuel and maintenance for increased usage of the bulldozer and front-end loader will be required. We estimate that an additional 750,000 dinars (US \$8,000) per year will be required. A total annual increase of about 1,000,000 dinars (US \$11,000) is expected.

11.2.3 | Development of New Sanitary Landfill and Vermicomposting Operations

Sanitary Landfill

The additional cost to operate the Mezraitine dump site discussed above should be adequate for operations at the new sanitary landfill as well. One equipment operator and additional funds for fuel and maintenance totaling about 1,000,000 dinars (US \$11,000) should be

expected. These funds should not be double-counted as they represent landfill operations at either the Mezraitine dump site (while closing) or the new sanitary landfill site (when open).

Vermicomposting

Initially, the vermicomposting operation will require two personnel (one skilled and one unskilled laborer). We estimate that labor costs would be approximately 450,000 dinars (US \$5,000) per year. In addition, a supplement of worms may be required on an annual basis at estimated cost of 90,000 dinars (US \$1,000). Other costs involved with this initial operation will be the cost of fuel, equipment maintenance, and the replacement of tools and water. This should not amount to more than 540,000 dinars (US \$6,000) per year. It was also assumed that finished product would be picked up on-site in bulk; thus no bagging operations were required. To be conservative, no sales revenue for compost was assumed.

Total vermicomposting costs are estimated to be approximately 1,080,000 dinars (US \$12,000) annually.

11.2.4 | Slaughterhouse Waste

There may be some small amount of additional cost for collection of slaughterhouse waste. This would be to cover separate collection and disposal of the waste. We assume that the slaughterhouse will cover the costs of this collection.

11.2.5 | Medical Waste Incinerators – Air Pollution Control Devices

Operation of the new wet scrubber system will not require any additional staff. Additional cost for caustic reactive agents (such as sodium hydroxide) and stabilization of the wastewater is estimated at approximately 900,000 dinars (US \$10,000) per year.

11.2.6 | Other Capital Improvements

The proposed public education program is assumed to cost about 900,000 dinars (US \$10,000) per year after the initial start-up.

11.2.7 | Total Operating Costs of Proposed Improvements

It is estimated that costs will increase by an additional 1,520,000 dinars (US \$17,000) per year by implementing these improvements. A breakdown is included in Exhibit 11-4.

Exhibit 11-4 | Operating Costs of Proposed Improvements

Proposed Improvement	2001 Cost in Dinars	2001 Cost in US Dollars
Collection	(2,360,000) ^a	(\$26,000) ^a
Mezraitine Closure	1,000,000	\$11,000
New Sanitary Landfill	1,000,000 ^b	\$11,000 ^b
Vermicomposting	1,080,000	\$12,000
Slaughter House Collection/Disposal	0	0
Medical Waste – Air Pollution Control Devices	900,000	\$10,000
Public Education	900,000	\$10,000
Totals	1,520,000	\$17,000

^aSavings from more efficient collection system.

^b The new sanitary landfill operating costs represent the same funds as the Mezraitine Site closure and should not be double counted.

11.3 | Comparison of Existing to Proposed Costs

The City's 1999 operational costs of approximately 22,400,000 dinars are estimated to increase by about 1,520,000 dinars, as discussed above with operations of the new improvements to about 23,920,000 dinars (plus any adjustment for inflation). In 1999 the City's annual amortized costs for capital financings was approximately 21,800,000 dinars. We do not have any information on how much this will be reduced in 2001. New capital financing of the approximate 200,010,000 dinars in recommended improvements will add about 32,500,000 dinars (US \$360,000) per year assuming a 10 percent interest rate and a 10-year term.

Section 12 | Pricing Strategy

Pricing Issues in Jijel

It is estimated that the current user fees generated by residents and businesses in Jijel will not be adequate to support the recommended improvements to the solid waste system.

Under most collection systems, waste generators are required to pay fees according to the level of services they receive (based on the amount of solid waste they generate). These fees (or customer rates) are intended to cover the cost of collecting, recycling, transporting, and disposing of the solid waste. Other charges, like municipal fees, operator profit, regulatory fees, and environmental enforcement, are often included in the customer fees. If these charges were implemented in Jijel, they would help to offset the cost of cleaning dump sites, sweeping streets, and servicing non-paying generators.

Simply increasing the service prices to cover the full cost of the system is not the solution, however. Drastic fee increases are likely to be politically infeasible, and more importantly, waste generators may not be able to pay the full cost of service immediately. If significantly higher service rates were suddenly implemented for system users, an increase in illegal dumping and littering may result – activities undesirable for both health and safety reasons.

We recommend that Jijel:

- Continue to subsidize the system initially while implementing a transition plan that gradually increases customer rates to the actual cost of service over a 5 to 10 year period.
- Gradually implement a different method of assessing customer fees, so customers who generate more waste pay a higher fee than those who generate less waste. Sections 12 .2 and 12 .3 discuss this concept in more detail.
- Develop an enforcement mechanism for more complete and successful collection of bills so every waste generator that utilizes the system pays for the services.

- Implement the proposed system improvements; they will increase operational efficiencies.

Success in these areas would produce a system not only pays for itself, but also provides a revenue source to Jijel.

12.1 | Revenue Generation Options

In addition to the recommendations above, the City may implement other strategies for revenue generation.

12.1.1 | Franchise Fees

In many privatized systems where the city grants an exclusive franchise to a contractor (which the City may or may not implement), customer rates are set such that the contractor is fully compensated for the actual cost of providing the service plus some negotiated level of profit. These profits are attractive enough that the contractor is willing to pay the city government an annual franchise fee for the exclusive right to provide service. The amount of the franchise fee is usually calculated as a percentage of the contractor's gross revenues. In the United States, franchise fees generally range from 4 to 12 percent of the gross revenues.

It is in the city's best interest to require mandatory service and enforce bill collection. This guarantees contractor revenues, which in turn increases the contractor's franchise fee payment to the City. This franchise fee is in addition to any other fees the City collects and does not replace any applicable municipal fees, regulatory fees, or environmental permitting fees.

Although the City is not currently considering franchise fees, this option could be implemented as a long-term strategy to provide revenue assurance and stabilize the system income.

12.1.2 | Licensing Taxes

Some municipalities charge a city tax with the issuance of business licenses or license renewals. This tax can be structured by first setting a basic rate, such as US \$150. The basic rate would cover businesses with a certain number of employees. Additional tax increments could then be paid based on the number of additional employees, such as US \$20 per person over the limit covered by the basic rate. The City needs to define what should be considered an employee. For example, an employee may be defined as "every person engaged in the operation or conduct of the business, whether as owner, partner, associate, agent, manager, or solicitor; and every person employed or working in the business for a wage, salary, commission, or room and

board.” Alternatively, a tax can be levied on each collection truck, so that smaller companies pay less tax than the larger operations. Typically, an upper tax limit would also be set, such as US \$25,000. The city would not be obligated to refund the tax if the business was discontinued, dissolved, or otherwise terminated.

12.1.3 | Special Fees for Special Services

BVA recommends that customer rates remain the same initially and increase gradually to more appropriate levels. However, the City should establish new fees for any special services that it institutes, however. For example, special fees may apply to the following:

- Household or business hazardous waste collection, treatment, and disposal,
- Additional, specially scheduled refuse pick-ups,
- Provision and pick-up of temporary drop boxes,
- Bulky item pick-ups beyond those regularly scheduled,
- Rental of refuse containers or bins.

These special service rates would provide additional revenue to the City, thereby decreasing the financial deficit.

12.1.4 | Participation of Waste Generators

Because the customer/user fee is the basic revenue source for solid waste management systems, the best way to obtain revenues is to ensure that waste generators participate and pay into the system. We recommend that waste generators be mandated to participate in the system with exemptions granted only in special cases (Section 9).

The City might consider the following strategies to encourage waste generators to comply with the mandate:

- Provide financial incentives to new customers, such as a lower introductory rate or free bin rental for some initial period of time.
- Provide free promotional items to new customers, such as durable refuse containers or recycling bins.
- Implement a rate structure that encourages customers to subscribe to new services. For example, businesses may increase their pickup frequency from two times a week to four times a week, yet be charged less than double the cost of the two times a week service. Customers may also receive a reduction in fees if they include significant quantities of recyclable materials in the refuse they set out for collection.

- Offer more services, including combined recycling and refuse collection, options for more frequent collection for businesses, and other special services.
- Implement a publicity and public education plan to make customers aware of the changes taking place and new opportunities associated with these changes.

12.1.5 | Recycling Revenue

Informal recycling currently occurs at the dump site. Individuals scavenge film plastic, paper, and ferrous metals from the refuse disposed at the dump site and sell their findings to customers in Algiers. Some individuals also separate glass from the waste stream prior to collection for direct sale to a glass factory in Taher Commune.

The City may implement more formal recycling activities at the new landfill, so the City can obtain revenues from material recovered from the refuse. By formally employing the individuals who currently perform these functions at the dump site, organizing them to do the work more thoroughly and efficiently, and establishing formal ties to markets that purchase recovered materials, the City may retain the profits generated from the operational economies of scale. The City may also better address public health and safety issues at the new landfill if the City establishes these formal relationships with the individuals currently performing these recycling functions.

12.1.6 | Self-Haul Fees

Jijel should ensure that generators who self-haul their refuse to the landfill pay into the system. At this time, several large, local industries haul their own industrial solid waste directly to the dump site. Some residential and commercial customers haul their own solid waste directly to the dump site as well. Because the dump site has no gate or entrance station, it is impossible to monitor the generators that haul their own waste to the site and to record the amount of waste disposed of by these self-haulers. Under the current system, self-haulers do not pay fees to the City for waste disposal at the City's dump site.

BVA recommends that the new landfill should have a gate or entrance station. When the landfill is operational, self-haulers should pay for the disposal at the landfill entry gate. To avoid charging double fees to self-haulers who do not require regular waste collection at their residence or business, the City would consider these customers exempt from paying the fees levied on regular waste generators (see Section 9). Waste generators who do require regular collection of their waste at their residence or business, in addition to occasionally self-hauling their waste to the landfill, should pay the regular fees as well as a fee for their additional self-haul disposal needs.

For the purpose of monitoring the amount of waste disposed of at the landfill, the gate attendant should keep a record of all self-haul deposits.

12.1.7 | Compost Sales

The City may implement a vermicomposting project at the new landfill site. Depending on the quality of the compost product that results from these operations, the City may decide to sell the product to agricultural customers, plant nurseries, and residential customers. Compost can be used as fertilizer, mulch, or soil amendments to improve physical soil properties.

The prices charged for the compost will depend on the compost quality, which may be measured in terms of nutrient composition, moisture content, and organic matter. A high level of contaminants in the compost may lower the market value of the product. Contaminants in the compost product are dependent upon the type and cleanliness of the feedstock used and the level of grinding and screening (see Section 7 for more details of the composting process). Characteristics, such as feedstock type (compost ingredients), compost salinity, stability/maturity, acidity level, and composting method utilized may factor into the price of the compost. If bagging and transporting the compost to consumer markets is necessary, these costs should be added to the price.

12.1.8 | Tourist Surcharge

The intent of these system improvements is to improve the City's environment and attract tourists to the area. An increased numbers of visitors will also result in increased refuse generation. When increased refuse generation occurs in private establishments, like hotels or restaurants, these establishments will be responsible for paying for the increased refuse disposal requirements.

However, increased refuse generation will also occur in public areas, such as beaches and parks. The cost of collecting and disposing of this waste will fall upon the City. To offset the increased public costs associated with tourism, the City may consider implementing an appropriate tourist surcharge or another cost-recovery mechanism.

12.2 | Typical User Fee Systems

User fees should not initially be expected to cover the City's actual costs; they may continue to resemble the flat rate structure currently implemented. However, as user fees are gradually increased and begin to reflect the true cost of service, the rate structure should begin to resemble the examples in Appendix H. Exhibit 1 in Appendix H shows the rate structure for a

city that has mandatory source-separated recycling and green waste (yard waste) collection for all residential accounts, including single family homes and multi-family residential accounts. With this rate structure, single family homes choose their level of service based on the amount of refuse they generate in a week. Managers of multi-family apartment buildings also select the appropriate level of service for their buildings. Both single family and multi-family rates include the charge for recycling and green waste services. Commercial customers select their level of bin service, but their rates exclude recycling and green waste services, which are provided separately by independent contractors.

Exhibit 2 in Appendix H shows a rate sheet in which residential customers may select not only different can sizes, but also the number of cans they wish to use. Compared to the example from Exhibit 1, commercial customers are given more choices for frequency of collection, but the bin size selections are more limited.

Exhibit 3 in Appendix H shows a comparison of solid waste rates in six U.S. cities. In these cities, multi-family residential buildings are considered commercial customers. Residential services are therefore limited to single-family homes. Different than Exhibits 1 and 2, this rate sheet shows the specific monthly charges associated with special services including bulky waste pickup, special pick-ups, recycling, and green waste. Both residential and commercial customers are allowed to select their level of service. The rate sheet also includes the franchise fee paid by the contractor to the city.

Exhibit 4 in Appendix H shows a rate sheet for commercial rates only. These rates differ based on the type and size of container used (regular vs. Toter), the number of containers collected at a time, the frequency of pick-ups each week (up to seven times per week for most of the services), and the type of refuse collected (regular garbage, restaurant or wet garbage, organics, or wood).

We are not recommending these specific rate schedule strategies. However, the City should consider implementing some of these ideas to more directly apply costs to the service users.

Section 13 | Financing Mechanisms

This section discusses the City's public and private options to finance the solid waste improvements. It also discusses loan guarantees and investment insurance. To procure the required project funds, the City will likely require some form of financing. Financing can be arranged using either public or private options. The City may decide to acquire financing itself or retain a private company to develop and finance its projects.

13.1 | Public Financing Options

The City can pursue financing through internal (in-country) or external sources, or through a combination of both. External sources include a variety of multilateral lending entities or government lending agencies. Although there are many public financing options available to the City, two of the primary lending groups active in Algeria are the World Bank and the African Development Bank.

13.1.1 | External Public Financing

World Bank

The World Bank includes the International Bank for Reconstruction and Development (IBRD) and the International Development Association (IDA). The IBRD and IDA give loans to governments for projects that promote economic and social progress. Total lending in fiscal year 1999/2000 amounted to US \$15.3 billion for the International Bank for Reconstruction and Development (IBRD) and the International Development Association (IDA) combined.

International Bank for Reconstruction and Development: The IBRD lends only to government agencies or institutions that can obtain a guarantee of repayment from their government. All successful applicants must be credit-worthy borrowers for projects that promise high real rates of economic return to the borrowing country. IBRD loans have near-commercial terms.

International Development Association: The IDA provides loan assistance to countries that cannot meet the IBRD's stringent loan terms. IDA loans are given to countries with an annual per capita gross national product of US \$925 or less in 1997. The loans are given only to governments and have repayment periods of 35 to 40 years. No interest is charged on the loans, but other charges are levied, including a service charge (currently 0.75 percent) and a commitment charge (which may range from 0 - 0.5 percent of the undisbursed loan balance).

Loan Information

Depending on the nature and complexity of the project, it may take one to two years (or more) to obtain approval for a loan from the World Bank. Once loans are approved, funded projects must follow set procurement procedures for goods and services. World Bank staff carefully supervises project procurement and implementation to ensure that all standard procedures are followed. They may choose to review bidding documents, the borrower's evaluation of the bids, and the proposal for contract award. Moreover, when the contract is awarded, World Bank staff will review it to ensure that it corresponds with the bid.

Activity in Algeria

The Algerian Ministry of Interior and Environment received a loan in 1996 for an Industrial Pollution Control Project in Annaba for \$78 million that will be active until 2005.

Environmental and Solid Waste Projects

The World Bank formulated a new corporate environment strategy in 1999. The main goal of the strategy is to better align the bank's environmental work with its central mission of poverty alleviation through either environmental interventions that directly benefit the poor or through changes in government and public policies that foster sustainable economic growth. The bank's environmental strategy addresses the following key areas: urban environment and pollution management, including solid waste management; water resource management; forests; land management and desertification; biodiversity; energy/environment issues; and climate change.

Parallel with this strategy, the bank has developed a portfolio of projects with environmental objectives in the areas of pollution management and urban environmental priorities, natural resource management, environmental institutional capacity building, and global environmental issues. The bank's environmental portfolio of projects shows trends toward assisting smaller operations. While the average size of environmental projects has decreased, the number of projects has increased.

Some recent examples of World Bank loans and assistance for solid waste management are as follows:

Sulawesi Urban Development Project, Indonesia

- Loan for US \$155 million, approved November 1996.
- The objectives of the loan include improving the provision of urban services, improving urban environmental management, and reducing local environmental impacts. Planned infrastructure projects include solid waste management.

Eastern Caribbean States

- Loan for US \$11.5 million, approved May 1995.
- The objectives of the loan include improving the coverage and effectiveness of domestic solid waste collection and disposal facilities; improving the collection, treatment, and disposal of ship-generated solid wastes; assisting the governments to establish appropriate legal and institutional frameworks to enable effective management and disposal of shore and ship-generated waste; and identifying regional opportunities for reduction, recovery, and recycling of solid waste.

Lebanon

- Loan for US \$55 million, approved June 1995.
- The loan funds a project to provide refuse collection facilities, waste disposal facilities, and a hospital waste collection and disposal system. The project also intends to strengthen the institutions responsible for solid waste management and encourage private sector participation and investment in the system.

Latvia

- Loan for US \$7.95 million, approved February 1998.
- The loan funds a project to demonstrate modern management of municipal solid waste, including remediating an existing landfill to meet environmental requirements for leachate treatment; meeting western sanitary landfill standards; improving the separation of recyclables; and collecting landfill gas and generating electricity.

Ho Chi Minh City, Vietnam

- Loan for US \$100 million.
- The loan funds environmental improvements including solid waste management.

In addition to these project-specific environmental efforts, the bank also tries to integrate environmental policies into its general lending and advisory work, including establishing requirements and guidelines for project environmental assessments, training bank and borrower staff about the bank's environmental safeguard policies, and monitoring compliance with these policies.

Contact information |

Hanan Dowidare
Communications Associate
1818 H Street, NW
Washington, D.C 20433
Tel: (202) 473-7199 or (202) 522-0003
dhanan@worldbank.org

In Morocco:
Hafida Sahraoui, Information Assistant
7, rue Larbi Ben Abdellah
Rabat-Souisi, Morocco
Tel: 212-7-63 60 49 or 212-7-63 60 51
hsahraoui@workdbank.org

In Tunisia:
Fatma Felah, Operations Analyst
1, Boulevard Bab Benat – 1035
Tunis, Tunisia
Tel: 216-1-436 475 or 216-1-436 475
ffelah@worldbank.org

African Development Bank

The African Development Bank (AfDB) is a regional multilateral development bank, engaged in promoting the economic development and social progress of its Regional Member Countries (RMCs) in Africa, including Algeria.

The Bank's principal functions are:

- 1) To make loans and equity investments for the economic and social advancement of the RMCs;
- 2) To provide technical assistance for the preparation and execution of development projects and programs;
- 3) To promote investment of public and private capital for development purposes; and
- 4) To respond to requests for assistance in coordinating development policies and plans of RMCs. In its operations, the Bank is also required to give special attention to national and multinational projects and programs that promote regional integration.

The Bank's operations cover the major sectors, with particular emphasis on agriculture, public utilities, transport, industry, the social sectors of health and education, and concerns cutting across sectors, such as poverty reduction, environmental management, gender mainstreaming, and population activities. Most Bank financing is designed to support specific projects. However, the Bank also provides program, sector, and policy-based loans to enhance national economic management. The Bank also finances non-publicly guaranteed private sector operations. The Bank actively pursues co-financing activities with bilateral and multilateral institutions.

Activity in Algeria

In 1998, there were two projects in Algeria funded through loans by the AfDB.

- Sidi Bel Abbes Potable Water Supply
- Gas Transport and Distribution

In 1999, the Algerian Agriculture and Rural Development Bank, or BADR, received a \$210 million loan to finance its second line of credit. The loan financed the activities of the agriculture, food, fisheries industry and services sectors and promoted private sector development.

Contact Information |

African Development Bank
Financial Technical Services Division
01 B.P. 1387, Abidjan 01
Cote d'Ivoire
Tel: (225) 20 20 48 49
Fax: (225) 20 20 49 01
ftry4@afbd.org

Islamic Development Bank

The Islamic Development Bank, IDB), is a multilateral financial institution with 52 member countries, one of which is Algeria. Its purpose is to foster the economic development and social progress of member countries and Muslim communities in non-member countries, in accordance with Shariah (Islamic legal principles). Following are some examples of public sector financing options.

Loans

Loans provide long-term financing for the implementation of development projects, mainly in agriculture (land development, irrigation networks, small holders development, rural water supply, etc.) and infrastructure (road transport, social facilities such as schools, hospitals, etc.).

- Currently loans are limited to a maximum of 7 million Islamic Dinars per project. They are given interest-free and bear a service fee to cover related administrative expenses incurred by IDB while formulating and processing the project. Repayment is made in equal semi-annual installments and extends over a period varying between 15 to 25 years, with a grace period of 3 to 7 years, depending on the beneficiary member country and the type of project. Loan financing with very soft conditions is also provided under a Special Account for the Least Developed Member Countries.
- IDB financing usually covers (fully or partially) the foreign cost of specific components. In certain cases, particularly for least-developed countries, it may also cover part of the local cost.
- The beneficiary is expected to contribute in the project financing. Co-financing with other institutions is also possible under certain conditions (usually parallel financing or, if procedures are similar to those of IDB joint financing).
- Loans are normally extended to governments or public institutions having the government guarantee. The private sector may also benefit from loans in special cases.
- While loans are mainly given to least developed member countries, these may also be extended to other member countries, particularly in combination with other modes of financing (leasing, installment sale or *Istisna'a*) whenever possible.

Installment Sale

An Installment Sale is another method of financing available to government agencies or private entrepreneurs. This mode of financing calls for a contract between the IDB and the Beneficiary for whom the Bank procures tangible asset(s) and sells it at a mark-up allowing the Beneficiary to make the payment on a deferred basis. If it is a project sponsored by the government or its agencies, guarantee by the government is sufficient. In case it is a private sector project, it is necessary to provide a guarantee from a first class commercial bank acceptable to IDB.

Equity Mode

By way of Equity Mode of Financing, the IDB seeks to diversify its equity investments into different productive sectors of the economy. The equity mode of financing can be used to finance all types of companies/ enterprises both in public and private sectors. Such funds from

IDB are available to finance new proposals as well as expansion and modernization of ongoing concerns.

Contact Information |

Cooperation Office
P.O. Box 5925 – Jeddah
21432 – Kingdom of Saudi Arabia
Tel: (+9662) 6466636 - Fax: (+9662) 6466682

Islamic Banks' Portfolio IDB Headquarters
Qasr Khuzam, King Khalid Street
P.O. Box 5925 Jeddah
21432 Kingdom of Saudi Arabia
Tel: + 966 2 636-1400 (IDB Switchboard)
Fax: + 966 2 644-8087
ibp@isdb.org.sa
www.isdb.org/english_docs/idb_home/

13.1.2 | Internal Public Financing

There are city-level and province-level funds potentially available for the City. They include the “Plan Communal de Developpement” (city), and “Plan Sectorial de Developpement” (province/wilaya).

The City may also be able to locate financing through any number of internal government lending programs of the Algerian ministries responsible for agriculture, interior, environment or finance. Other government agencies may also loan money to municipalities or have a Municipal Development Fund that can lend to a waste management program. Municipal infrastructure projects, in some countries, can be financed through a type of central government revenue transfer. These generally go to municipalities for general services to secure loans.

13.2 | Private Financing Options

Jijel may choose a private developer to implement these solid waste projects. Private developers can pursue loans from the private arms of multilateral lending entities, use corporate financing, or obtain loan packages from private commercial banks. We have identified several options below.

13.2.1 | External Private Sector Financing

International Finance Corporation

The International Finance Corporation (IFC), the private sector arm of the World Bank, encourages private sector activity in developing countries. One of its primary activities is to provide loans to and make equity investments in private sector projects in World Bank countries. The IFC charges market rates for its products and does not require government guarantees for its financing.

To be eligible for IFC financing, projects must be profitable for investors, benefit the economy of the host country, and comply with stringent environmental guidelines. Although it is primarily a financier of private sector projects, the IFC may provide financing for a company partially owned by a government entity provided if there is private sector participation and if the venture is run on a commercial basis. The IFC also provides financing to companies that are entirely locally owned, as well as to joint ventures between foreign and local shareholders.

To ensure the participation of additional investors and lenders in the private sector, the IFC limits the total amount of debt and equity financing it provides to 25 percent of the total estimated project costs. IFC investments typically range from US\$1 million to US \$100 million. The IFC can assist in procuring the remaining funds from other debt and equity sources.

The Environmental Projects Unit of the IFC accelerates market acceptance of technologies, products, and operating practices that benefit the environment. One of the unit's main objectives is to identify and develop innovative, private-sector projects that offer environmental benefits, as do solid waste management projects. The Environmental Projects Unit's past efforts have included feasibility studies of a ship waste facility for St. Petersburg, Russia, solid waste disposal options for Durban, South Africa, and solid waste processing centers for the Greater Moscow area.

Contact Information |

Mr. Sami Haddad, Director
Middle East & North Africa Department
International Finance Corporation
2121 Pennsylvania Avenue, N.W.
Washington, D.C. 20433
USA
Tel: (202) 473-6864
Fax: (202) 974-4396

African Development Bank Private Sector Assistance

In response to growing emphasis on private enterprise in Regional Member Countries (RMCs), the African Development Bank offers assistance to the private sector to promote efficient use of resources and to help accelerate economic development. Specifically, the Bank's role is to catalyze the flow of domestic and external resources to private enterprises and help them undertake environmentally, technically, financially, and economically viable projects.

Assistance to Private Enterprise

Bank assistance is provided directly to private enterprises and financial institutions through term loans, equity participations, quasi-equity investments, guarantees, underwriting and advisory services. The Bank also extends lines of credit to financial institutions for on-lending to small and medium enterprises (SMEs). The nature, terms, and conditions of the Bank's investment in a particular venture depend on the risks and expected returns of the venture, as well as the characteristics of the corporate entity receiving the investment.

In addition, the Bank provides advisory services to RMCs on ways to improve the environment for private enterprise and develop capital markets.

Type of Projects

Bank assistance may be considered for projects to establish, expand, diversify, and modernize productive facilities in various sectors including energy, manufacturing, transportation, infrastructure, extractive industries, banking and finance, tourism, and other service industries, as long as the investment is beneficial to the economy of the host country. The Bank does not participate in real estate development projects or provide direct trade or housing finance to enterprises, but may invest in domestic or regional financial and capital market institutions that support such activities; or alternatively, extend an agency credit line for such purpose. In selecting projects, the Bank gives consideration primarily to financially viable proposals, which hold good prospects for earning a profit adequate to provide a good return on invested capital, and which contribute to one or more of the following:

- 1) Generation of foreign exchange earnings and savings;
- 2) Creation of employment, improvements in the skills of both labor and management, and for the enhancement of productivity of capital and labor;
- 3) Transfer of technology and acquisition of appropriate scientific equipment;
- 4) Forward and backward linkage effects.

Export oriented enterprises that have access to local raw materials are given preference.

For the Bank to be involved in a project, it needs to be satisfied that the project is consistent with the country's economic development objectives and possesses sufficient comparative advantage to have a very good chance of success. The Bank will satisfy itself that the project concept, technology, sponsorship, and management are sound, that a market exists for the products or services, that the project cost is reasonable, and that the financing plan is adequate. In making investment decisions, the Bank takes into account the economic circumstances in the country concerned and the policies of the government as they affect private enterprises.

Projects in which the Bank invests are required to comply with the Bank's Group Environment Assessment Guidelines and the prevailing environmental regulations of the country.

Scope of Bank Assistance

The Bank aims to play a catalytic role to encourage private enterprise in Africa and does not wish to compete with private sources of finance. Its role is to stimulate and support initiatives by entrepreneurs, investors and bankers and to provide direct financial support for worthy projects. In line with this option, the total amount of Bank assistance to any enterprise, including loans, equity investment, guarantees and underwriting commitment will not normally exceed 33 1/3 percent of the total cost of the project. The Bank's total investment in any project should not normally exceed USD 15,000,000. However, this limit may be exceeded on a case-by-case basis to allow the Bank to play a meaningful role in large projects.

The Bank's equity investment will not normally exceed 25 percent of the share capital of the enterprise and will not be lower than US \$150,000.

Contact Information |

African Development Bank
01 B.P. 1387, Abidjan 01
Cote d'Ivoire
Tel: (225) 20 20 41 68
Telefax: (225) 20 20 49 68
Telex: 23717 or 23498

Islamic Development Bank

The Islamic Development Bank (IDB) is a multilateral financial institution with 52 member countries. Its purpose is to foster the economic development and social progress of member

countries and Muslim communities in non-member countries, in accordance with Shariah (Islamic legal principles). Algeria is a member country.

The Bank's private-sector opportunities focus primarily on assistance to:

- 1) Financial intermediaries involved in leasing, Islamic banking, mutual funds, and insurance;
- 2) Infrastructure projects such as power, water supply, transport, and telecommunications
- 3) Industrial, agro-business, and other projects that have significant economic merit.

IDB support is provided directly to private enterprises and financial institutions through installment sale, leasing, lines of installment sale and leasing, investment in equity securities, co-financing in trade finance, and export credit and investment guarantees.

To be eligible for assistance from the IDB, an enterprise should be in the private sector of a member country. An enterprise owned jointly by private interests and public enterprise may also be eligible for assistance, provided it satisfies the criteria of operational autonomy and managerial freedom, and is run on a commercial basis.

Another eligibility criterion for a project to receive the Bank's assistance is for the project to improve the operating environment for the development of the private sector. Thus, projects that will develop capital markets or provide basic infrastructure services such as power, roads, ports, or water, are of prime interest to the Bank.

Furthermore, the project itself must be compatible with the IDB's objectives and the rationale of the Medium-Term Strategic Agenda (MTSA), and must be economically justified. In this respect, although the economic internal rate of return is an important indicator, it will be weighed alongside other factors like the indirect economic effects and the social and environmental impacts. The project must be technically, institutionally, and managerially feasible. Its assumptions and objectives must be realistic and should not be exposed to excessive physical, political, or financial risks. In particular, the proposed management must have the experience and expertise to implement the project successfully. The project must also be able to generate sufficient cash flow to service its financial liabilities and to provide a reasonable rate of return to shareholders.

Contact Information |

Cooperation Office
P.O. Box 5925 - Jeddah
21432 - Kingdom of Saudi Arabia
Tel: (+9662) 6466636 - Fax: (+9662) 6466682

Islamic Banks' Portfolio IDB Headquarters
Qasr Khuzam, King Khalid Street
P.O. Box 5925 Jeddah
21432 Kingdom of Saudi Arabia
Tel: + 966 2 636-1400 (IDB Switchboard)
Fax: + 966 2 644-8087
ibp@isdb.org.sa
www.isdb.org/english_docs/idb_home/

U.S. Department of Commerce, Commercial Service

The mission of the Commercial Service places primary emphasis on the promotion of exports of goods and services from the United States, particularly by small businesses and medium-sized businesses, and on the protection of United States business interests abroad.

List of banks with U.S. Correspondent Arrangements

According to the information listed on the U.S. Commercial Service website of the U.S. Department of Commerce, at www.usatrade.gov, each of the state-owned Algerian banks maintains correspondent banking relationships with several U.S. banks. The following banks may be useful in providing financing services:

Banque Extérieure d'Algérie Banque Nationale d'Algérie
Bank of New York American Express Bank
BankAmerica International Bank of America
Bankers Trust Bank of New York
Chase Manhattan Bank Bankers Trust
Chemical Bank Chase Manhattan Bank
Citibank Citibank
First Chicago CoBank Denver
First Interstate Bank
Crédit Populaire d'Algérie of California
Citibank Mellon Bank
Arab American Bank Pittsburgh national Bank
Chemical Bank United Bank for Africa
Mellon Bank
Banque de l'Agriculture Banque de Développement Local
et du Développement Rural Citibank
Bank of America NY Crédit Lyonnais NY
CoBank Denver Rabo Bank
Citibank United Bank for Africa

Bankers Trust
First Chicago
Rabo bank

Contact Information |

The U.S. Department of Commerce also has a Commercial Liaison to the World Bank and the African Development Bank to assist in coordination with multilateral funding.

Karen Zens Director
Commercial Liaison Office
Commercial Liaison to the World Bank
Office of the US Executive Director
1818 H Street, NW
Washington, D.C. 20433
Tel: (202) 458-0120/0118
Fax: (202) 477-2967
karen.zens@mail.doc.gov

Mr. Tapan Banerjee
Director, Commercial Liaison Office
Commercial Liaison to the AfDB
USA Trade Center
Mail Stop: R-MDBO
U.S. Department of Commerce
Washington, D.C. 20230
Tel: (202) 482-3399
Fax: (202) 482-3914
tapan.banerjee@mail.doc.gov

13.2.2 | Internal Private Sector Financing

Corporate Financial Resources

Private companies can rely in whole or in part on their own financial resources – equity contributions through private investment and public stock offerings or company funds generated from past and on-going operations – to pay for project costs. Companies typically supplement their equity with corporate lines of credit or other borrowing mechanisms that allow them to obtain loan packages from domestic or foreign commercial banks with terms and conditions that make large project financing feasible.

A line of credit is a revolving loan that companies use to borrow money, using company assets as collateral. The amount of money available through a line of credit is based on the company's collateral and cash flow needs. Corporate borrowings are used to leverage the company's equity contribution on a 4:1 or 5:1 debt to equity ratio. Companies pay interest on the outstanding monthly balance. Principal that is repaid is again available to the company for future loans. Interest rates equal or exceed the prime rate and are based primarily on the company's financial strength.

13.3 | Loan Guarantees and Investment Insurance

Many countries have government agencies that guarantee loans to buy or produce goods or services for export, guarantee loans provided by financial institutions in the same country, or insure overseas investments for investors from their countries. Loan guarantees are provided to lenders and reduce their lending risks. Investment insurance is provided directly to the investors. These services facilitate the successful financing of projects such as the proposed recommendations to Jijel's solid waste management system. Included below are descriptions of two agencies active in the United States and a multilateral agency unaffiliated with any single country.

13.3.1 | Export-Import Bank

The Export-Import Bank (Ex-Im Bank) is the official export credit agency of the U.S. government. It encourages transactions that the private sector is unable to support, with the goal of increasing exports of goods and services from the United States.

Among other financial services, the Ex-Im Bank provides working capital guarantees to cover 90 percent of the principal and interest on commercial loans made to creditworthy small and medium-sized U.S. companies to buy or produce goods or services for export. The Ex-Im Bank processes direct applications for guarantees of working capital loans over US \$833,333. Smaller applications can be processed by the U.S. Small Business Administration or by lenders who have delegated authority status from Ex-Im Bank.

The Ex-Im Bank also provides guarantees for commercial loans to foreign buyers of U.S. goods or services. This guarantee covers up to 100 percent of the repayment risks due on the buyer's debt obligations. In the event of default due to political and commercial reasons, the Ex-Im Bank will repay the principal and interest on the loan. Political risks are defined as events beyond the control of the buyer, usually caused by government action, and include political violence, government expropriation, cancellation of export or import licenses, and inability to purchase U.S. dollars in a legal market. Commercial risks are defined as a buyer's inability to pay when an obligation is due because of a financial difficulty.

The Ex-Im Bank targets banks and other lenders. Special enhancements are available for environmental goods and services. The Bank also offers fixed-rate loans directly to foreign buyers of U.S. goods and services.

Contact Information |

Export-Import Bank of the United States
Washington, D.C. Office
811 Vermont Avenue, N.W.
Washington, D.C. 20571
Tel: (800) 565-3946
Fax: (202) 565-3380
www.exim.gov

Specific information regarding Ex-Im programs in Algeria can be obtained by calling 202-566-8945.

13.3.2 | Overseas Private Investment Corporation

The Overseas Private Investment Corporation (OPIC) protects investors against political risks overseas by providing insurance for U.S. investments in new ventures, expansions, or privatizations of existing enterprises in 140 countries, including Algeria. Covered risks include currency inconvertibility, expropriation, and political violence. OPIC's goal is to increase U.S. investment in foreign projects and enterprises.

OPIC's financial services include insurance coverage for investments, including parent company and third party loans and loan guarantees. Typically, loan guarantees are provided for large projects and are available to U.S. banks and other institutional investors to facilitate their participation in foreign projects. The loans must be for private sector borrowers in the foreign country. Insurance coverage is provided for equity investments, consigned inventory or equipment, cross-border leases, and other investments.

OPIC requires significant U.S. participation in its projects. Insurance is available to citizens of the United States; corporations, partnerships, or other associations created under the laws of the United States or U.S. territories and owned by U.S. citizens; foreign corporations at least 95 percent owned by investors eligible under the above criteria; and foreign entities that are 100 percent U.S.-owned. Enterprises that are majority-owned or controlled by a foreign government are not eligible for OPIC support.

OPIC also provides direct loans to small U.S. businesses (defined as companies with annual revenues of less than US \$250 million or individuals and non-corporate entities with net worth less than US \$67 million) and cooperatives. It provides project financing based on repayment

from project revenues for projects in countries where commercial financial entities are not able or willing to lend on this basis.

Contact Information |

Diane M. Ferrier
Insurance Information Assistant
Overseas Private Investment Corporation
1100 New York Avenue, N.W.
Washington, D.C. 20527
Tel: (202) 336-8596
Fax: (202) 408-5142
info@opic.gov

Rod Morris, Vice President
Insurance Department
Overseas Private Investment Corporation
1100 New York Avenue, N.W.
Washington, D.C. 20527
Tel: (202) 336-8582

13.3.3 | Multilateral Investment Guarantee Agency of the World Bank

The Multilateral Investment Guarantee Agency (MIGA) works to encourage investment in its developing member countries. MIGA offers long-term political risk insurance to eligible investors from member countries for qualified investments in developing member countries.

MIGA's insurance covers political risks, including transfer restriction, expropriation, breach of contract, and war and civil disturbance. Investments eligible for insurance include new investments; new contributions associated with the expansion, modernization, or financial restructuring of existing projects; and acquisitions that involve privatization of state-owned enterprises. In each risk category, MIGA may insure equity investments for up to 90 percent of the investment contribution, plus an additional 450 percent of the investment contribution to cover earnings attributable to the investment. For loans and loan guaranties, MIGA may insure up to 90 percent of the principal plus an additional 135 percent of the principal to cover interest that will accrue over the term of the loan. Investment projects must be financially and economically viable, environmentally sound, and consistent with the labor standards and other development objectives of the host country. MIGA's program may be used to

supplement national loan guarantee or investment insurance programs, allowing investors to obtain more comprehensive investment insurance coverage.

Eligible investors must be citizens of a MIGA member country other than the country in which the investment is to be made. Under certain conditions, investments made by citizens of the host country are eligible. A corporation is eligible for this program if it is either incorporated and has its principal place of business in a member country or if it is majority-owned by citizens of member countries. A corporation wholly or partially state-owned is eligible if it operates on a commercial basis.

Contact Information |

MIGA contact for investment insurance:

Roger Pruneau
Vice President
MIGA
1818 H Street, N.W.
Washington, D.C. 20433
Tel: (202) 473-6168
rpruneau@worldbank.org

MIGA Regional contact:
Investment Marketing Services
Promote Africa *Field Function*
Ken Kwaku
Program Manager
Tel: (202) 473-6142 *USA*
Tel: 011-264-61-2062224 *Namibia*
Kkwaku@worldbank.org

13.4 | Recommendation

We understand that the City is interested in continuing public ownership and operations of its solid waste infrastructure. In this case, the City should seek financing from the World Bank and the African Development Bank. The City should also look at the funding available from

in-country sources. Another option for the City is to seek financing from the various equipment vendors and suppliers of services and materials, with appropriate export bank guarantees.

If the City desires to transfer the responsibility for system improvements to the private sector and forego the lengthy process and requirements involved in obtaining multilateral bank funding, we recommend that the City require private contractors to finance the proposed solid waste system.

The City could structure the project cost recovery method and solid waste management system so the arrangement is attractive to the private sector. Contractors and their financing agents will make their own assessment about whether the potential profits outweigh the financing risks. A well-structured project will attract interest and investment from the private sector.

The competitive process for award of privatization contracts should allow flexibility for prospective proposers to develop their own individual packages of equity debt and loan guarantees necessary to finance the required equipment and facilities. This will allow each competing company to provide the lowest cost financing package possible.

Section 14 | Project Implementation Strategy

This section presents a strategic plan for implementation of the recommended solid waste system improvements. The implementation plan includes details regarding: 1) strategy, 2) responsible entities or agencies, 3) timeframe/schedule, 4) estimated budget, and 5) required outside resources. The implementation plan is presented by each recommended improvement and overall considerations.

An initial step to implementation of this plan is to appoint one person from a City department or agency to be responsible for carrying out the plan. This responsible entity should have direct contact with key City leaders and a basic knowledge of solid waste management. The responsible entity should be trained in the United States or in another country that employs state-of-the-art solid waste management systems to learn about solid waste management through visiting facilities or taking classes. This person would be in charge of carrying out the plans listed below. The cost of travel and training is estimated at approximately 2,700,000 dinars (US \$30,000) and should take one to three months.

Another recommendation is to implement a public education program. Without public education, many of the programs discussed below could fail. The estimated first year cost of this program is 3,600,000 dinars (US \$40,000) with an estimated 900,000 dinars (US \$10,000) needed on an annual basis after the initial year. This should take about two to three months to start the program.

Most projects discussed will require some form of financing, as discussed in Section 13. Once a project is defined and bids are received from the various contractors, financing agencies will need to be contacted by the City. We have assumed some consultant time in each project for assisting the City.

14.1 | Collection Equipment

Implementation of this project will take three steps: 1) procuring and evaluating bids from qualified equipment vendors, 2) negotiating contractual terms, and 3) modifying current collection system to incorporate new equipment.

Procuring and Evaluating Bids

The first step in implementation is to prepare a request for bid document to gather bids from various qualified equipment vendors. This document should include requests for cost information, equipment details and specifications, warranties, delivery terms, parts availability, required fuel and maintenance, and references from vehicle and container vendors. The request for bid document should be sent to the list of vendors included in Section 10 of this report. Once the City receives bids, they need to be evaluated and ranked. Higher-ranking bids will be those that come closest to meeting or exceeding the City's requirements. One highest-ranking bid for collection vehicles and one for containers will be selected by the City (two total). If one company bids on both vehicles and containers, it is possible that that only one bid will need to be selected. This activity should take approximately 10 to 12 weeks and should cost the City some internal staff time and consultant assistance.

Contract Negotiations

Next, the City will need to negotiate a contract with the selected equipment vendor(s). The contract will include cost, warranty, equipment specifications, delivery terms, maintenance and spare parts agreements, and a payment plan. This activity should take approximately six to eight weeks.

Modify Existing Collection System

As described in Sections 5 and 7 of this report, the City's existing waste collection system will need to be modified to take advantage of the efficiencies created by the new equipment. Even before the equipment is delivered, several plans should be initiated. A plan for revised collection routes and delivery and installation of the new bins and boxes needs to be developed. Once the equipment is delivered, the responsible entity discussed above will need to train the solid waste management staff in the proper operation of the new equipment. This activity should take approximately 10 to 12 weeks (this can be conducted while other activities above are underway – minimal additional schedule time) and cost the City internal staff time and consultant assistance.

In summary, the following steps, in appropriate order, should be taken for project implementation:

- Prepare request for bid document and issue to list of equipment vendors provided within this report.
- Review and select most appropriate vendor(s) for contract negotiation.
- Negotiate contract and procure financing.
- Revise collection zone plan to integrate new equipment.
- Operations training and start-up.

This project should take approximately 18 to 24 weeks to implement with an initial cost of approximately 95,960,000 dinars (US \$1,100,000). Annual savings are estimated to be approximately 2,360,000 dinars (US \$26,000).

14.2 | Mezraitine Dump Site Closure

Closure of the Mezraitine dump site should occur in several phases; 1) developing a closure plan that includes the identification of the limits of wastes, a waste consolidation, plan and a final cover soil placement plan, 2) developing and implementing an operations and facilities transition plan, 3) implementing the actual dump site closure activities, and 4) long-term maintenance of the dump site after closure (post-closure).

Closure Plan

As described in Section 5 of this report, the first step in dump site closure should be to retain a consultant to prepare a closure plan for the Mezraitine dump site. The plan should include identification of the waste limits, waste consolidation, and cover placement. We estimate that this should cost approximately 4,500,000 dinars (US \$50,000).

Transition Plan

The City should internally develop a facilities transition plan as described in Section 5 of this report. The City will need to coordinate the scheduling of the closure of Mezraitine dump site with opening of the new sanitary landfill.

Closure Activities

The closure plan should direct the City in appropriate closure activities. We recommend that the City adopt new operating protocols that consolidate and place cover on the waste while the dump site is still in operational mode, prior to opening the new site. A full-time skilled

equipment operator needs to be hired to consolidate and cover the fill. This person will require training in proper closure techniques. In addition, it is estimated that approximately 9,000,000 dinars (US \$100,000) will be required for contractor assistance, fencing, cover, etc.

Post-Closure Activities

Although the Mezraitine dump site will be closed to MSW loads, long-term restoration and rehabilitation of the site could be required for 15 to 20 years. The City's responsible entity should be in charge of monitoring the Mezraitine dump site after closure. In addition, a consultant will be needed to set up a proper maintenance and monitoring program. We estimate that this will cost approximately 2,700,000 dinars (US \$30,000).

In summary, the following steps, in appropriate order, should be taken for project implementation:

- Retain a consultant to prepare a closure plan.
- Prepare a facilities transition plan with assistance from a consultant to phase out the old site and phase in the new sanitary landfill.
- Hire a full-time skilled equipment operator to begin waste consolidation and cover operations at the site. Obtain training for this person.
- Hire a consultant to set up a maintenance and monitoring plan. Monitor the closed site over a 15 to 20 year period.

This project should take approximately one to two years to implement and cost the City initially about 16,200,000 dinars (US \$180,000). Annual operational costs will need to be increased by approximately 1,000,000 dinars (US \$11,000).

14.3 | Development of a New Sanitary Landfill and Vermicomposting Facilities

New Sanitary Landfill

The first step for the City in developing the landfill is to conduct a more in-depth environmental impact analysis. A consultant should be hired to evaluate the potential impacts and propose mitigations. The site's geological and hydrogeological conditions need careful examination. After it is determined that the site is appropriate for landfill operations, a consultant needs to be retained to develop a master plan and to design the site. It is estimated that this will cost approximately 13,500,000 dinars (US \$150,000) and take six to nine months. Next, a contractor needs to be hired to develop the initial cell. This would include excavating the initial landfill cell, stockpiling soil, and installing a liner. The initial cell should have four

to five years of capacity. The cost to develop this area is assumed to be about 27,000,000 dinars (US \$300,000) including environmental analysis, development plans, excavation, and liner.

Vermicomposting Operations

To initiate vermicomposting operations, two operators should be hired (one skilled and one unskilled). They should receive training from a consultant. This is estimated to cost approximately 3,600,000 dinars (US \$40,000). In addition, some equipment, a water tank, and watering system will need to be procured and installed at the portion of the landfill site designated for vermicomposting. Worms will need to be procured and loads of organic material segregated and stockpiled. This is estimated to cost approximately 12,600,000 dinars (US \$140,000). As the program is increased in size, waste separation programs will need to be instituted, costing additional monies.

In summary, the following steps, in appropriate order, should be taken for project implementation:

- Hire a consultant to conduct an in-depth environmental impact analysis of the proposed site, including geological and hydrogeological tests.
- Hire a consultant to develop a master plan and prepare the design.
- Hire a contractor to construct the initial landfill cell.
- Hire two operators to implement the vermicomposting operations.
- Hire a consultant to train the vermicompost operators.
- Procure and install the required equipment and water system for vermicomposting operations.
- Procure the required worms and begin directing organic waste to the specified site for composting.

This project should take approximately one to two years to implement and initially cost the City about 56,700,000 dinars (US \$630,000). Annual operational costs will need to be increased by approximately 2,080,000 dinars (US \$23,000).

14.4 | Slaughterhouse Waste Disposal

The first step for the City in redirecting the slaughterhouse waste is to meet with slaughterhouse representatives to discuss and prepare a plan for collection and disposal of the waste. Either the slaughterhouse will be required to haul their waste to the dump site or the City will need to collect slaughterhouse waste separately and charge the slaughterhouse

accordingly. The City may need to organize an alternative collection system for slaughterhouse waste using City collection vehicles or other designated collection vehicles. If separate collection by the City is required, the slaughterhouse should be required to pay for this service.

After the slaughterhouse waste is delivered to the dump site, special disposal methods should be employed. A distinct site for the burial of slaughterhouse waste will be selected at the City's new sanitary landfill. An isolated cell, or mono cell, will be built similarly to the other MSW landfill cells. However, this cell will be smaller in size and will not receive MSW loads. The description of landfill cell construction outlined in Section 5.3 of this report can be used for development of the slaughterhouse waste mono cell.

A consultant will need to be hired to prepare the cell design. A contractor will need to be retained to develop the cell. This project is estimated to cost approximately 3,200,000 dinars (US \$35,000) and take two to three months to complete.

14.5 | Medical Waste Incinerator (MWI) Improvements

Implementation of this project will take four steps: 1) emissions testing, 2) procuring and evaluating bids from qualified equipment vendors, 3) contractual negotiations, and 4) installation and start-up of the units. In addition, a separate cell will need to be developed at the landfill to receive the MW ash.

Emissions Testing

The first step in implementing the MWI improvements is to conduct a detailed emissions test for the two units. The results will provide a basis for determining the design and size of the required wet scrubber system. The estimated cost for the testing is 450,000 dinars (US \$5,000).

Procuring and Evaluating Bids

The next step is to prepare a request for bid document to gather bids from various qualified equipment vendors. This document should include the emissions test data, requests for cost information, equipment details and specifications, warranties, delivery and installation terms, parts availability, required maintenance, and references. The request for bid document should be sent to the list of vendors included in Section 10 of this report. Once the City receives bids, they need to be evaluated and ranked. Higher ranking bids will be those that come closest to meeting or exceeding the City's requirements. The City will select the highest ranking bid for the equipment. This activity should take approximately 10 to 12 weeks and cost the City some

internal staff time and consultant assistance. This is estimated to cost approximately 4,500,000 dinars (US \$50,000).

Contract Negotiations

Next, the City will need to negotiate a contract with the selected equipment vendor. The contract will include cost, warranty, equipment specifications, delivery and installation terms, maintenance and spare parts agreements, and a payment plan. This activity should take approximately six to eight weeks.

Installation and Start-up

Once the units are purchased, delivery and installation will need to be monitored. The vendor should be required to conduct a performance test to specific emissions levels prior to the City's acceptance. The vendor should also train staff in proper operation and maintenance of the units.

Ash Mono Cell

After the MWI ash is delivered to the dump site, special disposal methods should be employed. A distinct site for the burial of these wastes will be selected at the City's new sanitary landfill. An isolated cell, or mono cell, will be built similarly to the other MSW landfill cells. However, this cell will be smaller in size and will not receive MSW loads. The description of landfill cell construction outlined in Section 5.3 of this report can be used for development of the MW ash mono cell.

A consultant will need to be hired to prepare the cell design. A contractor will need to be retained to develop the cell. This project is estimated to cost approximately 3,200,000 dinars (US \$35,000) and take two to three months to complete.

In summary the following steps, in appropriate order, should be taken for project implementation:

- Conduct emissions test.
- Prepare request for bid document and issue to list of equipment vendors provided within this report.
- Review and select most appropriate vendor for contract negotiation.
- Negotiate contract.
- Monitor installation and start-up.
- Conduct performance test to City specifications.
- Develop mono cell for ash disposal.

This project should take approximately 18 to 24 weeks to implement with an initial cost of approximately 21,650,000 dinars (US \$240,000). Annual costs are estimated to be approximately 900,000 dinars (US \$10,000).

14.6 | Implementation Plan Summary

A summary of the implementation plan is included as Exhibit 14-1.

Exhibit 14-1 | Implementation Plan

Implementation Step	Responsible Agency	Outside Resources	Timeframe	Capital Cost (dinars)	Annual Cost (dinars)
Collection Equipment			18 - 24 weeks	95,960,000 DA	Save 2,360,000 DA
Prepare Bid Document	City	Consultant	4 - 6 weeks	4,500,000 DA	None
Select Vendor	City	Consultant	4 - 6 weeks	Included Above	None
Negotiate Contract	City	Consultant	6 - 8 weeks	Included Above	None
Procure Financing	City	Finance Agency	6 - 8 weeks	Included Above	None
Revise Collection Zones	City	Consultant	10 - 12 weeks	Included Above	None
Operations Training	City	Consultant	2 - 4 weeks	Included Above	None
Mezraitine Closure			1 - 2 years	16,200,000 DA	1,000,000 DA
Develop Closure Plan	City	Consultant	6 - 8 weeks	4,500,000 DA	None
Develop Transition Plan	City	City & Consultant	6 - 8 weeks	Included Above	None
Hire/Train Equip Operator	City	City & Consultant	2 - 4 weeks	Included Above	Included Above
Close Site/Operations	City	Consultant & Contractor	1 - 2 years	9,000,000 DA	Additional 1,000,000 DA
Monitor Closed Site	City	City & Consultant	15 - 20 years	2,700,000 DA	Variable

Implementation Step	Responsible Agency	Outside Resources	Timeframe	Capital Cost (dinars)	Annual Cost (dinars)
New Sanitary Landfill			1 - 2 years	27,000,000 DA	1,000,000 DA
Environmental Analysis	City	Consultant	3 - 6 months	Included Above	Staff Time
Master Plan & Design	City	Consultant	3 - 6 months	Included Above	Staff Time
Develop Site	City	Contractor	6 -12 months	Included Above	Staff Time
Vermicomposting			2 - 3 months	16,200,000 DA	1,080,000 DA
Hire & Train Two Operators	City	City & Consultant	2 - 4 weeks	3,600,000 DA	450,000 DA
Procure & Install Equipment	City	Vendor	2 - 3 months	12,600,000 DA	None
Procure Worms/Begin Operations	City	Consultant	2 - 3 months	Included Above	630,000 DA
Slaughterhouse Waste			2 - 3 months	3,200,000 DA	Staff Time
Collection Plan	City	Slaughter House	4 - 6 weeks	Staff Time	Staff Time
Mono Cell Development	City	Consultant & Contractor	2 - 3 months	3,200,000 DA	Staff Time
Medical Waste Incinerators			18 - 24 weeks	21,650,000 DA	900,000 DA
Conduct Emissions Test	City	Consultant	4 - 6 weeks	450,000 DA	None
Prepare Bid Document	City	Consultant	4 - 6 weeks	4,500,000 DA	None
Select Vendor	City	Consultant	4 - 6 weeks	Included Above	None
Negotiate Contract	City	Consultant	6 - 8 weeks	Included Above	None
Procure Financing	City	Finance Agency	6 - 8 weeks	Staff Time	None
Installation & Start-Up	City	Vendor	8 - 16 weeks	Staff Time	None

Implementation Step	Responsible Agency	Outside Resources	Timeframe	Capital Cost (dinars)	Annual Cost (dinars)
Appoint & Train Staff Person	City	Consultant	1 –3 months	2,700,000 DA	None
Public Education	City	Consultant	2 –3 months	3,600,000 DA	900,000 DA

**Appendix A | Legislative Articles Relating To
Algerian Environmental Laws**

Appendix A

Articles

Article 1:

In application of arrangements of the first chapter of the third title of the law number 83-03 of the 05/02/1983, the present decree has for subject to regulate the atmospheric broadcasts of smokes, gases, dusts, odors and strong particles emanating from stationary facilities and likely to disturb the population, to compromise health or the public security, to harm to plants and the agricultural production as well as the conservation of constructions, of monuments and historic and natural sites.

Article 2:

In application of arrangements of the first chapter of the decree number 84/378 dated on 15/12/1984 fixing conditions of cleaning, abduction and the urban solid waste treatment, the article 2 expresses what follows:

The urban solid waste get along to terms of the present decree of the domestic waste and those which are assimilated to them by the nature and the volume.

Article 3:

The chapter 3 of the decree N° 84/378 dated on 15/12/1984 fixing conditions of urban solid waste treatment. In spite of the number of inhabitants, the local popular assembly (APC) assures or makes assure the urban solid waste treatment.

The treatment is done by means of the following processes:

- The controlled landfill (compacted, ground... etc.)
- The dating
- Incinerations.

The choice of the fashion of waste treatment must search for the process the more indicated to the plan of the hygiene preservation, of the easiness of exploitation and the recuperation of waste.

In spite of the or fashions of urban residue treatment the APC creates a place of landfill for waste coming from its territory. It takes all measures to the effect to proscribe the wild landfills on its territory.

Article 4:

Is submitted to an authorization of the Governor of JIJEL besides the general and particular arrangements concerning protection of the environment planned by laws and regulations in vigor all choice of the site for the treatment of waste.

The demand of realization of a controlled landfill or a unit of solid urban and industrial waste treatment is accompanied of study of impact and feasibility as well as all useful information relating to forecasting of exploitation on a period of fifteen (15) years.

Article 5:

Whatever is the type of treatment kept by APC, the chosen site should satisfy to the following conditions:

- a) to Be the nearest of the center of the collection sector in order to reduce loads of transportation, but however, enough far from the nearest habitations;
- b) The minimal distance to respect between the site of treatment and the nearest habitations must be inevitably superior to 200 meters;
- c) The distance of remoteness of the treatment place in relation to the plane water is fixed by survey hydrogéologique;
- d) to Take account as well of the project of extension and planning of the agglomeration as they are defined in documents of the leading plan of urbanism or if the case arises, of the temporary plan of urbanism, that of the necessity to reduce to the minimum and in all place nuisances that can generate wastes;
- e) to Take account of the imperative and possibilities of recuperation and recyclable waste treatment;

f) Process to an investigation hydrogéologique to insure that the waters of ruissellement or infiltration won't be able to join an underground tablecloth;

g) to Proscribe the underground career use, well, gulfs as a landfill of waste and urban residues;

h) to Proscribe the landfill of waste and urban residues in points of water of all nature

Article 6:

In any case where it is established, the existence of a watertable under the site planned for the site of a site of urban solid waste treatment, the authorization foreseen to the article 25 specifies precautions which should be taken for an absolute protection of the watertable. These, notably, concerns:

- The drainage of soil;
- The waterproofing of the landfill by a compaction of clay or marl of thickness being sufficient or by the realization of an insulated bottom by the setting up of a plastic movie.

In the two aforementioned cases, the sewage that flows out to the basis is treated before dismissal in the natural back-ground.

Article 7:

The site of treatment is distributed as follows:

- a) to Surround by a fence in resistant materials of a minimal height of two meters (2 ms);
- b) exits are closed by a portal or a gate and are supervised and kept during hours of opening and closed outside of these hours;
- c) some interior ways are distributed to assure an easy circulation by all times to vehicles called to circle ;
- d) All local constructed on the site are distributed in accordance with arrangements of the legislation of work and the public health which is in effect.

Besides, in the controlled landfills the planning foresees according to the admitted tonnage (01tonne = 1000 Kg) , the limitation of the landfill forehead is:

- 10 meters for the small landfills,
- 50 meters for the big landfills.

Article 8:

We understand by stationary installations, all industrial or agricultural exploitation established in a given place, notably factories, yards, careers, deposits or warehouses, establishments of sale or transformation and factories.

Article 9:

The stationary installations must be conceived, constructed, exploited used either so that their broadcasts in the atmosphere of gases, smokes, dusts, odors or solid particles don't pass to the source norms of concentration as fixed by the in effect regulation.

Article 10:

The stationary installations are submitted to the periodic withdrawals of samples and controls done by the inspector of environment.

To this title withdrawals of samples and methods of analyses of gases, dusts, odors and the solid particles are sudden in accordance with the in effect norms and techniques.

Article 11:

The procedure and delays bound to withdrawals and analyses of samples are defined by decree of the minister charged of the environment.

Article 12:

When the exploitation of an installation presents dangers, inconveniences or serious conditions for the security, the healthiness, the convenience of the neighborhood, for the public health, the City must, after report of the inspector of the environment, put the operator in home to take the necessary arrangements to make to stop and to disappear dangers and inconveniences noted.

Mistake by the operator or the administrator to conform himself, in the right delay, to this stake in home, the temporary abeyance of the working of all or a part of the installation can be pronounced, on proposition of the inspector of the environment, by decree of the city territorially competent and that, without other judicial pursuit prejudice in accordance with articles 55 and 56 of law Number 83-03 dated on 05/02/1983, relative to the protection of the environment previously aware.

Article 13:

When a threat judged serious for the health of the population owed to pollution of the atmosphere here over by the stationary facilities as definite to the article 2, is declared, the city territorially competent takes the set of the necessary and enforceable measures able to stop trouble.

Article 14:

To transient title, the minister charged of the protection of the stationary environment by decree delays to the exit of which, the existing stationary facilities at the date of publication of the present decree must conform himself to arrangements of the article 3 of the present decree.

Article 15:

According to the decree of application of the relative law to the nature conservation that exposes, in its article 5, the different phases that must presents a survey of impact:

The content of the impact survey must be in relation with the importance of works, amenities and work projected and with their foreseeable impacts on the environment.

The survey of impact must understand successively:

- 1) an analysis of the initial condition of the site and its structural environment, notably, on the natural wealth and the agricultural, forest, maritime, hydraulic spaces or of leisure, affected by works, amenities or works.
- 2) an analysis of effects on the environment and in particular on sites and landscapes, fauna and flora, natural back-ground and biologic balances, on the convenience of the neighborhood (noises, vibrations, odors, smokes) or on hygiene and the public healthiness.
- 3) reasons for which the presented project has been kept;
- 4) measures considered by the master of the work or the petitioner to suppress, to reduce and to compensate the prejudicial consequences of the project on the environment, as well as the corresponding expense evaluation.

**Appendix B | Waste Characterization Study
Protocol**

Appendix B

WASTE CHARACTERIZATION STUDY PROTOCOL

A waste characterization study was conducted over a three day period (March 28th, 29th and 30th, 2000) to determine the waste composition of the residential and commercial components from the City's ten waste collection zones. The study protocol consisted of three phases: initial planning, field work, and data analysis. The procedures have been documented with sufficient detail so that a person familiar with waste characterization methods could replicate this study.

Phase I: Initial Planning

The initial planning phase included data review, preparation of a sampling plan, and organization of the equipment and personnel necessary for the field analysis.

Data Review. NEE provided a description of the general types and quantities of waste received at the Mezraitine Landfill in Jijel. The bulk of the waste is delivered by city waste collectors who serve residential and commercial customers. Waste is also direct-hauled by industrial generators and public self-haul, although these were not sampled as part of this waste characterization study. The information was used to prepare a sampling plan and schedule for the field analysis portion of the study.

Sampling Plan. BVA and NEE discussed the methods in which the City waste haulers collect waste from residential and commercial customers and the ability to sample waste from various types of generators. To conduct a data analysis that is statistically valid, a minimum of 15 waste samples per generator type were required from the waste stream. Based on an understanding of the collection methods and truck routing procedures, BVA and NEE agreed that the residential and commercial waste could not be distinguished, and therefore approximately 30 mixed loads were planned to be studied in the waste characterization analysis. BVA and NEE developed a plan to obtain the waste samples as they came into the Landfill and to categorize each sample by one of the City's ten zones.

BVA discussed operational practices and procedures with key Landfill operating staff. Based on the Landfill operating practices, we developed a strategy for the field work which included procedures for gathering waste samples at the Landfill, transporting waste samples to and from the Landfill and sorting site, and sorting the waste.

The sampling plan included a list of the various categories that waste materials were to be sorted into. Seven major material categories were identified and subcategories within each major material category were included. In total, 24 material categories were identified for the sorting work. The material categories are listed in the following table.

Material Categories in the Waste Composition Study

Paper Cardboard, uncoated, corrugated Newspaper Office paper Remainder/composite paper	Other Organics Food Landscape and agricultural Bone
Glass Beverage Remainder/composite glass	Other Construction and demolition
Metal Tin/steel Aluminum/other metal Remainder/composite metal	Special Waste Tires Mixed residue Hazardous waste (medical and household)
Plastic Plastic containers Film plastic Durable plastic	

Equipment and Field Crew Preparation. In preparation for field work, BVA assembled a field crew and equipment, presented a Health and Safety Plan to the field crew, and discussed the purpose of the study and plans for field analysis. In addition, we identified a suitable location for sorting the waste samples. The sorting was conducted on-site at the Mezraitine Landfill. NEE assisted with the acquisition of field personnel, acquisition of equipment, and identification of a sorting location. NEE staff participated in the actual sorting as well.

Phase 2: Field Work

Field work was conducted the 28th through the 30th of March, 2000. The field work included collecting and sorting 27 waste samples (approximately 100 kg each) and assembling a representative sample for moisture content analysis at the laboratory.

Equipment Setup. In preparation for the field analyses, BVA gathered, constructed and assembled the required equipment and tools. Small containers and several canvas sacks were obtained on-site and used for the waste material sorting and gathering. Equipment and tools provided by the City of Jijel were delivered to the waste sorting site and setup on March 28, 2000. The equipment included the following:

- A platform scale (with 300-Kilogram capacity and a weighing accuracy to the nearest 0.25 Kilogram) for weighing waste samples and sorted materials
- Worktables for sorting waste
- Protective clothing and equipment for field personnel
- Data collection sheets for recording sample weights and weights of sorted materials
- Multiple 32-gallon plastic wastebags to collect waste samples and transport the samples to and from the sorting site (including salvaged canvas bags)
- Numerous 3 to 5 gallon basins to segregate materials (collected at landfill)
- Other miscellaneous items.

All bins and basins were weighed prior to the initiation of the field work to record the empty weight (tare weight) of each container.

The field crew consisted of BVA/NEE representatives to manage the waste characterization analysis and 8 sorters (including the on-site Landfill Manager) to collect waste samples and sort the waste into various categories. On March 28, 2000, the BVA representative trained the NEE/field crew. NEE provided a supervisor and a data recorder. The crew was trained during the first field sorting day, learning the procedures for sorting samples, categorizing materials, and recording weight data.

Waste Sampling and Sorting Procedures. Waste samples were obtained by the crew at the Mezraitine Landfill. The Landfill Manager and gate house personnel assisted the sampling crew by identifying the trucks listed on the sampling plan and designating separate areas for each truck to unload the waste. The waste piles were identified by wooden signs, representing the geographical origin of the each load. Waste samples were obtained after the truck unloaded its waste. A waste sample consisted of approximately 100 Kilograms of waste materials extracted from the selected load. The sample was loaded in 32-gallon plastic wastebags and moved to the sorting area. At the sorting area, the 32-gallon plastic wastebags were weighed. After recording the weight of the sample container (the plastic/canvas wastebags weighed less than 0.25 Kilogram and therefore could not be accounted for by weight) on the data collection sheets, the containers were emptied onto the sorting tables. A crew of six to eight

persons manually sorted the waste sample into the 24 material categories. Each material type sorted was placed into a designated small sorting basin (i.e., 2-gallon and 5-gallon basins). After all materials in each waste sample were sorted, the materials (which were placed in the small sorting basins) were weighed and the weights were recorded.

A waste sample for the moisture content testing was prepared to reflect the composition of the waste stream based on preliminary field calculations of the waste sorting information. The sample was prepared with a weight of approximately 5.1 kg, and was assembled in such a way as to include the relative percentages of the 24 material types.

Phase 3: Data Analysis

The data analysis phase of the waste characterization study involved analysis of the data collected during the field work.

Data Input. Data collected in the field for each waste sample included the weight of the sample and weight of the various material type components segregated from the sample. The weight information, which was obtained from hand-written data collection forms prepared in the field, was entered into BVA's computerized database in for statistical analysis. All data input into the database was double checked to confirm accuracy of data entry work.

Waste Composition and Statistics. The waste composition was calculated for each waste sample and identified the concentration of each material type in the sample as a percentage of the total waste sample. After the waste composition for each sample was determined, an average of the concentrations for all samples collected in each waste stream category was calculated to provide an average waste composition for each waste stream. Statistical analyses were applied to indicate the reliability of the waste composition percentages. Standard deviations were calculated for each material type (waste component) of each waste stream. The margin of error for each material type (waste component) at a 90-percent level was calculated for each of the waste streams.

Appendix C | Moisture Content Analysis

EURL
au Capital Social
de 1 000,000 DA



Filiale du Groupe E.E.C ex edil

N.E.E

وطنية - مياه و بيئة

Nationale Eau et Environnement

REF/N.E.E/N° 584/ 2000

Alger le 27.05.2000

Mrs KENT et KEANE
Société BROWN VENCE ASSOCIATES
U.S.A.

**Objet/ Etude de faisabilité des déchets solides
De la ville de JIJEL**

Messieurs,

Après vérification auprès du Laboratoire de l'Agence Nationale des ressources hydriques, organisme qui a procédé aux analyses du taux d'humidité de l'échantillon des déchets solides de la ville de JIJEL, nous avons l'honneur de vous transmettre ci-joint les précisions et modifications relatives aux résultats :

1- l'échantillon des déchets solides prélevé au niveau de la décharge de JIJEL a été trié

Le poids de tous les déchets non humides (humidité = 0) figure dans la première page qui est donné à titre indicatif

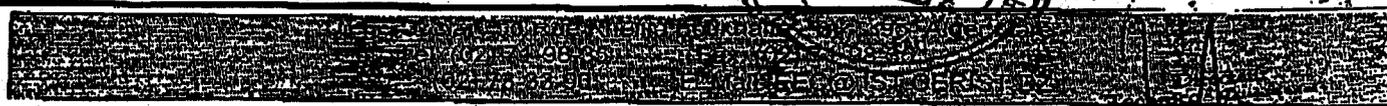
2- Pour les matières organiques, deux (02) prélèvements (échantillon prise N° 1et 2) ont été analysés afin d'obtenir des résultats fiables.

Echantillon : Prise N°1 ; lire « poids de l'échantillon 1209,13 g au lieu De 562,85 » (représentant le poids de la tare)

Echantillon : Prise N° 2 ; lire « poids de l'échantillon 1532,37 au lieu De 568,48 » (représentant le poids de la tare).

Nous vous en souhaitons une bonne réception et restons à votre entière disposition pour répondre à toutes vos sollicitations.

Nous vous prions d'agréer, Messieurs l'expression de nos salutations distinguées



ZIANI



وزارة التجهيز والتهيئة العمرانية

الوكالة الوطنية للموارد المائية

- تأسست بالرسوم رقم 81-167 المؤرخ في 25 جويلية 1981 و الرسوم رقم 87-129 المؤرخ في 19 ماي 1987 المتضمن تغير التسمية
- حساب الخزينة المركزية بالجزائر رقم 402.003.221

N° DCES/2000

19 AVR. 2000

Demandeur : E.E.C / NEE
Analyse demandée : Analyse taux d'humidité
Date de la demande : N° Ron 002531 du 03-04-2000
Numéro de laboratoire : Code EEC

ANALYSE DU TAUX D'HUMIDITE DES DECHETS SOLIDES

(Ordures ménagères de la ville de Jijel)

Mode opératoire :

Après séparations et pesés des différents types de déchets, une analyse du taux d'humidité a été réalisé sur deux échantillons d'ordures, selon la méthode suivante :

Séchage à l'étuve (105 °C) d'une masse donnée de l'échantillon d'ordures ménagères, jusqu'à masse constante.

Broyage de l'échantillon N° 1 et 2 d'ordures ménagères, après détermination de l'humidité.



AFTER SEPARATIONS AND PESES OF THE VARIOUS TYPES OF DECHETS AN ANALYSIS OF THE RATE D HUMIDITE HAS ETE REALISE ON TWO SAMPLES OF REFUSE ACCORDING TO THE FOLLOWING METHOD: DRYING HAS THE DRYING OVEN (105 C) OF A GIVEN MASS OF THE SAMPLE OF REFUSE MENAGERES UNTIL A MASSES CONSTANT. CRUSHING OF SAMPLE N 1 AND 2 OF REFUSE MENAGERES AFTER DETERMINATION OF THE HUMIDITE

ECHANTILLON : BOUTEILLES EN PLASTIQUE

177.54 g

ECHANTILLON : SACHETS EN NYLON

284.37 g

ECHANTILLON : PAPIER ALUMINIUM

68.87 g

ECHANTILLON : BOITES METALIQUES

98.74 g

ECHANTILLON : CAILLOUX

443.20 g

ECHANTILLON : OSEMENTS

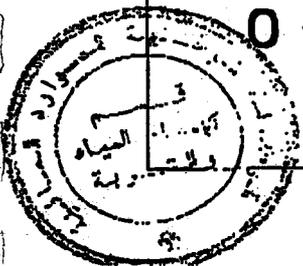
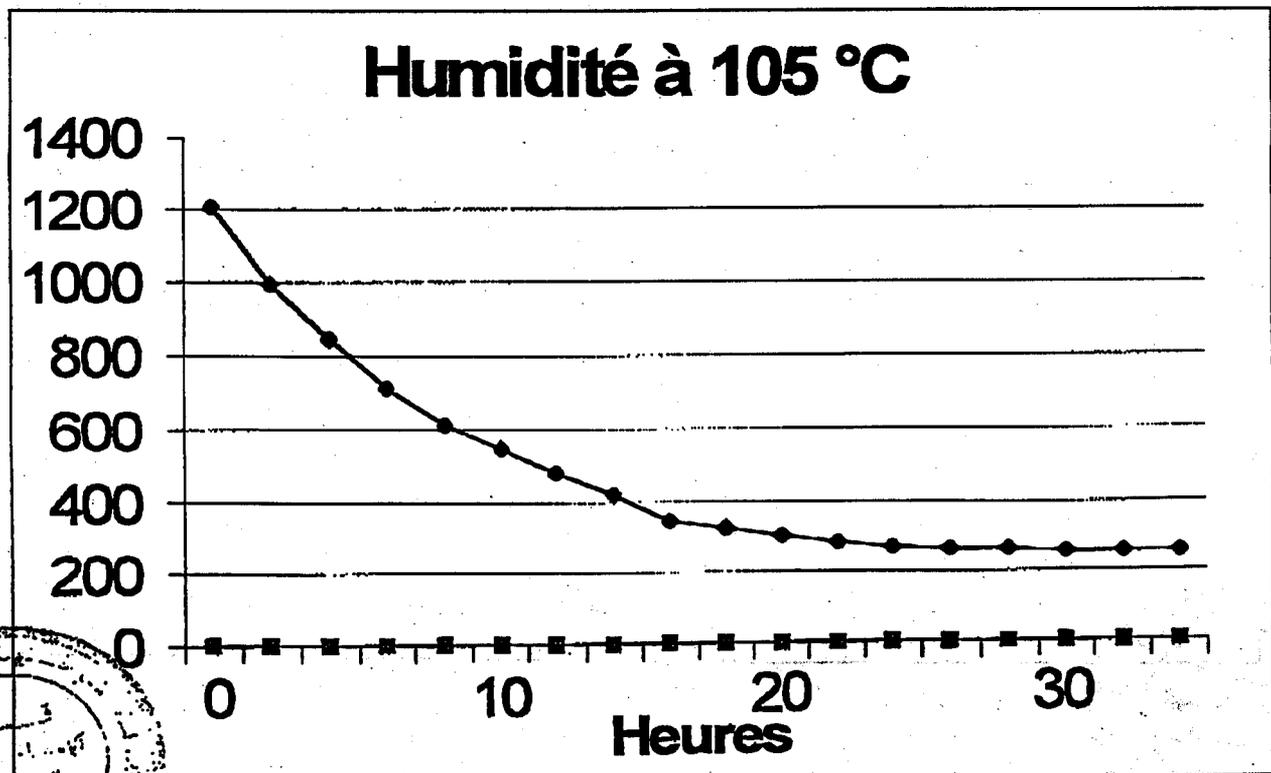
98.87 g

ECHANTILLON : DEBRIES DE VERRE

92.68 g

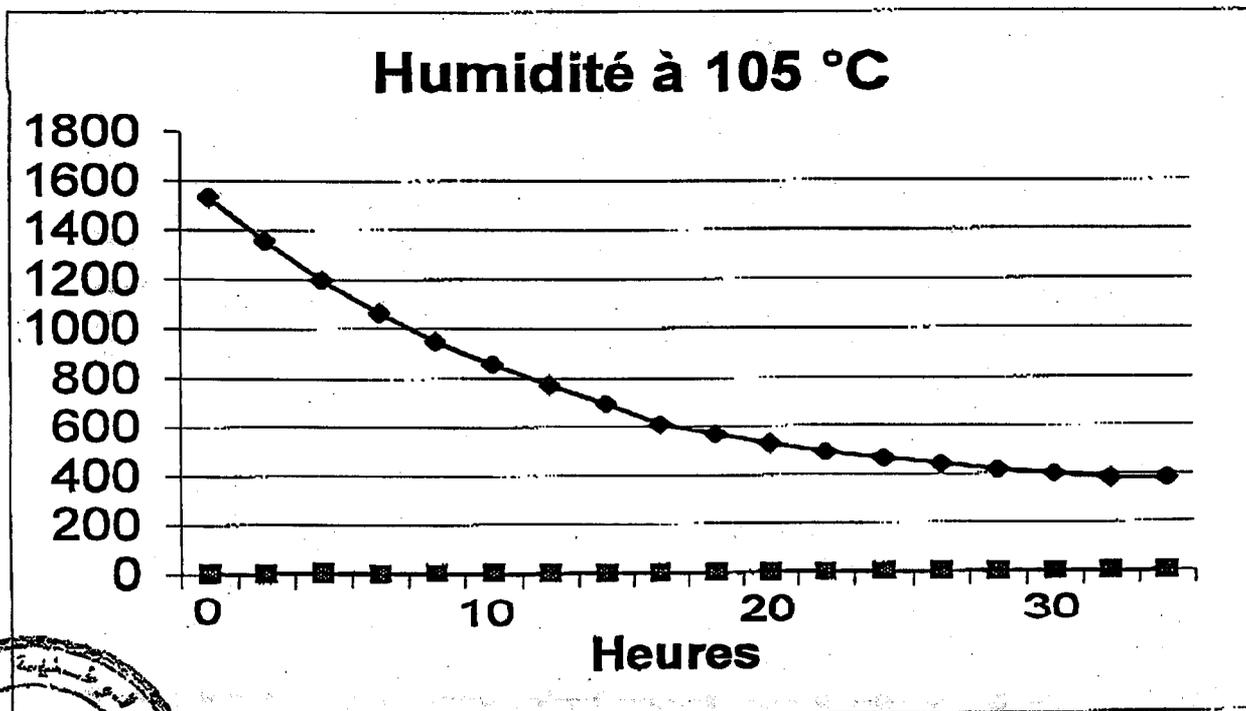
ECHANTILLON : ORDURES MENAGERES : PRISE N° 1

Poids de l'échantillon	:1209,13	g
Poids à 105 °C après 2 H	: 998,03	g
Poids à 105 °C après 2 H	: 851,66	g
Poids à 105 °C après 2 H	: 718,67	g
Poids à 105 °C après 2 H	: 613,18	g
Poids à 105 °C après 2 H	: 541,27	g
Poids à 105 °C après 2 H	: 477,06	g
Poids à 105 °C après 2 H	: 421,12	g
Poids à 105 °C après 2 H	: 347,82	g
Poids à 105 °C après 2 H	: 322,29	g
Poids à 105 °C après 2 H	: 302,28	g
Poids à 105 °C après 2 H	: 287,42	g
Poids à 105 °C après 2 H	: 275,27	g
Poids à 105 °C après 2 H	: 267,95	g
Poids à 105 °C après 2 H	: 262,12	g
Poids à 105 °C après 2 H	: 259,28	g
Poids à 105 °C après 2 H	: 258,33	g
Poids à 105 °C après 2 H	: 257,10	g



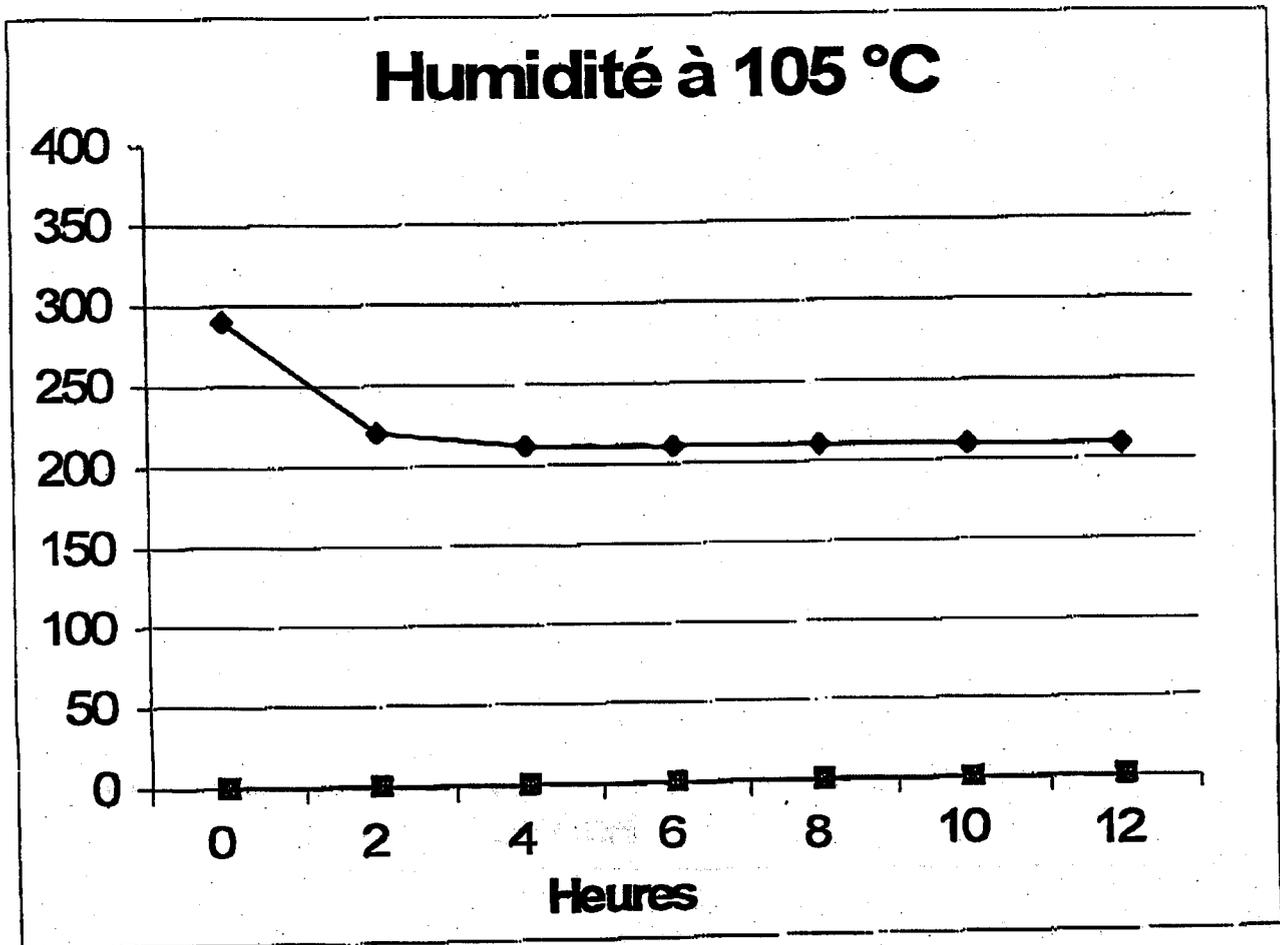
ECHANTILLON : ORDURES MENAGERES : PRISE N° 2

Poids de l'échantillon	: 1 532,37 g
Poids à 105 °C après 2 H	: 1357,29 g
Poids à 105 °C après 2 H	: 1197,31 g
Poids à 105 °C après 2 H	: 1063,46 g
Poids à 105 °C après 2 H	: 950,48 g
Poids à 105 °C après 2 H	: 858,49 g
Poids à 105 °C après 2 H	: 772,72 g
Poids à 105 °C après 2 H	: 697,42 g
Poids à 105 °C après 2 H	: 610,31 g
Poids à 105 °C après 2 H	: 569,42 g
Poids à 105 °C après 2 H	: 528,49 g
Poids à 105 °C après 2 H	: 494,08 g
Poids à 105 °C après 2 H	: 466,30 g
Poids à 105 °C après 2 H	: 442,19 g
Poids à 105 °C après 2 H	: 418,25 g
Poids à 105 °C après 2 H	: 399,84 g
Poids à 105 °C après 2 H	: 382,47 g
Poids à 105 °C après 2 H	: 380,66 g



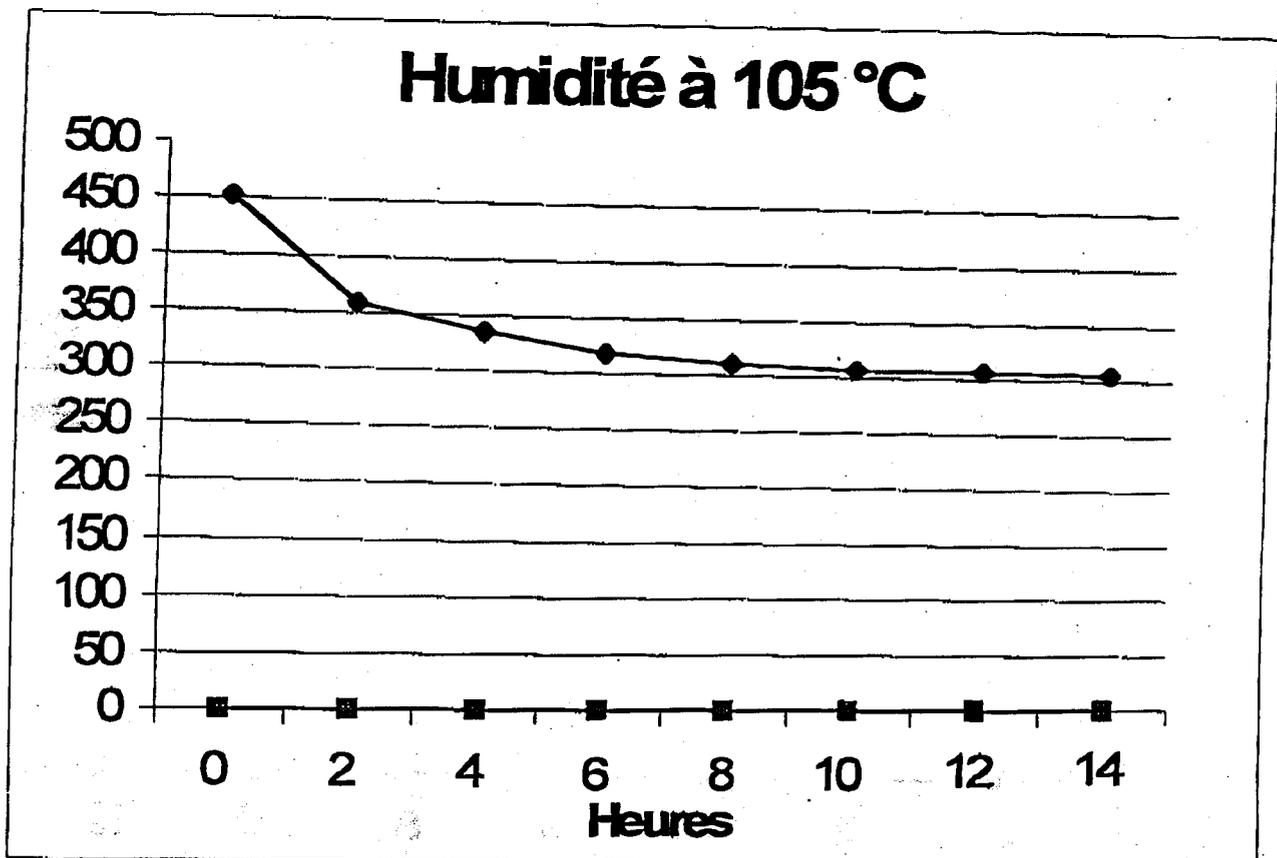
ECHANTILLON : PAPIER JOURNAL

- Poids de l'échantillon : 290,11 g**
- Poids à 105 °C après 2 H : 220,20 g**
- Poids à 105 °C après 2 H : 211,45 g**
- Poids à 105 °C après 2 H : 210,46 g**
- Poids à 105 °C après 2 H : 210,20 g**
- Poids à 105 °C après 2 H : 209,49 g**
- Poids à 105 °C après 2 H : 209,34 g**



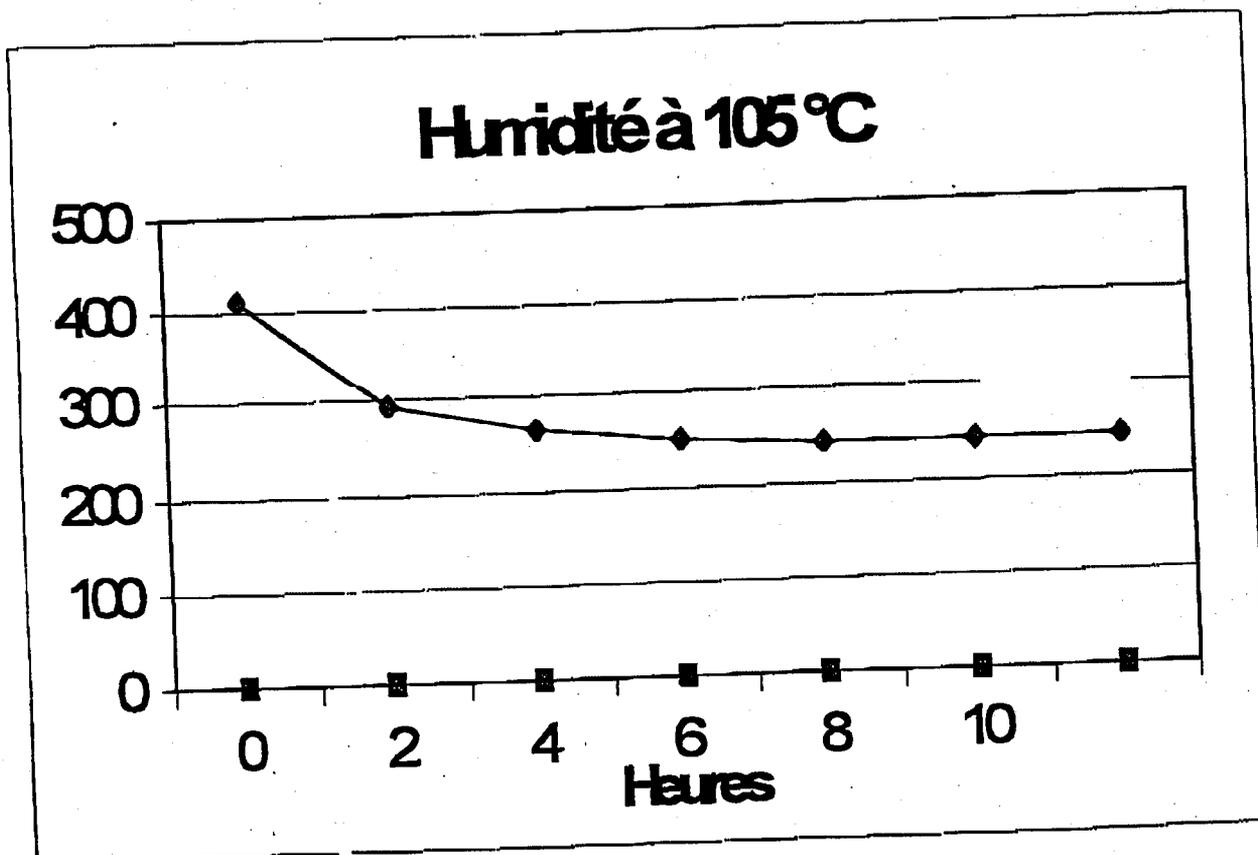
ECHANTILLON : PAPIER CARTON

Poids de l'échantillon : 451,68 g
Poids à 105 °C après 2 H : 358,85 g
Poids à 105 °C après 2 H : 335,72 g
Poids à 105 °C après 2 H : 318,00 g
Poids à 105 °C après 2 H : 310,88 g
Poids à 105 °C après 2 H : 306,56 g
Poids à 105 °C après 2 H : 306,33 g
Poids à 105 °C après 2 H : 305,85 g



ECHANTILLON : CHIFFON

Poids de l'échantillon	:	411,13 g
Poids à 105 °C après 2 H	:	293,48 g
Poids à 105 °C après 2 H	:	265,09 g
Poids à 105 °C après 2 H	:	251,72 g
Poids à 105 °C après 2 H	:	243,33 g
Poids à 105 °C après 2 H	:	241,73 g
Poids à 105 °C après 2 H	:	240,87 g



**Appendix D | Waste Survey Summaries
and Forms**

Residential Waste Stream Survey

Residential Waste Stream Survey Results (Low Income District)

1. Type of waste or recycle collection service and type of container? Vegetable peelings, canned food waste, plastic and glass bottles, cardboard from product packaging (detergents and medicine), textile, and old shoes. This is all mixed in the same plastic bag.

2. What does the collection cost?

- Included in rent
- 400 DA/year

3. How often is your waste and/or recyclables collected?

Waste is collected in a small concrete holding bunker and collected by the APC who directs it to the Landfill.

4. Waste disposal methods if no service is available?

- Favorable opinion for the privatization of waste collection service, but they need a subsidy from the APC because of the high cost
- Favorable opinion for the privatization of waste collection service for the health of children and fly control, especially in summer.
- Favorable opinion for the privatization of waste collection service provided that it is good service

5. What is the cost and frequency of this disposal method?

- Can't afford private service
- 50 DA/month
- 100 DA/month
- 300 DA/month
- 0-100 DA/month
- 0-100 DA/year
- 0-50 DA/month
- 400 DA/month

6. Estimated disposal or recycling?

- One bag/week and 2-3 bags during summer
- One 35-liter bag/ week
- One can of 20 Kg./day
- Five Kg./week-ten days
- Cannot be estimated
- Zero to one plastic bag/week
- 5-6 Kg./day three days per week
- One box of 3 Kg. Three days/week
- One small bag/week-ten days
- One 50-liter bag/two days
- One big plastic bag/day
- Two big plastic bags/day
- One average bag/two days
- One small bag/day
- One small bag/day waste and rose petals collected by lotion-maker
- Two 100 liter cans/week

7. What are the five types of materials you dispose of in the largest amounts?

Food, plastic, paper, tin, glass (repeated 15 times)

8. Are you aware of any laws or regulations concerning wastes?

No

9. Are you aware of any waste disposal or recyclable handling sites in or near Jijel?

No

Residential Waste Stream Survey Results (Middle Income District)

1. Type of waste or recycle collection service and type of container? Fruit and vegetable peelings, cooked food waste, plastic and glass bottles, canned food waste, plastic bag, cardboard, textile, broken wood, broken glass, old clothes and shoes, office paper. All wastes are put in the same plastic bag.

2. What does the collection cost?

400 DA/year

3. How often is your waste and/or recyclables collected?

Every day except Friday the waste is collected by city trucks.

4. Waste disposal methods if no service is available?

- Favorable opinion for the privatization of waste collection service, but the service must not be expensive
- Favorable opinion for the privatization of waste collection service but want service even on Fridays
- Favorable opinion for the privatization of waste collection service provided that it is good service

5. What is the cost and frequency of this disposal method?

- Can't afford private service
- 50-100 DA/month
- 100 DA/month
- 150-200 DA/month
- 200 DA/month
- 150 DA/month
- 300 DA/month
- 500 DA/month
- 400 DA/year

6. Estimated disposal or recycling?

- One small bag/day

- One 5 Kg. Bag/day
- One average bag/two days
- One average plastic bag/day
- Two average plastic bags/day
- Three average plastic bags/day
- Two 100 liter cans/week

7. What are the five types of materials you dispose of in the largest amounts?

Food, plastic, paper, tin, glass (repeated 15 times)

8. Are you aware of any laws or regulations concerning wastes?

No

9. Are you aware of any waste disposal or recyclable handling sites in or near Jijel?

No

Residential Waste Stream Survey Results (High Income District)

1. Type of waste or recycle collection service and type of container? Fruit and vegetable peelings, cooked food waste, plastic and glass bottles, canned food waste, plastic bag, cardboard, textile, broken wood, broken glass, old clothes and shoes, office paper. All wastes are put in the same plastic bag.

2. What does the collection cost?

400 DA/year

3. How often is your waste and/or recyclables collected?

The wastes are collected every day except Friday by APC trucks.

4. Waste disposal methods if no service is available?

- Favorable opinion for the privatization of waste collection service, but the service must be subsidized by the APC and be free

- Favorable opinion for the privatization of waste collection service but want service better than now
- Favorable opinion for the privatization of waste collection service provided that it is good service
- The collection of waste is done by the owner. He doesn't want to pay for a non-established service
- Favorable opinion for the privatization of waste collection service provided that it is good service and includes street sweeping

5. What is the cost and frequency of this disposal method?

- 50-150 DA/month
- 100 DA/month
- 200 DA/month
- 150 DA/month

6. Estimated disposal or recycling?

- One average bag/two days
- One average plastic bag/day
- Two average plastic bags/day
- One average plastic bag/2-3 days
- One bag of 35 liters/1-2 days
- One bag of 35 liters/week

7. What are the five types of materials you dispose of in the largest amounts?

Food, plastic, paper, tin, glass

8. Are you aware of any laws or regulations concerning wastes?

No

9. Are you aware of any waste disposal or recyclable handling sites in or near Jijel?

No

Commercial Waste Stream Survey

1. Type of waste or recycle collection service and type of container? Hair, Dye, shampoo bottles, plastic bags, small bottles, coconuts, blades, textile, vegetable peelings, bottle caps, canned food waste, broken glass, plastic, cardboard, paper, worn cathode tube ,meat and bone scrap, plastic bottles, grease, meat packing paper, detergent box, paper scraps, floor sweepings, paper bags, mixed paper, egg shells, bakery dough, wood, sawdust, food and meat scraps, fruit peelings, brake parts, candles, worn out spare auto parts, cigarette butts, leaves, stems, string, cellophane paper, dead flowers.

2. What does the collection cost?

- Zero
- 400 DA/year,
- 3000 DA/year

3. Frequency of pickup:

- Six days/week except Fridays,
- Self-haul as needed,
- Roll-off box every 2-3 days,
- Weekly self-haul,
- APC hauls six days and company rents truck for self-haul on Fridays,
- Private hauler

4. Waste disposal methods if no service is available?

- Favorable opinion for the privatization of waste collection and transportation service,
- The cathode tubes are transported by the owner to the Mezraitine Landfill,
- If the majority of the population pays for the waste collection service, the opinion is favorable,
- Favor the privatization of waste collection but quantity of waste generated must be important because the pharmacy doesn't generate a lot of garbage,
- Sawdust is recovered by henhouse owner,

5. What is the cost and frequency of this disposal method?

- 50 DA/month

- 100 DA/month
- 20 DA/month
- 200 DA/month
- 150 DA/month
- Cannot estimate the cost
- None
- 1000 DA/month
- 500 DA/year

6. Estimated disposal or recycling?

- One bag/week and 2-3 bags during summer
- One 35-liter bag/ week
- One can of 20 Kg./day
- Five Kg./week-ten days
- Cannot be estimated
- Zero to one plastic bag/week
- 5-6 Kg./day three days per week
- One box of 3 Kg. Three days/week
- One small bag/week-ten days
- One 50-liter bag/two days
- One big plastic bag/day
- Two big plastic bags/day
- One average bag/two days
- One small bag/day
- One small bag/day waste and rose petals collected by lotion-maker

7. What are the five types of materials you dispose of in the largest amounts?

- Hair, plastic
- Hair, plastic
- Food, tin, glass
- Plastic, cardboard, paper, glass

- Bone, plastic cardboard
- Bone and grease, plastic bottles
- Cardboard, plastic, floor sweepings
- Paper
- Food, paper, plastic
- Sawdust
- Food, tin, paper, plastic, glass
- Plastic, paper
- Textile, floor sweepings, cigarette butts
- Landscaping, film plastic

8. Are you aware of any laws or regulations concerning wastes?

No

9. Are you aware of any waste disposal or recyclable handling sites in or near Jijel?

No

Commercial Survey Form Example

JIJEL - COMMERCIAL WASTE STREAM SURVEY
1. Do you have any type of waste or recyclable collection service? If yes, please describe.
2. What does this collection service cost?
3. How often is your waste and/or recyclables collected?
4. If you do not have any collection service, how do you dispose of your waste or recycle materials?
5. What is the cost and frequency of this disposal method?
6. Please estimate how much waste you dispose or recycle. For example, "We dispose of 2 - 100 liter cans each week".
7. What are the 5 types of waste you dispose of in the largest amounts? For example: paper, food, plastics, glass, tin. 1)_____ food_____, 2)_____plastic_____, 3)_____ paper_____, 4)_____ tin_____, 5)_____ glass_____.
8. Are you aware of any laws or regulations concerning wastes? If yes, please describe.
9. Are you aware of any waste disposal or recyclable handling sites in or near Jijel? If yes, please list.

Residential Survey Form Example

JIJEL - RESIDENTIAL WASTE STREAM SURVEY
1. Do you have any type of waste or recyclable collection service? If yes, please describe.
2. What does this collection service cost?
3. How often is your waste and/or recyclables collected?
4. If you do not have any collection service, how do you dispose of your waste or recycle materials?
5. What is the cost and frequency of this disposal method?
6. Please estimate how much waste you dispose or recycle. For example, "We dispose of 2 - 100 liter cans each week".
7. What are the 5 types of waste you dispose of in the largest amounts? For example: paper, food, plastics, glass, tin. 1) _____ food _____, 2) _____ plastic _____, 3) _____ paper _____, 4) _____ tin _____, 5) _____ glass _____.
8. Are you aware of any laws or regulations concerning wastes? If yes, please describe.
9. Are you aware of any waste disposal or recyclable handling sites in or near Jijel? If yes, please list.

**Appendix E | Collection Equipment Vendor
Information**



CAPITAL INDUSTRIES, INC. CONTAINERS INDUSTRIAL AND SOLID WASTE

CAPITAL CONTAINERS AN INTRODUCTION

Capital Industries manufactures a wide variety of refuse containers for an industry whose requirements are many. Our inventory of quality materials and utilization of the most sophisticated manufacturing techniques result in products of the utmost quality and dependability, factors which enhance the life of our product. The result is a greater return for our customers on their investments.

All Capital Industries refuse containers meet the new A.N.S.I. Safety Standard Z245.3. This and Capital's long-time reputation for quality products are your assurance of safe, well-made containers.

CONTACT:

David Taylor, Jr.
Dick Fuegmann
Bob Wilson
Denny Gram
Randy Smith

Capital Industries, Inc.
5801 Third Avenue South
Seattle, Washington 98108
206-762-8585
FAX 206-762-5455
1-800-967-8585

PRODUCT GUIDE:

REAR LOADERS	1
FRONT LOADERS	3
BEAR PROOF	7
ROLL OFF	8

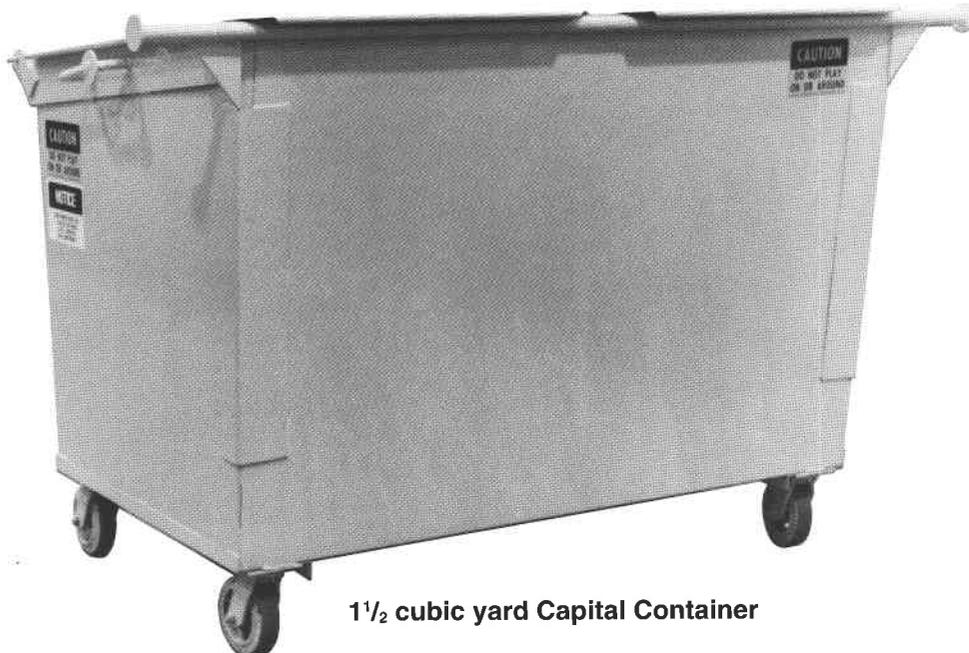
COMPACTOR BOXES	10
SLUDGE WASTE	11
RECYCLE CONTAINERS	12
SPECIAL CONTAINERS	14
HOPPERS AND BINS	16

REAR LOADER CONTAINERS

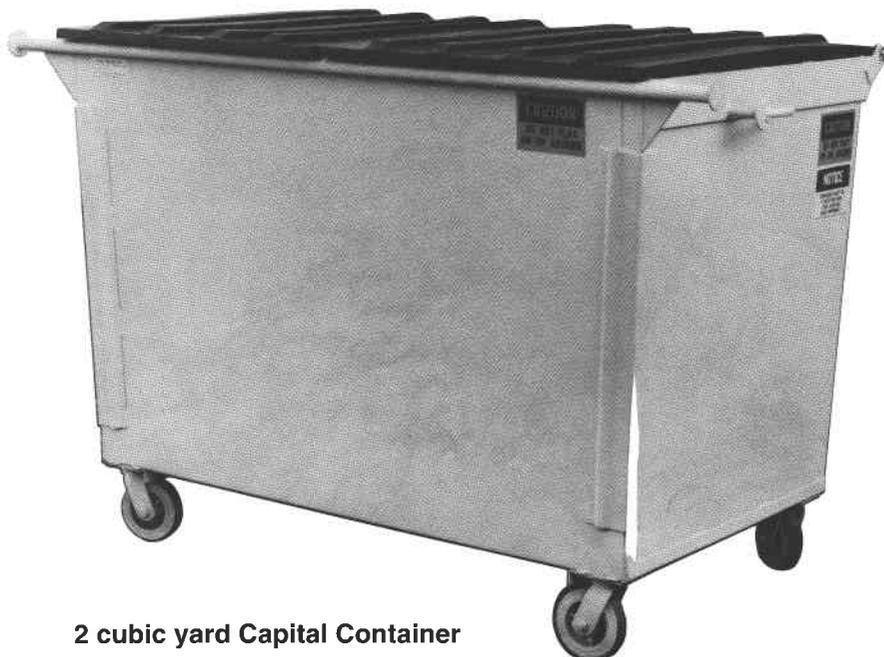
1 and 1½ Cubic Yard Containers

Body and lid are made of 14-gauge steel with rolled-pin hinges and flanges. Wrap-around striker plates plus 4 swivel casters are standard equipment. Plastic lids and overhead winch attachments are optional. Outriggers are mandatory on one-yard containers to meet federal safety standards.

Capacity	1 cu. yd.	1½ cu. yd.
Weight	330 lbs.	360 lbs.
Length o.a.	77½"	77½"
Length	62"	62"
Height (less casters)	40"	40"
Depth	25"	34"



1½ cubic yard Capital Container



2 cubic yard Capital Container

2 Cubic Yard Containers

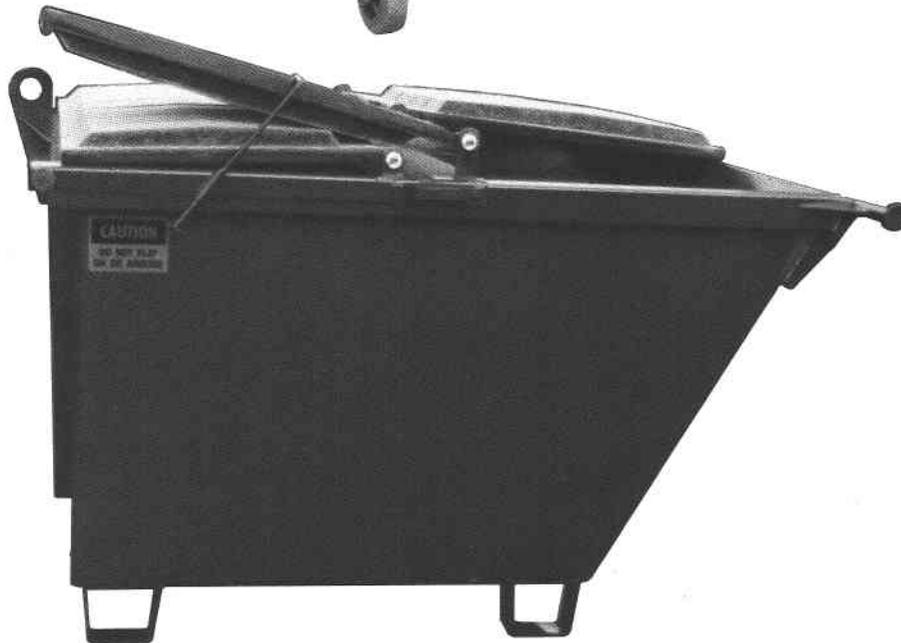
Body and lid are 14-gauge construction with rolled-pin hinges and flanges. Again, wrap-around striker plates and four swivel casters are standard. Plastic and aluminum lids and overhead winch attachments are optional. This particular container group is used almost exclusively with hydraulic dumping systems.

Capacity	2 cu. yds.
Weight	420 lbs.
Length o.a.	77½"
Length	64"
Height (less casters)	41"
Depth	44"

REAR LOADER CONTAINERS CONTINUED



**2 cubic yard,
slope front
Capital Container**



**3 cubic yard, slope-front
Capital Container**
Casters are standard (skids optional)

2 and 3 Cubic Yard, Slope Front Capital Container

14-gauge body and lid construction are standard with 12-gauge body being optional. A three-sectioned steel lid, or four-section plastic lids, are available. Four swivel casters is standard. All containers come equipped with outriggers to insure compliance with federal safety standards. Overhead winch attachments are optional.

Capacity	2 cu. yds.	3 cu. yds.
Weight	480 lbs.	570 lbs.
Length o.a.	77 $\frac{1}{2}$ "	77 $\frac{1}{2}$ "
Length	62"	62"
Height (less casters)	40"	40"
Depth	56"	70"

4, 6, 8 & 10 Cubic Yard Capital Slope Front Containers

12 gauge steel construction and equipped for overhead winch pick-up. Side sheets are welded to a one-piece body skin for lasting strength and shock load durability. These larger-size rear loaders are heavily reinforced at all stress and load points. Plastic lids on these units are available and advisable. Skids are optional.

FRONT LOADER CONTAINERS



**3 cubic yard
Capital Container with
plastic lid**

2, 3 and 4 Cubic Yard Capital Container (slant top)

Body is made of 14-gauge steel, 12-gauge is optional. Heavy fork pocket guide plates are standard. These bins have double-ribbed panels on the front, bottom and back. Plastic lids are standard. Steel lids are optional.

Capacity	2 cu. yds.	3 cu. yds.	4 cu. yds
Weight	470 lbs.	500 lbs.	630 lbs.
Length	72"	72"	72"
Depth	34"	43"	51"
Rear Height	45"	48"	56"
Front Height	34"	40"	46"



**4 cubic yard Capital Container
with plastic lid and
swing away lock bar**

FRONT LOADER CONTAINERS CONTINUED



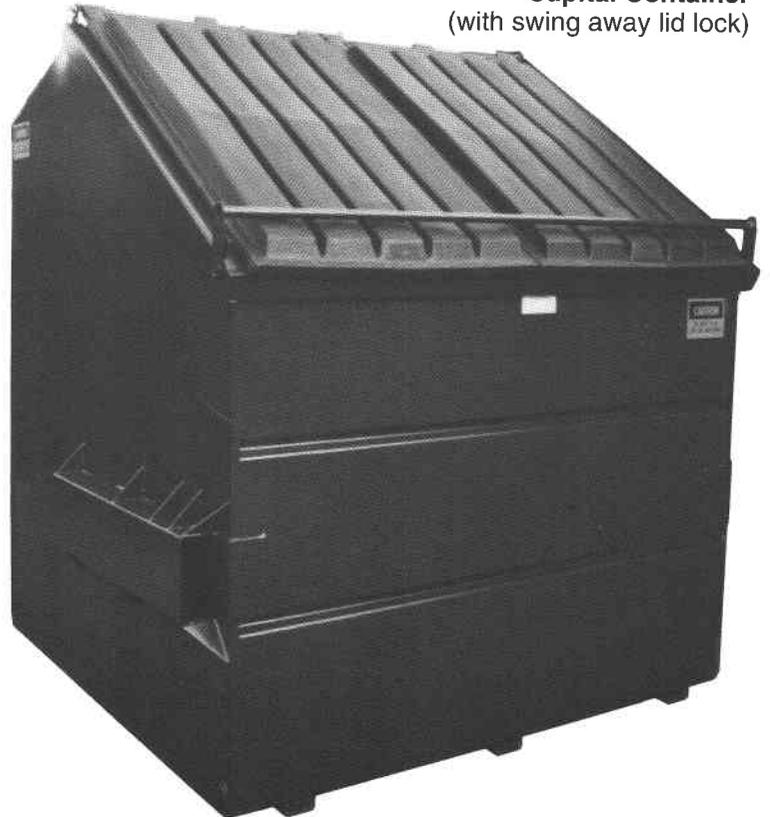
6 cubic yard, Cathedral-Style
Capital Container

6 Cubic Yard Cathedral-Style Capital Container

8 Cubic Yard Cathedral-Style Capital Container

Heavy-gauge steel construction is standard on both of these models. The peaked-roof design results in a low loading height for depositing refuse. Plastic lids (36"x58") allow a large opening for easy dumping and loading. Containers come standard with fork-pocket guide plates, capped channel skids and 3/16" bumper plates.

Capacity	6 cu. yds.	8 cu. yds.
Height (O.A.)	71"	86"
Front loading Height	47"	53"
Depth	66"	71"
Length	80"	80"



8 cubic yard, Cathedral-Style
Capital Container
(with swing away lid lock)



**6 cubic yard Low-Profile
Capital Container**

**6 Cubic Yard Low Profile
Capital Container
8 Cubic Yard
Capital Container**

10- and 12-gauge steel construction is standard in these models. Sliding side doors are gravity-controlled to close while dumping. Lids are fully framed with box reinforcement and controlled with heavy-duty lid torsion springs. 3/16" bumper plates, drain plugs, and three skids are standard. These containers are adaptable to single-point or two-point lifting mechanisms. Double-hinged door optional.

Capacity	6 cu. yds.	8 cu. yds.
Weight (prox.)	1000 lbs.	1200 lbs.
Height	60"	80"
Width	66"	66"
Length	72"	72"



8 cubic yard Capital Container

FRONT LOADER CONTAINERS CONTINUED



4 Cubic Yard Capital Container, flat top style with plastic cover.

These front load containers are constructed of 12-gauge steel with 1/8" pockets. Containers are tapered for stacking, with pockets set at variable heights for greater nesting capability. Lid design permits easy loading. Skids and plastic lids are standard; casters are optional. 2 through 4 cubic yards sizes are available.

Capacity	2.0 cu. yds.	2.7 cu. yds.	3.0 cu. yds.	4 cu. yds.
Weight (prox.)	430 lbs.	540 lbs.	575 lbs.	627 lbs.
Height (less skids)	41"	46"	48"	54"
Width	35"	42"	44"	51"
Length	72"	72"	72"	72"

BEAR PROOF CONTAINERS



2 and 3 Cubic Yard Rear Load Capital Container

14-gauge body and lid construction are standard with 12-gauge body being optional. Standard with four swivel casters. Overhead winch attachments are optional.

Capacity	2 cu. yds.	3 cu. yds.
Weight	566	605
Length o.a.	77 $\frac{1}{2}$ "	77 $\frac{1}{2}$ "
Length	57"	75"
Height (less casters)	40"	42"
Width	62"	62"



4 and 6 Cubic Yard Front Load Capital Container

Body and lid are made of 14-gauge steel, 12-gauge is optional. Heavy fork pocket guide plates are standard. Steel lids are standard.

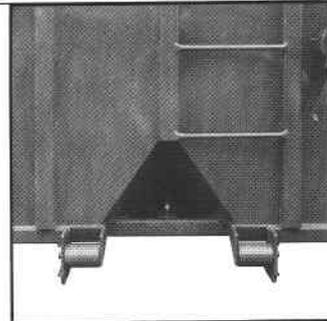
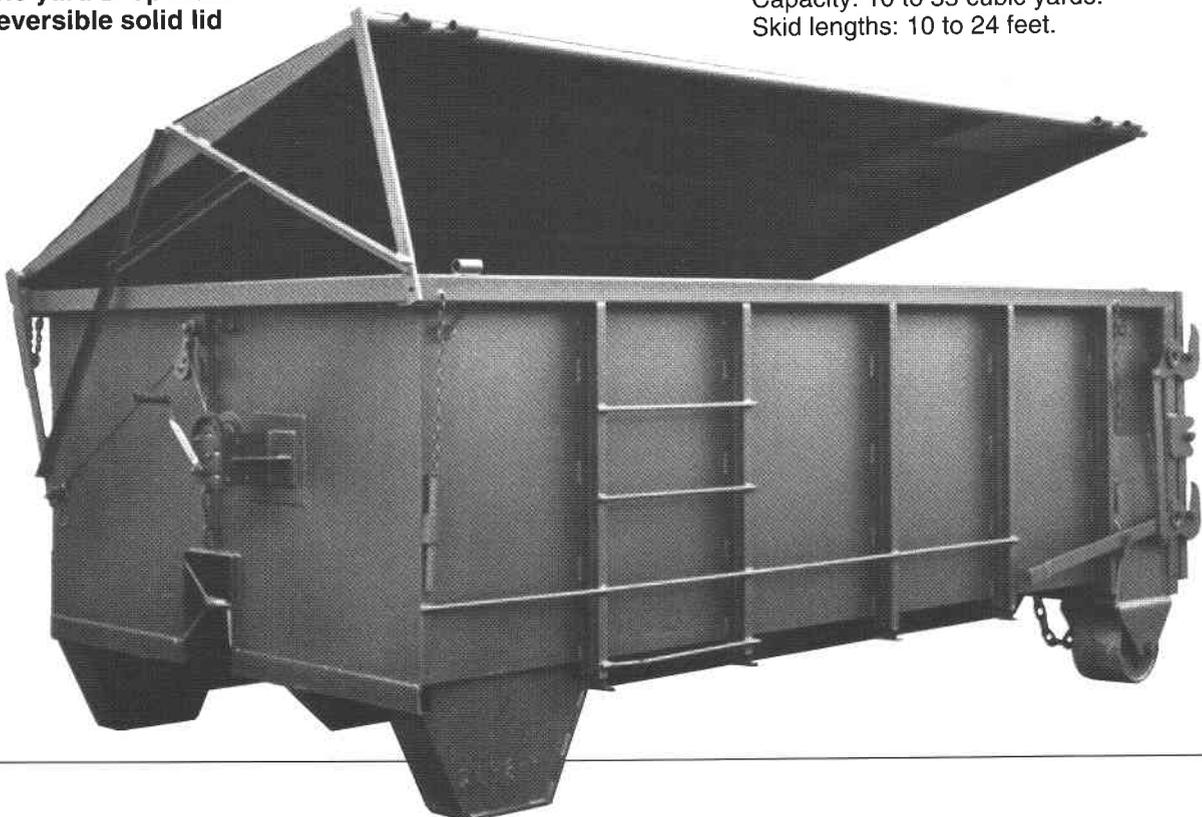
Capacity	4 cu. yds.	6 cu. yds.
Weight	660 lbs.	1110 lbs.
Length	72"	72"
Height	48"	60"
Width	56"	66"

ROLL OFF CONTAINERS



**32 cubic yard Drop-Box
Container with EZ Reverse
Solid Steel Lid**

**10 cubic yard Drop-Box
with E-Z reversible solid lid**



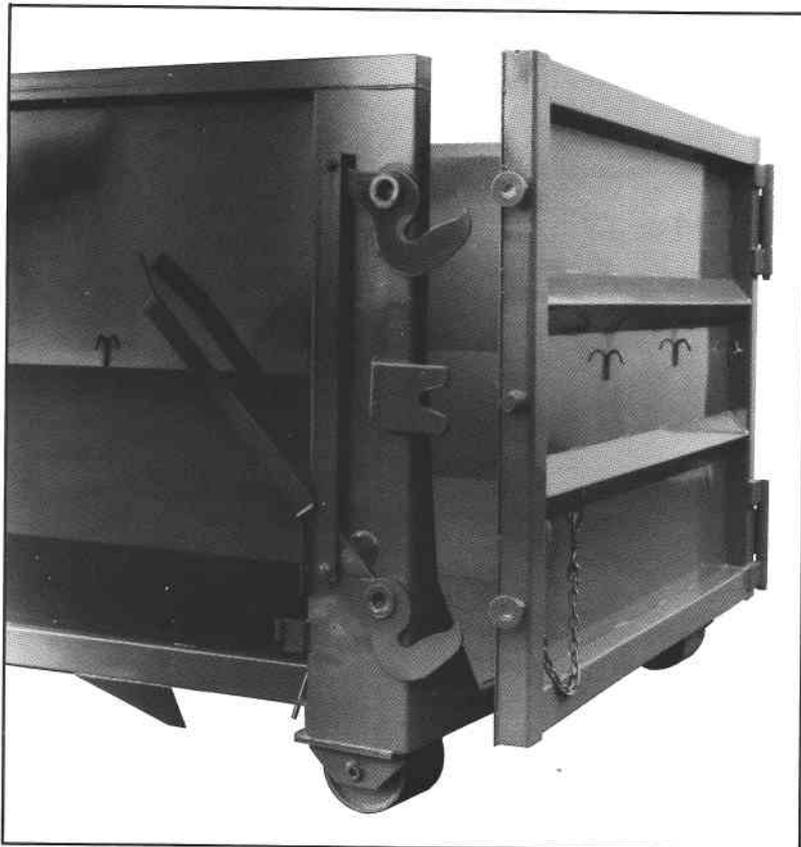
Various hoisting attachments available.
(Inset shows outside rail attachment for
cable lifting.)

Open top units are manufactured from prime structural sheet steel, plate and tubing. All moving parts are equipped with grease fittings. The standard containers are fabricated of 12-gauge sides and 10-gauge floor, supported by cross-members and vertical side posts. Top flange is reinforced with structural channel or angle. Heavy-duty models are constructed of 1/8" sides and 3/16" or 1/4" floors. Standard features include: double barn rear doors, 10" O.D. rollers, outside ladder, heavy-duty hinges, and tarp rail. A variety of lids are available.

Capacity: 10 to 55 cubic yards.
Skid lengths: 10 to 24 feet.



30 Cubic Yard Style



**Detail of Round-Bottom
Rear door and lock**

Round-Bottom Drop Boxes

Octagon-style open top container has a contoured body for easy dumping, cleaning and elimination of "rust pockets."

These units are designed so they may be shipped nested for freight savings.

Standard model is 10-gauge steel throughout. Optional heavy-duty models are made of 3/16" plate.

Standard features include: single rear door with vault-type hinges, top reinforced with heavy structural channel or tubing, 8" or 10" heavy-duty ground rollers with grease fittings and tarp hooks.

All units are continuously welded on the inside seams. Adaptable to any pickup system and skid length up to 22 ft.

A variety of lids are available.

ROLL OFF CONTAINERS CONTINUED



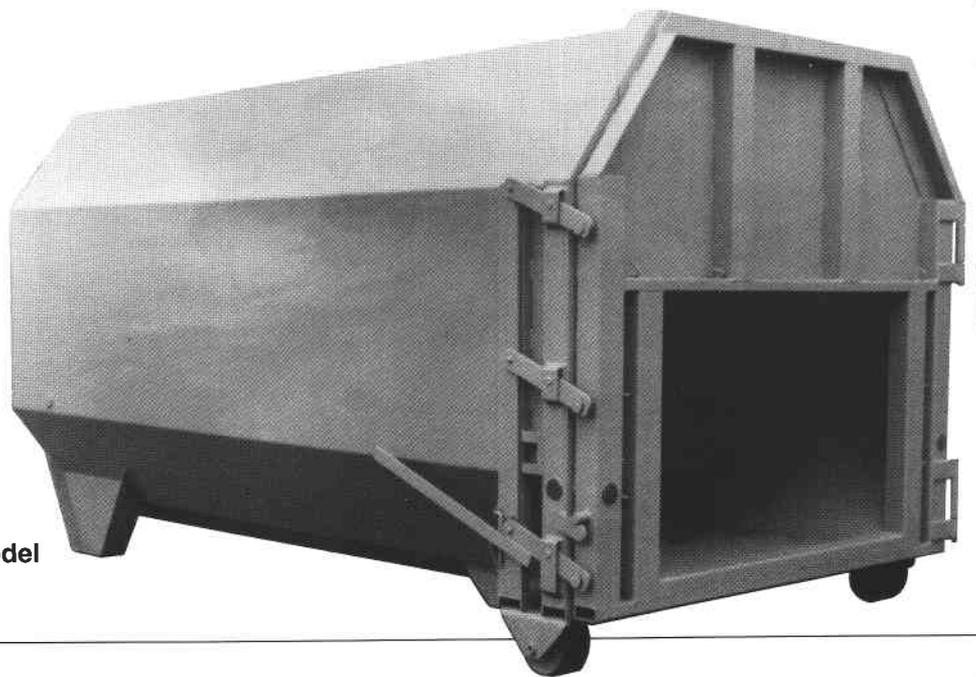
**40 cubic yard Structural
Style Roll-Off Box Container**
(Shown with screen lid - lids optional.)

This heavy-duty structural design container is our most popular model. This unique design provides extra strength in the critical side-to-floor connection area. All side and floor stiffeners are rolled structural channel members. Not formed gauge material. This design feature permits a clean exterior surface with no debris hang up. **Available in various sizes.**

COMPACTION CONTAINERS

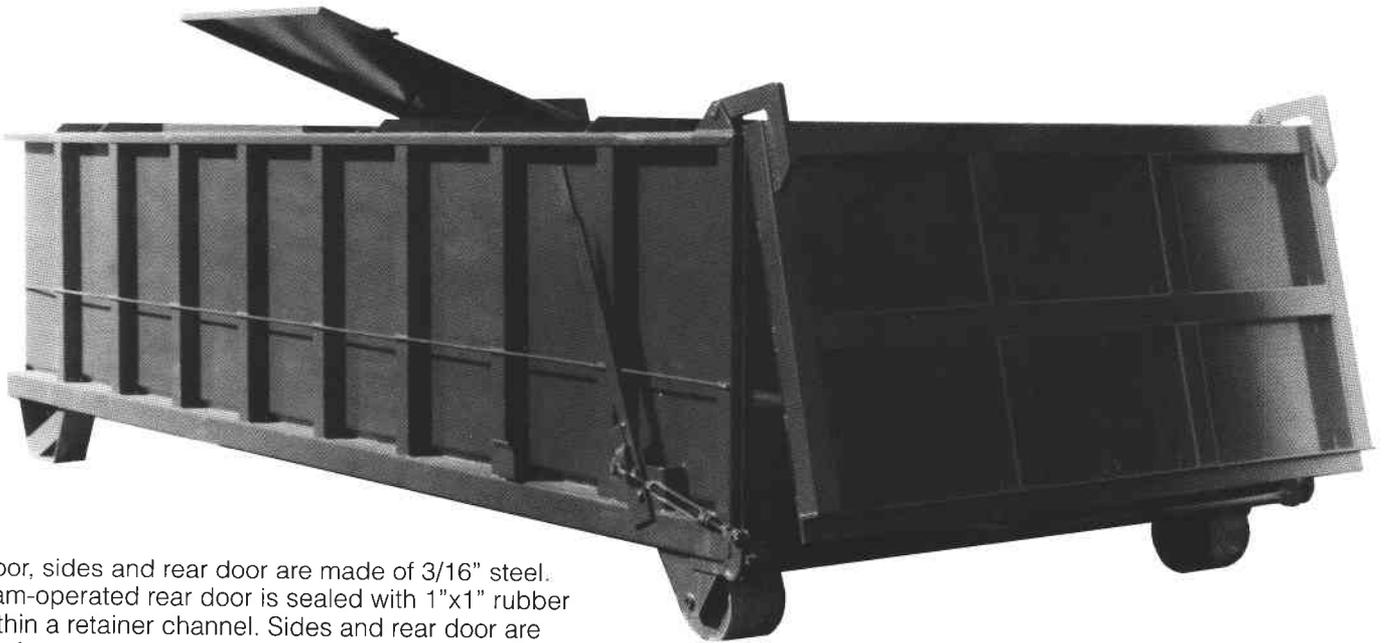
Compaction containers are designed and constructed to withstand repeated high-compaction pressures. These rugged octagonal-shape compactor boxes are fabricated from 3/16" steel and taper evenly front to back. The doors are heavily reinforced and hung on 3/4" hinge plates. The open ends are braced with 5" channels to insure proper door seal and refuse containment.

Capacity: 10 to 42 cubic yards.
Skid lengths range from 10 to 22 feet.



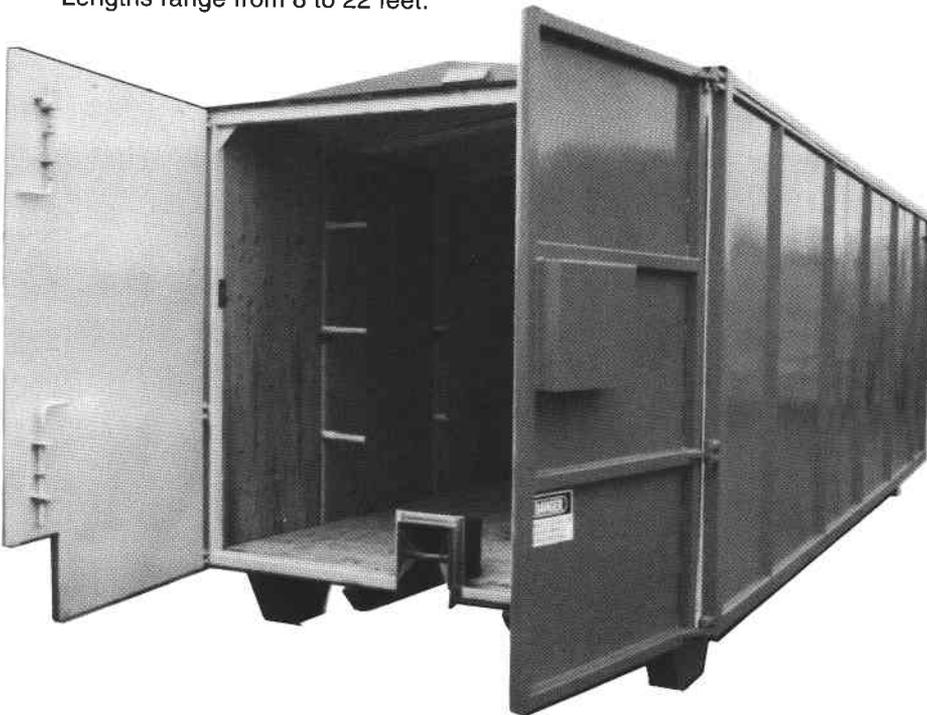
16-foot model

SLUDGE WASTE & STORAGE CONTAINERS



Floor, sides and rear door are made of 3/16" steel. Cam-operated rear door is sealed with 1"x1" rubber within a retainer channel. Sides and rear door are reinforced with structural angle and tubing. Turn-buckles are used to seal and secure the rear door. Standard designs feature a solid top with hatch door access to the container. Open-top containers are also available. These units are particularly suited to sludge and slurry-type wastes.

Capacity: 8 to 30 cubic yards.
Lengths range from 8 to 22 feet.



Capital Industries Storage Containers

- All Steel Construction
- Heavy 10ga Floor Standard
- Interior Vertical Supports Standard
- All Styles of Subframes Available
- Plywood Floors Available upon Request
- Security Doors Each End with Locking System
- Interior Dimensions: 22' Long x 78-6" Wide x 7' High
- Vandal Proof
- Features Include Adjustable Shelf Supports Both Sides (Option)
- 102" Wide Body Available
- Standard Interior Color is White with Exterior Finish as per Customer Requirement
- Wide Variety of Uses and Applications: Construction Sites-Farm & Residential-Commercial & Industrial-Storage

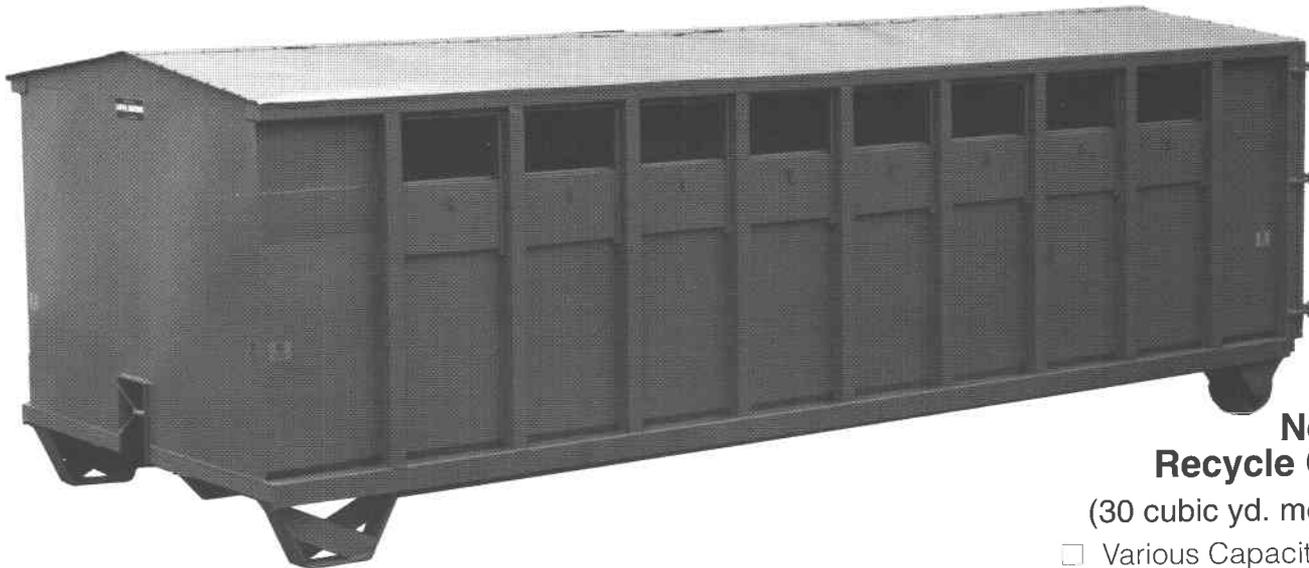
RECYCLE CONTAINERS



Multiple Use Recycle Container

(Model shown: 16 cubic yd. combination aluminum and tin cans)

- Heavy Duty Construction
- With or Without Lids
- Multiple Partition Combinations
- Capacity as per Customer Requirements
- Combination of Partial Roof & Open Top Available



Newspaper Recycle Container

(30 cubic yd. model shown)

- Various Capacities Available
- Multiple Partition Combinations
- Various Side Door Opening Combinations
- Easy-to-Operate Partition Locks
- Adaptable to Any Roll-off Lifting System



Front Load Paper and Cardboard Recycling Bin

(4 through 8 yd. available)

6 Yd. Front-Load Cathedral Style Paper Collection Box

- Optional Swingaway Lid Lock System
- Optional Side-Load Entry
- Front-Loading Chutes with Protective Edges



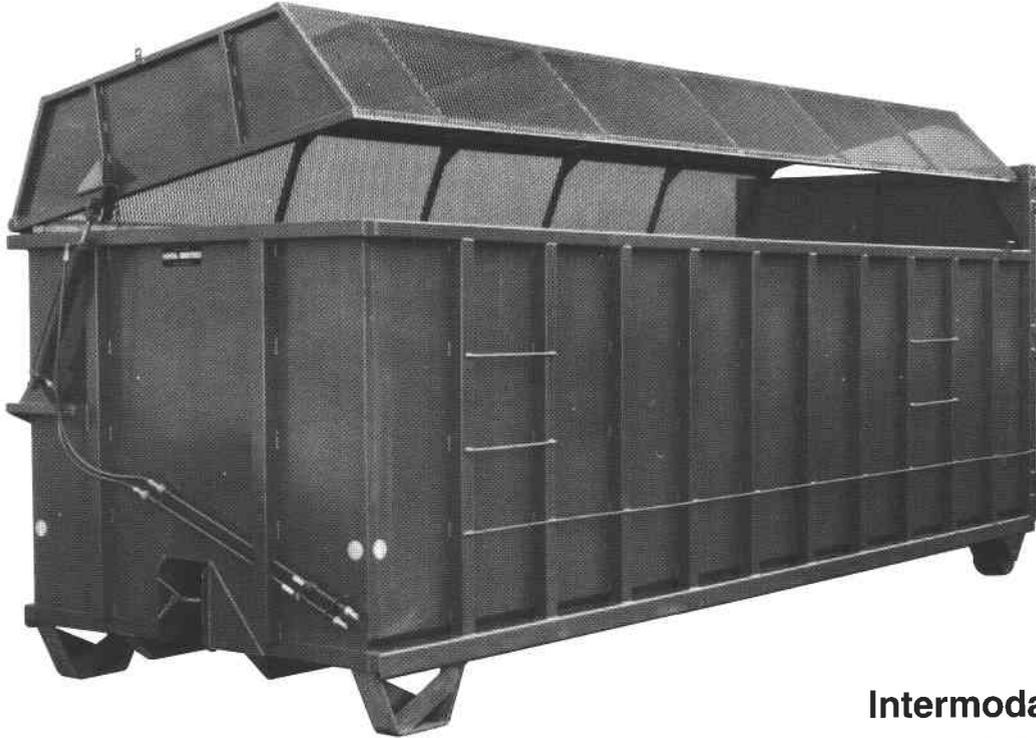
2 Yd. Rear-Load Paper Recycling Box

- With Locking Lid and Top-Pivot Loading Chute

SPECIAL CONTAINERS

Transfer Station Containers

Heavy-duty Transfer Station Container with hydraulically operated Mansard lid. Lid design allows normal high loads at Transfer Stations. Capacity of the model shown is approximately 46 cubic yards. The length is 22 feet.

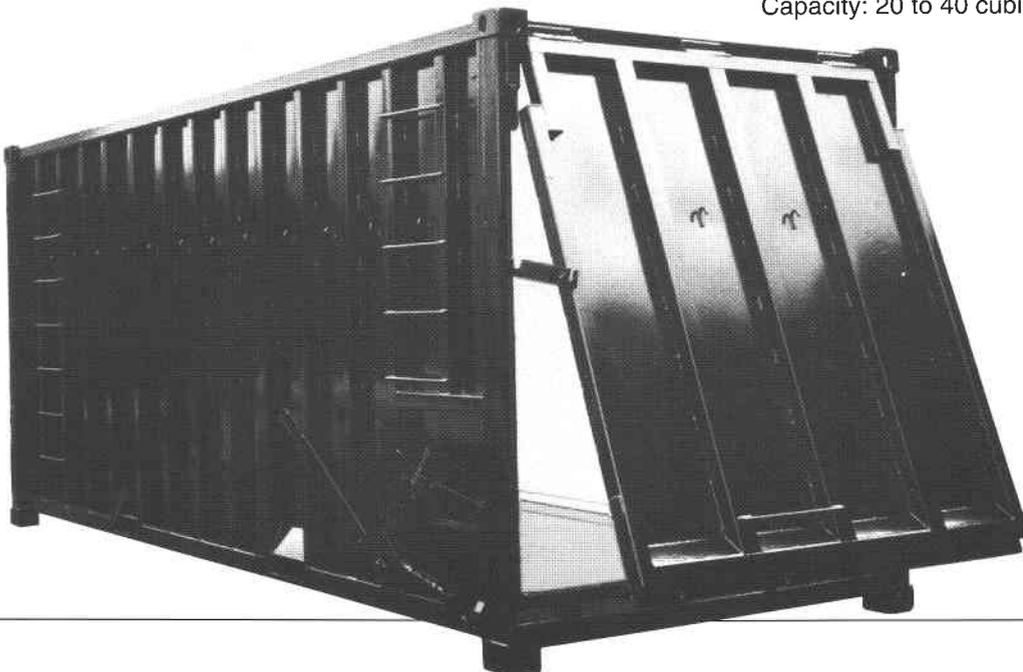


The following are the Special Containers which are manufactured by Capital Industries, Inc.:

- Transfer Station Containers
- Dock Carts
- Transportation Carts
- Radioactive Waste Containers (RAD Waste)
- Tipler Bins

Intermodal Shipping Container

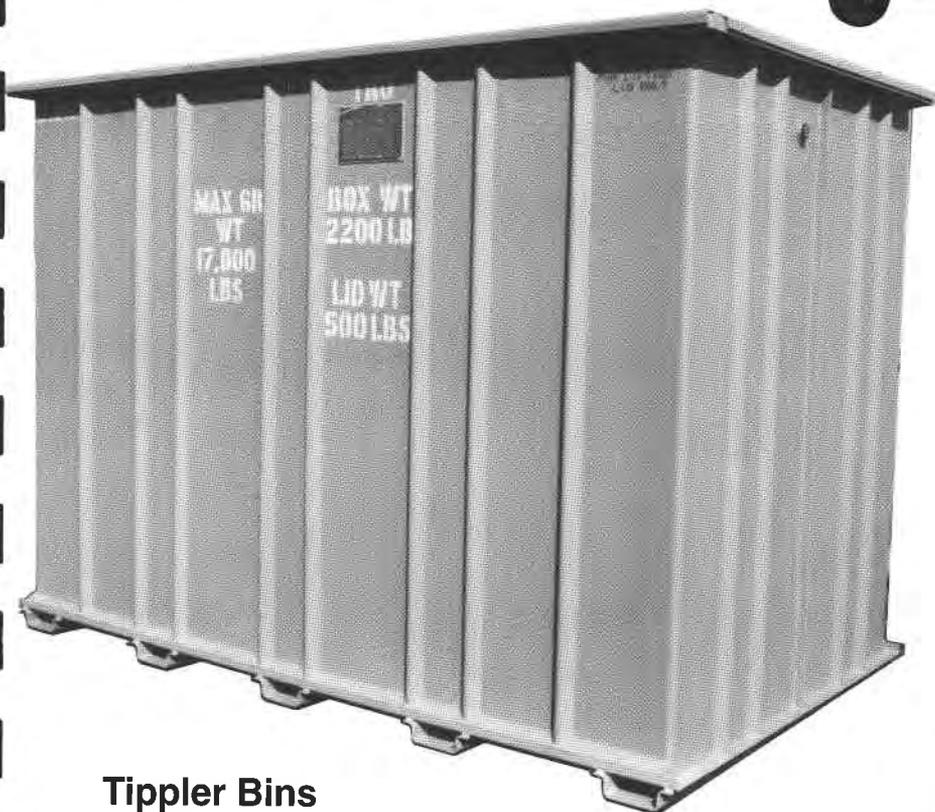
For railroad, truck and barge applications of incinerator ash, sludge, & mill waste. Capacity: 20 to 40 cubic yards.





Custom-Built Transportation Carts

Variety of different sizes available.



Tippler Bins

Rotating, tippler bins are designed for material handling, plant house-keeping and scrap recovery problems.

Sizes available: 1 yd., 2 yd., 3 yd. and 4 yds.



RAD Waste Container

Radioactive waste containers DOT 7A Type A certified steel containers in sizes from 36" W x 36" H x 84" L to 72" W x 84" H x 144" L. Special sizes designed to meet your requirements.

Tippler Bin is first positioned to hook onto container edge. As forks elevate, bin automatically rotates for 180° tipping action. Note safety chain.

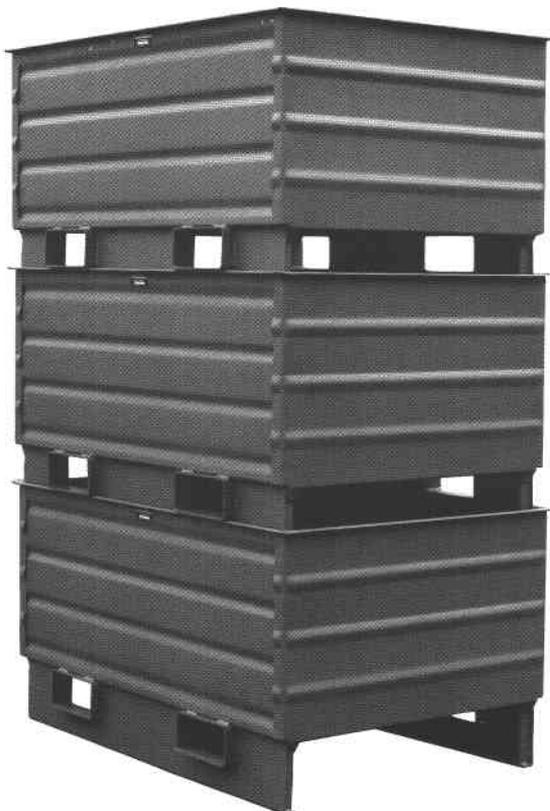
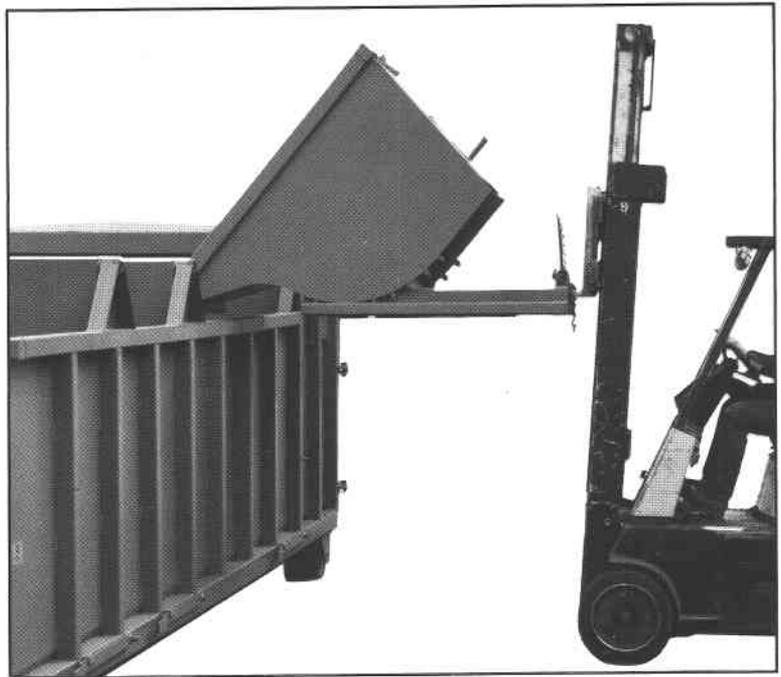
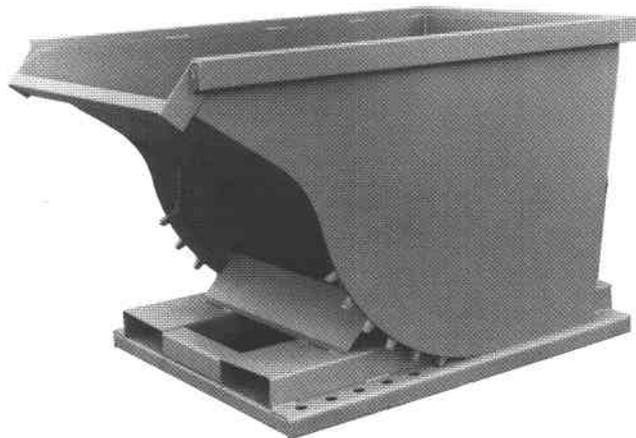


HOPPERS AND BINS

Self-Dumping Hoppers

(1 yd. shown)

Used for many varied types of material handling and recycling applications. Available in sizes 1 cubic yard through 4 cubic yards. Casters are optional.

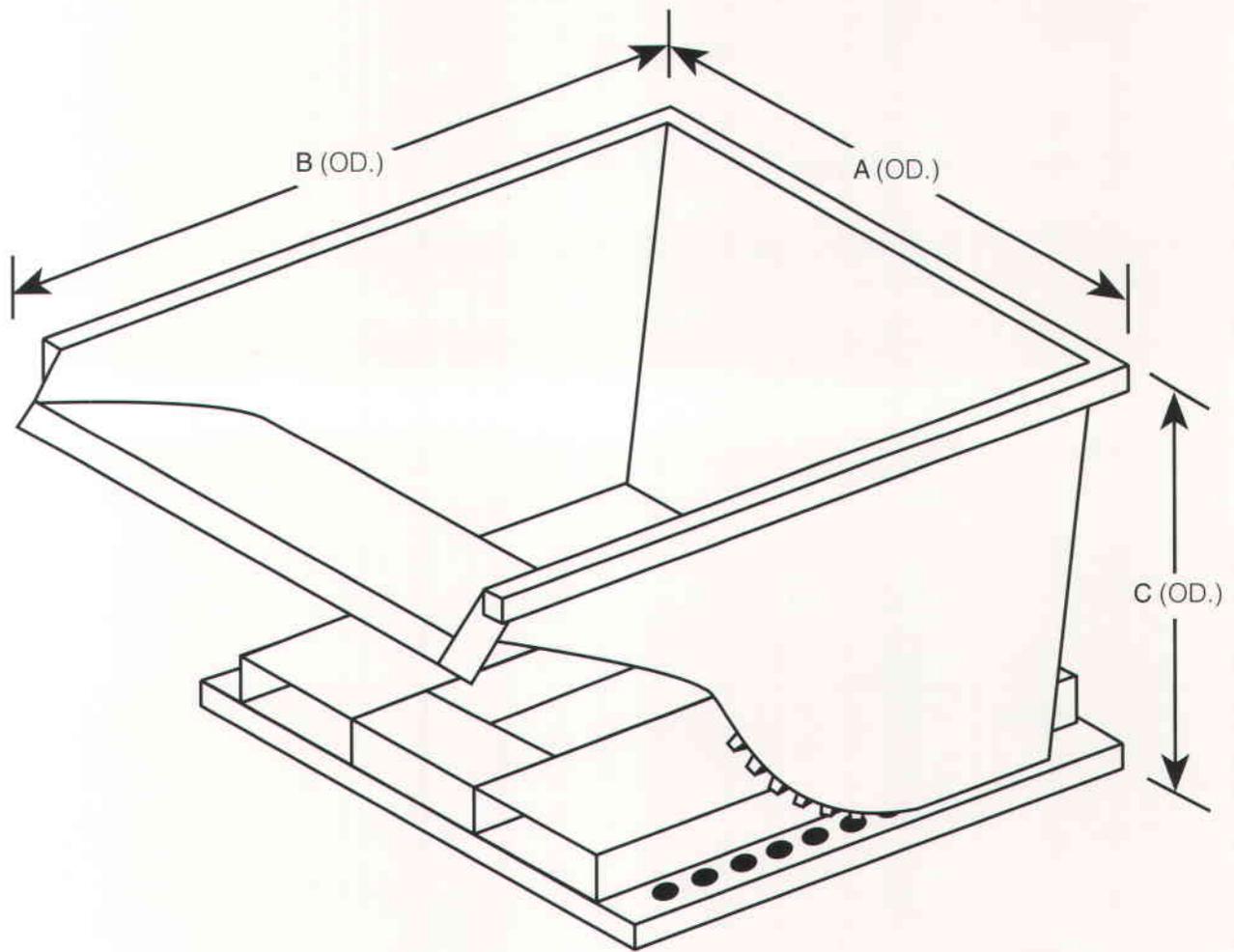


Tote Bins

(Model shown is 36" x 53" x 21" high)

Available in various sizes.
Standard features include:

- Stackability
- Four-way Entry
- Corrugated Panels for Strength



Self-Dumping Hopper Specifications

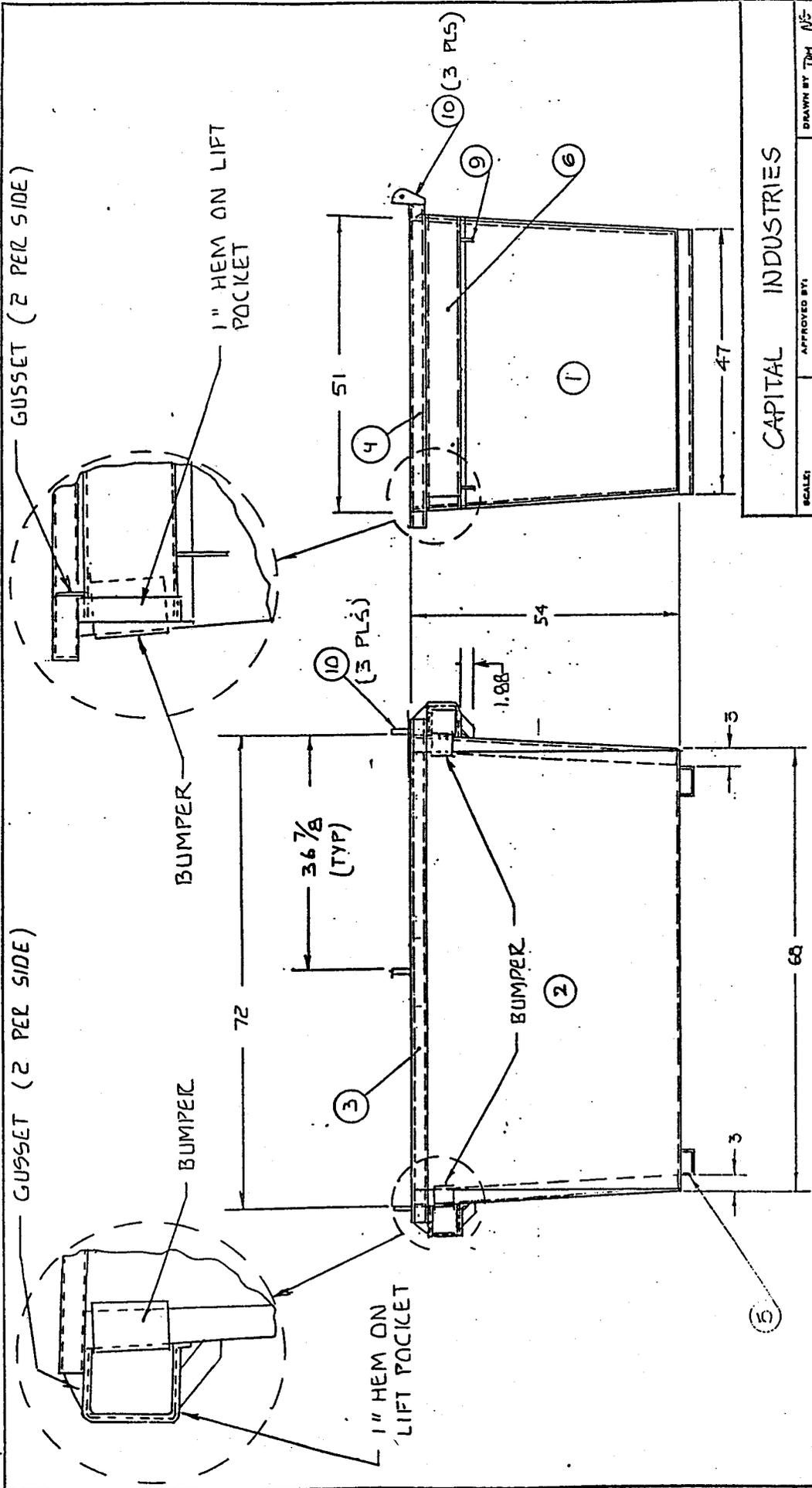
MODEL	1 YD.	2 YD.	3 YD.	4 YD.
CAPACITY	1 cu. yd.	2 cu. yd.	3 cu. yd.	4 cu. yd.
WIDTH "A"	39 $\frac{1}{2}$ "	76"	58"	77"
LENGTH "B"	63 $\frac{3}{4}$ "	64 $\frac{1}{2}$ "	99"	101"
HEIGHT "C"	39"	39"	51"	51"
WEIGHT	508#	830#	960#	1108#



**Capital Industries, Inc.
Metal Fabricators**

**P.O. Box 80983
5801 Third Avenue South
Seattle, Washington 98108**

206-762-8585



CAPITAL INDUSTRIES		APPROVED BY:	DRAWN BY T.M. AS-
SCALE:	DATE: 2-22-96	REVISED:	
4.0 YD. TAPERED F.L. REFUSE		ANCHORAGE	
ASSEMBLY		DRAWING NUMBER	
		AR27267	

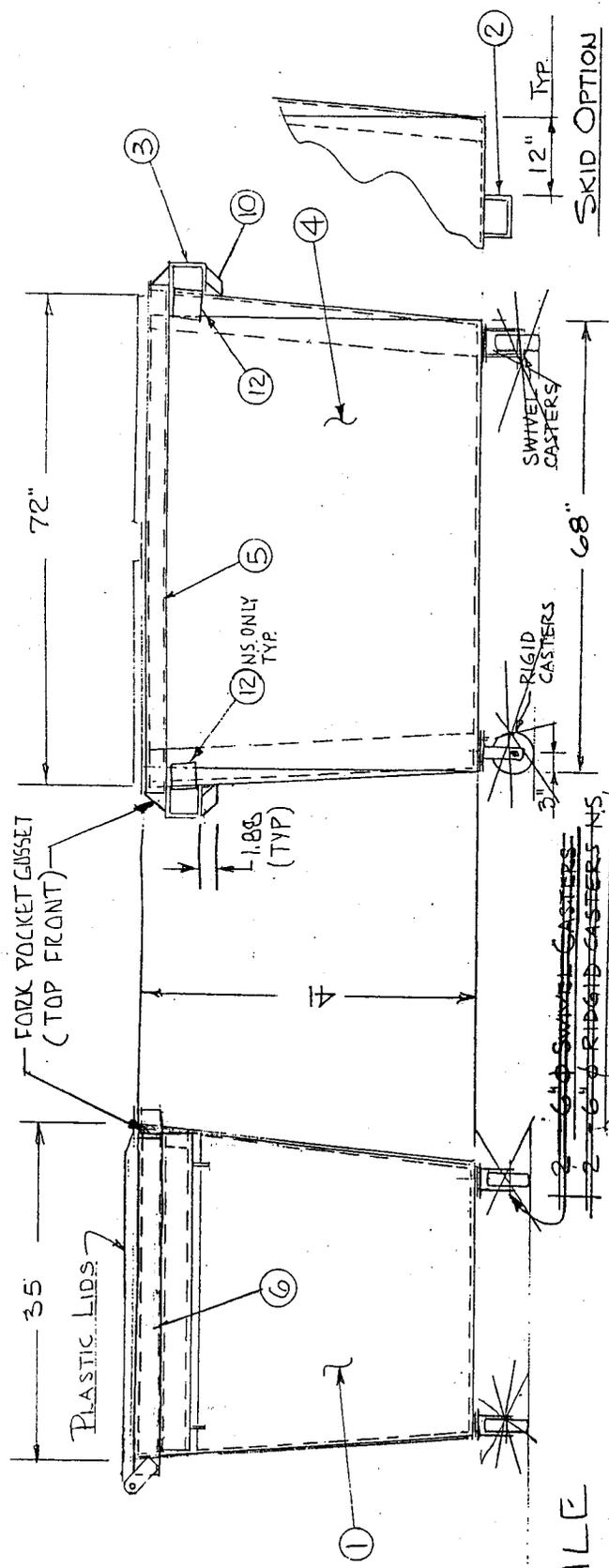
SH 1 OF 4

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11817 PRINTED ON REC. PAPER
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BILL OF MATERIAL				REMARKS	MAT'L SPEC	TOTAL WT.
NO TO SHIP	SHIP MARK	ASSY MARK	NO PCS	DESCRIPTION		

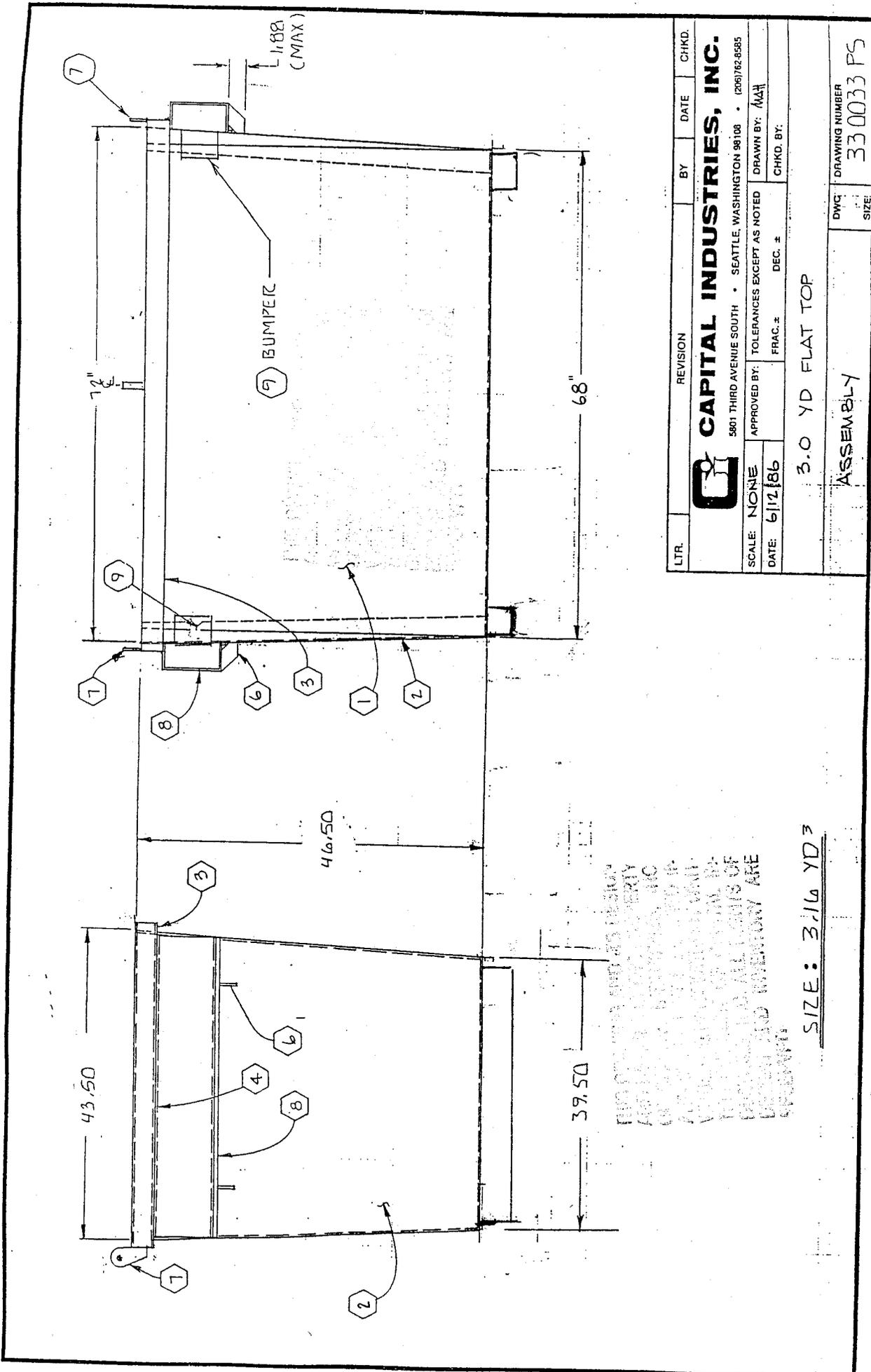


FRONT

SIDE

FILE
 607
 11/30/2000

LTR.	REVISION	BY	DATE	CHKD.
CAPITAL INDUSTRIES, INC.				
5801 THIRD AVENUE SOUTH • SEATTLE, WASHINGTON 98108 • (206)782-8585				
SCALE:	APPROVED BY:	TOLERANCES EXCEPT AS NOTED	DRAWN BY: L.C.	CHKD. BY:
DATE: 7-5-84	FRAC. #	DEC. #		
2.0 Cu. Yd. TAPERED FLAT TOP				DWC
WORK ORDER # 74036				DRAWING NUMBER
				97-36169
				SIZE



SIZE: 3/16 YD³

LTR.	REVISION	BY	DATE	CHKD.
CAPITAL INDUSTRIES, INC.				
5801 THIRD AVENUE SOUTH • SEATTLE, WASHINGTON 98108 • (206) 762-9585				
SCALE: NONE	APPROVED BY: TOLERANCES EXCEPT AS NOTED	DRAWN BY: MAH		CHKD. BY:
DATE: 6/12/86	FRAC. ±	DEC. ±		
3.0 YD FLAT TOP				
ASSEMBLY				DWG. NUMBER
				330033 PS
				SIZE:
				SH 1 OF 3



A DOVER INDUSTRIES COMPANY

INTERNATIONAL GROUP

February 27, 2001
Ref: rbj010227.001

Brown, Vince and Associates
65 Battery Street - Suite 200
San Francisco, CA 94111

Attn.: Ms. Lisa Paroly

PRO FORMA INVOICE

Qty (1) HEIL DURAPACK HALF/PACK FULL EJECT FRONT LOADER (40 Cubic Yard Total Capacity):

- All Standard Performance and Construction Specifications:
- 12 Cubic Yard Hopper
- Sliding Top Door
- 6 Micron Return Line filter with In-Cab Filter Bypass Monitor
- Four Arm Bearing Blocks
- Center Mounted Brake Light
- One Color Paint Finish (Customer's Choice)
- Chrome Plated Cylinder Rods and Telescopic Sleeves
- 140 Micron Suction Line Strainer
- ICC Reflective Tape
- Magnetic Oil Tank Drain Plug
- Cab Shield with Hinged Steel Extension
- 8000 Pounds Capacity Arms
- Fully Automatic Shur-Lock Tailgate Latches
- Bolt-On Rubber Arm Stops
- Backup Alarm
- Front Engine Drive Live Power Pump System with EOS
- Fabric Guard Hose Protection of All High Pressure Hoses
- Mid-Body Turn Signals
- Compliant with all ANSI Standards
- AUTOPACK System
- Programmable Logic Controls (PLC)
- Hinged Left Side Body Access Door
- Anti-Sail, Anti-Splash Mud Flaps
- Proximity Switching System
- Clamp-On-Arms
- Windshield Guard
- FMVSS # 108 Clearance Lights and Reflectors
- Suction Line Shut Off Valve
- Rear Underride Guard
- Tailgate Mounted Access Ladder to Top of Body

Page 1 of 2

- Complete Array of Function Indicator Lights in Cab
- Backup and License Plate Light
- Cross-Packing Cylinders
- Arm Cylinder Deceleration Valve -- Both Up and Down Directions
- In-Cab Air Control System with Joysticks
- Duplicate Stop, Turn and Tail Lights
- Six Month Warranty
- Mounted on 2001 Mack 690S chassis per attached specifications

	<u>Price Each US\$</u>	<u>Total US\$</u>
Net Price	\$155,250.00	\$155,250.00
<i>Ex-Factory Ft. Payne, AL</i>	<i>\$155,250.00</i>	<i>\$155,250.00</i>
Driveaway to Savannah, GA	\$ 600.00	\$ 1,800.00

Options:

Rotating Beacon - \$315.00
 Rear Vision Camera System - \$3,000.00
 Adjustable Fork Kit with Fork Stop Kit - \$2,985.00
 8" Fork Extensions - \$140.00

NOTES:

Payment Terms: Confirmed Irrevocable Letter of Credit, Payable at Sight. All US Banking Charges are for Applicant's Account.
 Shipment: Ex-Factory, 45-60 Days after receipt of chassis. Chassis delivery is presently quoted at 120 days.
 Validity: Price good for 60 days

Thank you for your interest in Heil Environmental Industries, Ltd.

Sincerely Yours,

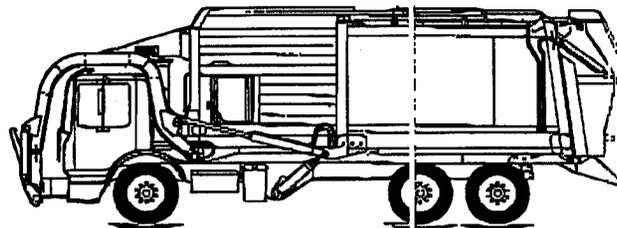


R. B. Quinn
 Managing Director
 Export Group

S P E C I F I C A T I O N S



DURAPACK™ HALF/PACK® FULL EJECT MODEL



DURAPACK™ HALF/PACK® DUMPING MODEL

PERFORMANCE SPECIFICATIONS	
Container Dump Cycle Time	18-20 seconds
Packer Cycle Time	22-26 seconds (Eject) 24-28 seconds (Dump)
Arms Lifting Capacity	8,000 lbs. (tested to 16,000 lbs.)
Compaction Force	105,000 lbs.
Dumping Angle	30°
Clearance - Stop - Tail - Back-up Lamp	FMVSS 108

HYDRAULIC SPECIFICATIONS	
PUMP	
Type	Gear
Max. operating pressure	2500 psi
Working RPM	1300 approx.
GPM at spec. cycle time	50 GPM
OIL RESERVOIR	
Tank Capacity	41 gallons (Eject) 32 gallons (Dump)
Filters	
100 Mesh reusable suction screen; 6 Micron return filter with in-cab filter monitor	
VALVES	
Type	6 section (Eject) or 7 section (Dump) stack valve, 50 GPM @ 2500 psi. Relief valve to prevent overload damage.

CONSTRUCTION SPECIFICATIONS			
HIGH TENSILE STEEL		THICKNESS	
		Standard	Extra Duty
Upper Corner Brace - 4" x 6"		11 ga. ⁽¹⁾	11 ga. ⁽¹⁾
Lower Corner Brace - 4" x 16"		11 ga. ⁽¹⁾	11 ga. ⁽¹⁾
Lower Hopper Sides		3/16 in. ⁽³⁾	3/16 in. ⁽³⁾
Upper Hopper Sides		12 ga. ⁽¹⁾	12 ga. ⁽¹⁾
Lower Packing Blade Face		3/16 in. ⁽²⁾	3/16 in. ⁽²⁾
Upper Half Packing Blade Face		7 ga. ⁽¹⁾	7 ga. ⁽¹⁾
Packer	Upper	1/4 x 3 1/2 in. ⁽²⁾	1/4 x 3 1/2 in. ⁽²⁾
	Slide Wear	3/8 x 3 1/2 in. ⁽²⁾	3/8 x 3 1/2 in. ⁽²⁾
Bars	Side	1/4 x 2 in. ⁽²⁾	1/4 x 2 in. ⁽²⁾
	Packer Tracks	1/4 in. ⁽²⁾	1/4 in. ⁽²⁾
Hopper Floor		1/4 in. ⁽³⁾	1/4 in. ⁽³⁾
Body Floor		3/16 in. ⁽³⁾	1/4 in. ⁽³⁾
Body Sides		10 ga. ⁽¹⁾	8 ga. ⁽¹⁾
Body Roof		10 ga. ⁽¹⁾	8 ga. ⁽¹⁾
Tailgate Sides & Back Sheet (Eject)		10 ga. ⁽¹⁾	10 ga. ⁽¹⁾
Tailgate Sides & Back Sheet (Dump)		11 ga. ⁽¹⁾	11 ga. ⁽¹⁾
Floor Longitudinals*		3/16 in. ⁽¹⁾	3/16 in. ⁽¹⁾
Under Body Cross Members*		5" x 4" 11 ga. ⁽¹⁾	5" x 4" 11 ga. ⁽¹⁾
Vertical Body Corner Posts*		3/16 in. ⁽¹⁾	3/16 in. ⁽¹⁾

(1) 80,000 psi min. yield (2) 145,000 psi min. yield, AR steel
(3) 150,000 psi min. yield, 221 BHN * Formed Channels

CHASSIS REQUIREMENTS							
BODY	USABLE CT	WHEEL BASE	GVWR	MIN. GAWR (F)	MIN. GAWR (R)	MIN. PF (Platform)	
						Dump	Eject
28 yd. ³	162" to 181"	197" to 216"	62,000	18,000	44,000	236"	264"
23 yd. ³	174" to 186"	179" to 185"	58,000	18,000	40,000	204"	236"

Diesel engines require full variable speed governor

BODY SIZE	CYLINDERS															
	PACKER (Dump Models) (2) Double Acting		PACKER / EJECT (Eject Models) (2) 3-Stage Double Acting Telescopic		ARM (2) Double Acting		HOIST (Dump Models) (2) Single Acting		FORKS (2) Double Acting		TOP DOOR (2) Double Acting		TAILGATE (2) Double Acting Each			
	BORE	STROKE	BORE	STROKE	BORE	STROKE	BORE	STROKE	BORE	STROKE	BORE	STROKE	BORE	STROKE	BORE	STROKE
28 yd. ³	5.5"	63"	5.5"	182"	4.5"	41.5"	4.5"	67.5"	4.0"	25"	2.5"	90	3.0"	28.25"	3.0"	3.62"
23 yd. ³	5.5"	63"	5.5"	151"	4.5"	41.5"	4.5"	67.5"	4.0"	25"	2.5"	68"	3.0"	28.25"	3.0"	3.62"

MODEL	BODY CAPACITY	HOPPER CAPACITY ⁽⁴⁾	GROSS CAPACITY	GROSS WEIGHT (APPROXIMATE)		OVERALL LENGTH ⁽⁵⁾	OVERALL WIDTH	OVERALL HEIGHT		HOPPER OPENING
				STANDARD	EXTRA DUTY			ARMS DOWN	ARMS UP	
				HPH-D-28	28 yd. ³			12 yd. ³	40 yd. ³	
HPH-E-28	28 yd. ³	12 yd. ³	40 yd. ³	18,600 lbs.	19,000 lbs.	412"	96"	107.5"	120.5"	80" x 93"
HPH-D-23	23 yd. ³	12 yd. ³	35 yd. ³	18,000 lbs.	18,400 lbs.	360"	96"	107.5"	120.5"	80" x 93"
HPH-E-23	23 yd. ³	12 yd. ³	35 yd. ³	17,600 lbs.	18,000 lbs.	360"	96"	107.5"	120.5"	80" x 93"

(4) Nominal (5) Arms down, Forks tucked



HEIL ENVIRONMENTAL INDUSTRIES, LTD.
A **DOVER** INDUSTRIES COMPANY

Contact Your Heil Distributor



INTERNATIONAL GROUP

February 27, 2001
Ref: rb 010227.002Brown, Vince and Associates
65 Battery Street – Suite 200
San Francisco, CA 94111

Attn.: Ms. Lisa Paroly

PRO FORMA INVOICE**Qty (4) HEIL FORMULA ® 4000 25 CUBIC YARD (19.11 CUBIC METER) REAR LOADER:**

- All Standard Performance and Construction Specifications:
- 2.3 Cubic Yard (19.11 Cubic Meter) Hopper
- High-Tensile Steel Body
- Interlaced Subfloor
- 10 Micron Return Line Filter
- 24 Gallon (90.8 liter) Oil Reservoir
- Neutral Safety Switch
- Center Mounted Brake Light
- One Color Paint Finish (Customer's Choice)
- ICC Reflective Tape
- Backup and License Plate Light
- Heavy Duty Bronze Slide Bearings
- Dual Turn, Tail And Brake Lights in Lower Tailgate and Above Hopper
- Backup Alarm
- Throttle Advance
- Remote Mount Cast Iron Roller Bearing PTO Pump
- Tailgate Service Props
- Suction Line Shut Off Valve
- FMVSS #108 Clearance Lights and Reflectors
- 12 Volt Lighting and Electrical Systems
- Right Side Packer and Signal Controls
- Six Month Warranty
- Mounted on 2001 International 4900 6x4 (SF495) Truck

	<u>Price Each US\$</u>	<u>Total JS\$</u>
Net Price	\$94,000.00	\$376,000.00
Ex-Factory Ft. Payne, AL	\$94,000.00	\$376,000.00
Driveaway to Savannah, GA	\$ 600.00	\$ 2,400.00

Options:

8,000 Lb. (3,636 Kg.) Line Pull Drum Winch with Control and Latch Kits - \$2,025.00
Body Side Access Door - \$350.00

NOTES:

Payment Terms: Confirmed Irrevocable Letter of Credit, Payable at Sight. All US Banking Charges are for Applicant's Account.
Shipment: Ex-Factory, 30-45 Days after receipt of chassis. Chassis delivery is presently quoted at 90 days.
Validity: Price good for 60 days

Thank you for your interest in Heil Environmental Industries, Ltd.

Sincerely Yours,



R. B. Quinn
Managing Director
Export Group

S P E C I F I C A T I O N S

CONSTRUCTION SPECIFICATIONS		
High Tensile Steel	Thickness	mm
Body sides	11 ga.	3.038
Body roof	11 ga.	3.038
Body floor	10 ga.	3.416
Body longitudinal	8 ga.	4.176
Floor support members	11 ga.	3.038
Front head	11 ga.	3.038
Hopper floor (150,000 PSI yield)	3/16 in.	4.763
Hopper sides	10 ga.	3.416
Packing blade (80,000 PSI yield)	3/16 in.	4.763
Ejector panel	11 ga.	3.038

HYDRAULIC SPECIFICATIONS	
PUMP	
Type	High pressure gear.
Maximum operating pressure	500 psi (17,237 kPa)
GPM at working RPM	2 GPM (83.28 liters/min.)
OIL RESERVOIR	
Tank capacity	4 gallons (90.6 liters).
Filters	Return line 10 micron, replaceable element.
VALVES	
Shut-off	Standard.
Packing control	Pool type.
Ejector and tailgate raise	Pool type.

OPERATING CONTROLS	
Packing	Right side of tailgate.
Tailgate raise	Forward left corner of body.
Ejector	Forward left corner of body
P.T.O.	Inside cab.
Signal buzzer switches	Right side of tailgate.
Engine speed-up	Forward left corner of body.

CHASSIS REQUIREMENTS									
MODEL	MIN. GVWR	MIN. GAWR ²		USABLE CA		USABLE CT		MIN. AF	
		Front	Rear	Inches	mm	Inches	mm	Inches	mm
4000-13	26,000	8,000	18,000	96"	2438	NA	NA	32	813
4000-16	27,000	9,000	18,000	108	2743	NA	NA	32	813
4000-18	29,500	9,000	20,000	120	3048	NA	NA	32	813
4000-20	32,000	9,000	23,000	138	3505	120	3049	32/31	813/1285
4000-25	43,000	9,000	34,000	ND	ND	137	3480	51	1295

² Requires 7" forward mounting of body.

NOTES:

- 1) Any chassis sent to The Heil Co. with less than these minimum GVWR/GAWRs will not be mounted.
- 2) If CA/CT is not as recommended, contact Heil Environmental Industries, Ltd. for applicable weight distribution and GVW/GAWR requirements.
3. Diesel engines require full variable speed governor.
4. L.H. Side Door optional
5. Closed Front Haul optional

TAILGATE SPECIFICATIONS

MODEL	HOPPER CAPACITY (TBEA Rated)		LOADING SILL HEIGHT BELOW CHASSIS FRAME		HOPPER LOADING WIDTH		HOPPER OPENING HEIGHT		CYCLE TIME Seconds	
	Yd ³	m ³	Inches	mm	Inches	mm	Inches	mm	Complete	Reload
4000-13-20	2.3	1.76	0	0	80	2032	46	1168	22-26	12-15
4000-25	2.3	1.76	2	51	80	2032	46	1168	22-26	12-15

BODY SPECIFICATIONS

MODEL	BODY CAPACITY		OVERALL LENGTH		OVERALL LENGTH TAILGATE RAISED		OVERALL WIDTH		OVERALL HEIGHT ABOVE FRAME		OVERALL HEIGHT TAILGATE RAISED		GROSS WEIGHT APPROXIMATE	
	Yd ³	m ³	Inches	mm	Inches	mm	Inches	mm	Inches	mm	Inches	mm	Lbs.	Kg.
4000-13	13.8	10.55	186	4724	211	5359	95.75	2432	86	2184	156	3962	9,100	4,128
4000-16	16	12.23	201	5105	226	5740	95.75	2432	86	2184	156	3962	9,400	4,264
4000-18	18	13.76	217	5512	241.5	6134	95.75	2432	86	2184	156	3962	9,650	4,377
4000-20	20	15.29	231	5867	255	6477	95.75	2432	86	2184	156	3962	9,900	4,491
4000-25	25	19.11	254	6452	287	7299	95.75	2432	93	2362	167	4242	10,700	4,853

CYLINDERS

MODEL	TAILGATE RAISE (2)				PACKING BLADE (2)				SLIDE (2)				EJECTION (1)					
	BORE		STROKE		BORE		STROKE		BORE		STROKE		MODEL	STAGES	BORE		STROKE	
	Inches	mm	Inches	mm	Inches	mm	Inches	mm	Inches	mm	Inches	mm			Inches	mm		
ALL	3	76.2	31	787.4	4	101.6	21 5/8	549.27	4 1/2	114.3	26 1/2	673.1	4000-13	3	5 1/2	140	64.75	1645
													4000-16	3	5 1/2	140	81.12	2060
													4000-18	4	6 1/2	165	98.12	2441
													4000-20	4	6 1/2	165	110.12	2767
													4000-25	4	6 1/2	165	129.00	3277



HEIL ENVIRONMENTAL INDUSTRIES, LTD.
A **TRIMET** INDUSTRIES COMPANY

P.O. Box 8676
Chattanooga, TN 37414, USA
1-800-824-4345 Fax: (423) 855-8478
www.heil.com

HEIL Specifications "1MRD"

2001 Mack 690S 210" W/B

4560P Automatic Transmission

Frame:

13.25" x 3.25" x 0.3125" w/ 0.25" inside channel reinforcement
 Combined Rating: 26.06 SM, 110,000 PSI steel, 2,870,000 in. lbs. RBM

Wheelbase/Platform:

210" WB, 289" LP

Engine:

EM7-300 - E-Tech
 300 HP @ 1750 gov. RPM
 1425 ft. lb. max torque @ RPM

Transmission:

Allison 4560P automatic- six speed
 Ratios: 4.7 low - 0.67 high - 68 mph geared/ 65 mph road speed limit

Engine Equipment:

Air compressor, 16.5 CFM Bendix TF-750
 Alternator, Delco 12VG 100A (21S1)
 Batteries, three (3) Mack 12V MP 625/1875 CCA
 Battery disconnect switch, E-Tech alarm, idle shutdown system
 Engine block heater, Phillips 1500W 120V
 Exhaust, single vertical w/ rain cap
 Starter, 12V Delco
 15" air cleaner
 Dietz HD electronic flashers
 Sprayed moisture proofing on electrical connections "Glyptol"

Transmission Equipment/Drivelines:

Neutral control for variable speed, stationary operation of rear case
 Side mounted PTO opening
 Drivelines: Spicer 1760 main & 1710 HD interaxle w/ coated splines

Cab:

CA531 low C.O.E. galvanized steel
 Air conditioner (Red Dot) w/ integral "E-Tech" heater
 Engine protection alarm system, Kysor w/ light & buzzer
 Electronic speedometer w/ trip odometer
 Electronic tachometer w/ hourmeter
 Roll-up window LH side
 Hand throttle control (electronic)
 Horn- air, twin trumpet (mounted under cab)
 Radio accommodation package (no radio)
 Radio antenna
 Cab front ladder & anti-skid roof surface
 Drive seat- Bostrom mid-back air suspension w/ DuPont cover
 Rider seat- Mack fixed non-suspension

Frame Equipment:

Bumper, swept back channel type 15" front frame extension for refuse service
 Crossmember 0.5" thick steel plate, bolted back-to-back, behind cab skid plate
 under bumper and radiator

HEIL Specifications "1MRD"

Page 2

Towing Device:

Front tow pin

Fuel Tanks:

70 ga. RH rectangular steel (approx. 15"H x 27.5"D x 46"L)

Front Axle/Equipment/Tires:

Axle: FAW 20 20,000#

Tires: Goodyear 425/65R 22.5 (G-286)

Wheels: 12.25" x 22.5" hub pilot (disc) Grey

Brakes: Rockwell Q-type "S" cam 16.5" x 5" brake drums, cast outboard mounted slacker adjusters, Haldex, automatic

Springs: Mack multi-leaf 20,000# grd. ld. rating

Steering: Sheppard 5925 integral power, ratio 20.1:1

Rear Axle/Equipment/Tires:

Mack S462 46,000# capacity

Suspension: Mack multi-leaf spring 46,000# capacity- SS462

Suspension fastening system: Huck bolts

Carrier, malleable (CRDPC 92/CRD93)- Ratio 4.64 (68 mph)

Tires: Goodyear 11R22.5, 14 ply, G-328 traction type

Wheels: 8.25" x 22.5" hub pilot (disc) Grey

Brakes: Meritor Q-plus "S" cam 16.5" x 7"

Brake drums, cast outboard mounted slacker adjusters, Haldex, automatic

Anti-sway springs

50" axle spacing

Air/Brake:

ABS federal anti-lock braking system

Air Dyer: Bendix "System Guard" AD-9 heated

30/30 Air brakes chambers

Air reservoirs, relocation mounted inside frame rail forward of bogie

Paint:

Cab, Fenders: Mack White- High Gloss

Chassis Running Gear: Mack Black Urethane, Water Base

PTO/Specialty/Additional Equipment:

PTO: Crankshaft adapter 1350 series flange for refuse PTO drive

Estimated Chassis Weight:

Front: 10,900#, Rear 7,720#, Total 18,620#



Formula[®] 4000

Mid-Range Rear Loader



The Standard Of The
Industry Worldwide.

HEIL ENVIRONMENTAL
INDUSTRIES, LTD.

A DOVER INDUSTRIES COMPANY

Heil Formula[®] 4000. The rear loader in the world.

The Heil Formula[®] 4000 rear loader is the mid-range workhorse of the industry. Its low profile, high-tensile steel body delivers the biggest payload-to-weight ratio of any mid-range rear loader. With a variety of container handling options available, the Formula[®] 4000 is a complete, economical system for refuse collection.

One Tough Body

Heil builds refuse vehicles to last. We start with high-tensile steel to put extra strength into the body and tailgate without adding extra weight. Heil's interlaced subfloor puts even more strength where it's needed most, to ensure years of dependable service. The body is full-seam welded (not skip welded) for superior strength, rust-free service and a cleaner appearance.

Low Cost of Ownership

Thousands of satisfied customers worldwide are using the Heil mid-range rear loader to handle collections in big cities and small towns alike.

Because we build it better in the beginning for greater durability and dependability, your long term cost of ownership is lower with the Formula[®] 4000. You can be assured your Formula[®] 4000 will be on the route day in and day out for years to come. That kind of dependability not only saves you money, it means peace of mind. And that can be priceless.



Tight Fit.
Ejector panel is engineered for precise fit and does not contact the tailgate. The snoutless ejector, with elevated cylinder base and aluminum/brass alloy shoes, ensures lower maintenance costs.



Open Front Head.
Provides easy access for maintenance behind ejector panel and to the ejector cylinder. An optional side access door is also available with an enclosed front head.

most popular mid-range
model, with over 15,000 sold.



Also Available in Narrow Width Models.



Stronger Floor.

Heil's interlaced subfloor and abrasion-resistant, high tensile steel result in a stronger floor to survive the most demanding conditions.



Filtration.

External oil tank with 10 micron spin-on oil filter and suction line shutoff valve. Easy service of hydraulic oil system will mean your system stays cleaner, reducing wear on hydraulic components.



Lighting.

High visibility lighting is standard on the Formula® 4000, for the safety of your operators as well as your customers.



Container Handling Options

A variety of container mechanisms are available, including the winch (shown), the fully hydraulic roll bar, and the reeving cylinder.

S P E C I F I C A T I O N S

CONSTRUCTION SPECIFICATIONS		
High Tensile Steel	Thickness	mm
Body sides	11 ga.	3.038
Body roof	11 ga.	3.038
Body floor	10 ga.	3.416
Body longitudinal	8 ga.	4.176
Floor support members	11 ga.	3.038
Front head	11 ga.	3.038
Hopper floor (150,000 PSI yield)	3/16 in.	4.763
Hopper sides	10 ga.	3.416
Packing blade (80,000 PSI yield)	3/16 in.	4.763
Ejector panel	11 ga.	3.038

HYDRAULIC SPECIFICATIONS	
PUMP	
Type	High pressure gear.
Maximum operating pressure	2500 psi (17,237 kPa)
GPM at working RPM	22 GPM (83.28 liters/min.)
OIL RESERVOIR	
Tank capacity	24 gallons (90.8 liters).
Filters	Return line 10 micron, replaceable element.
VALVES	
Shut-off	Standard.
Packing control	Spool type.
Ejector and tailgate raise	Spool type.

OPERATING CONTROLS	
Packing	Right side of tailgate.
Tailgate raise	Forward left corner of body.
Ejector	Forward left corner of body
P.T.O.	Inside cab.
Signal buzzer switches	Right side of tailgate.
Engine speed-up	Forward left corner of body.

CHASSIS REQUIREMENTS									
MODEL	MIN. GVWR	MIN. GAWR ²		USABLE CA		USABLE CT		MIN. AF	
		Front	Rear	Inches	mm	Inches	mm	Inches	mm
4000-13	26,000	8,000	18,000	96*	2438	NA	NA	32	813
4000-16	27,000	9,000	18,000	108	2743	NA	NA	32	813
4000-18	29,500	9,000	20,000	120	3048	NA	NA	32	813
4000-20	32,000	9,000	23,000	138	3505	120	3049	32/51	813/1295
4000-25	43,000	9,000	34,000	ND	ND	137	3480	51	1295

All designs, specifications and components are subject to change at the manufacturer's sole discretion at any time without notice. Data published herein is for information purposes only and shall not be construed to warrant suitability of the unit for any particular purpose, as performance may vary with the conditions encountered. The only warranty is our standard written warranty for this product.

- NOTES:
- Any chassis sent to The Heil Co. with less than these minimum GVWR/GVARs will not be mounted.
 - If CA/CT is not as recommended, contact Heil Environmental Industries, Ltd. for applicable weight distribution and GVWR/GAWR requirements.
 - Diesel engines require full variable speed governor.
 - L.H. Side Door optional
 - Closed Front Head optional

*Requires 7" forward mounting of body.

TAILGATE SPECIFICATIONS										
MODEL	HOPPER CAPACITY (TBEA Rated)		LOADING SILL HEIGHT BELOW CHASSIS FRAME		HOPPER LOADING WIDTH		HOPPER OPENING HEIGHT		CYCLE TIME Seconds	
	Yd ³	m ³	Inches	mm	Inches	mm	Inches	mm	Complete	Reload
4000-13-20	2.3	1.76	0	0	80	2032	46	1168	22-26	12-15
4000-25	2.3	1.76	2	51	80	2032	46	1168	22-26	12-15

BODY SPECIFICATIONS														
MODEL	BODY CAPACITY		OVERALL LENGTH		OVERALL LENGTH TAILGATE RAISED		OVERALL WIDTH		OVERALL HEIGHT ABOVE FRAME		OVERALL HEIGHT TAILGATE RAISED		GROSS WEIGHT APPROXIMATE	
	Yd ³	m ³	Inches	mm	Inches	mm	Inches	mm	Inches	mm	Inches	mm	Lbs.	Kg.
4000-13	13.8	10.55	186	4724	211	5359	95.75	2432	86	2184	156	3962	9,100	4,128
4000-16	16	12.23	201	5105	226	5740	95.75	2432	86	2184	156	3962	9,400	4,264
4000-18	18	13.76	217	5512	241.5	6134	95.75	2432	86	2184	156	3962	9,650	4,377
4000-20	20	15.29	231	5867	255	6477	95.75	2432	86	2184	156	3962	9,900	4,491
4000-25	25	19.11	254	6452	287	7299	95.75	2432	93	2362	167	4242	10,700	4,853

CYLINDERS																		
MODEL	TAILGATE RAISE (2)				PACKING BLADE (2) Double Acting				SLIDE (2) Double Acting				EJECTION (1) Double Acting Telescopic					
	BORE Inches	mm	ISTROKE Inches	mm	BORE Inches	mm	STROKE Inches	mm	BORE Inches	mm	STROKE Inches	mm	MODEL	STAGES	BORE Inches	mm	STROKE Inches	mm
ALL	3	76.2	31	787.4	4	101.6	21 5/8	549.27	4 1/2	114.3	26 1/2	673.1	4000-13	3	5 1/2	140	64.75	1645
													4000-16	3	5 1/2	140	81.12	2060
													4000-18	4	6 1/2	165	96.12	2441
													4000-20	4	6 1/2	165	110.12	2797
													4000-25	4	6 1/2	165	129.00	3277



HEIL ENVIRONMENTAL INDUSTRIES, LTD.
A DOVER INDUSTRIES COMPANY

P.O. Box 8676
Chattanooga, TN 37414, USA
1-800-824-4345 Fax: (423) 855-3478
www.heil.com



DPF Formula[®] 5000



**A Great Rear Loader
Just Got Better**

A Member Of The

DuraPack[™] Family

DuraPack™ Family

Formula® 5000

Legendary

The Heil Formula® 5000 re... toughness and durability, hi... work ethic. The time tested... municipal fleets, as well... private haulers and major w... it's hard to improve on su...



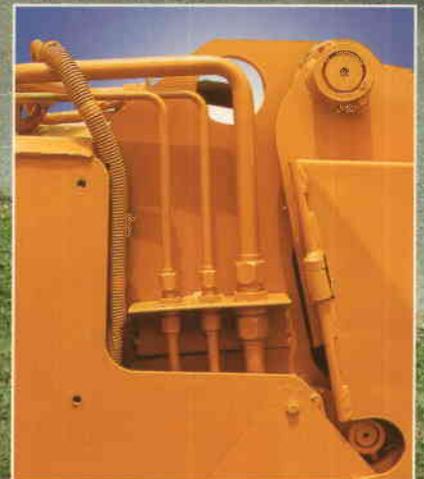
More than just good looks

In addition to its stylish appearance, the DuraPack™ body's curved shell and flat floor give the Formula® 5000 superior strength and durability. The body side is made from a single sheet of steel turned horizontally, which means packing forces will work with the grain of the steel for less wear. The snoutless concave ejector discharges loads cleanly, while the high angle cylinder mount puts more payload forward in the body for better weight distribution and less packing force on the track and floor.



A Solid Foundation

Heil's famous interlaced subframe is even better with the DPF body – more crossmembers, all evenly spaced and fully welded for superior resistance to corrosion.



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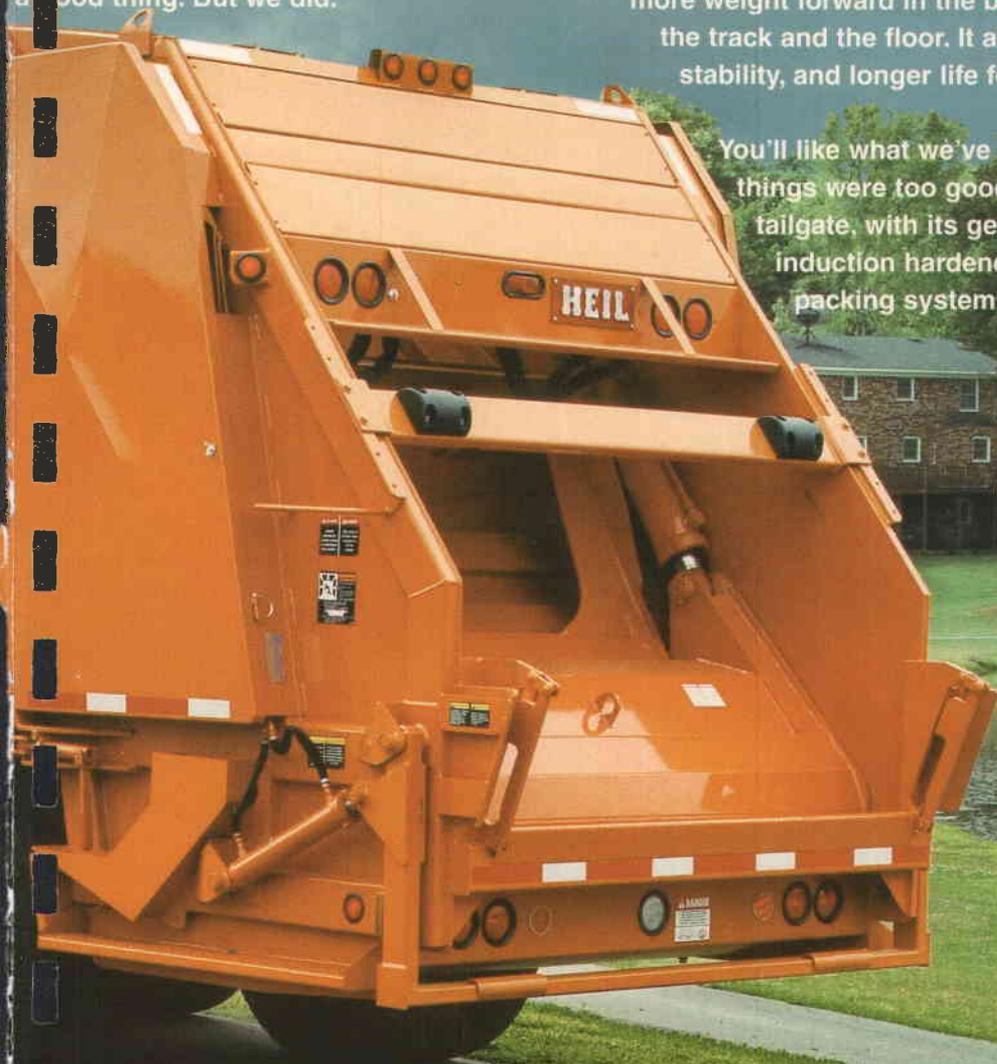
Quality In A Stylish New Package

Heil is known throughout the world for its high compaction payloads, and no-nonsense Formula[®] 5000 is the workhorse of large rear loader of choice for independent waste companies alike. With over 13,000 built, it's a good thing. But we did.

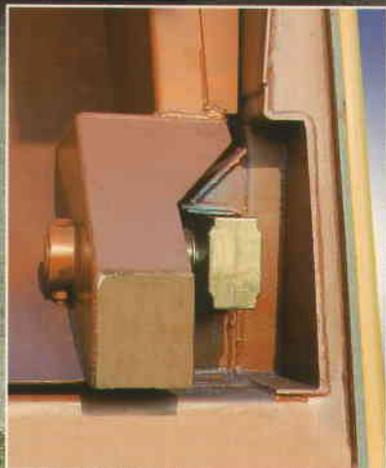
The new Formula[®] 5000 has joined the DuraPack[™] Family of products from Heil, with a smooth sided body made from a single sheet of high tensile steel, protected and concealed hydraulic tubes, and a stronger interlaced subframe. The DPF 5000 also uses the improved, high angle ejector cylinder mount which allows the ejector to retract farther, putting more weight forward in the body while reducing the packing forces on the track and the floor. It all adds up to better payloads, better stability, and longer life for internal body components.

You'll like what we've done to your favorite rear loader. But some things were too good to change. Like the Formula[®] 5000 tailgate, with its generous hopper, chrome plated and induction hardened cylinders for longer life, and the linkage packing system with no rollers or slides to wear out.

The DuraPack[™] Family Formula[®] 5000. It's solid proof that you can take a good thing and make it even better.



Making Your
easier
engineers
designed
DuraPack[™]
body for
service and
performance, like
easy to reach
hydraulic tubes,
located inside
rear bolster.



Common Sense Engineering

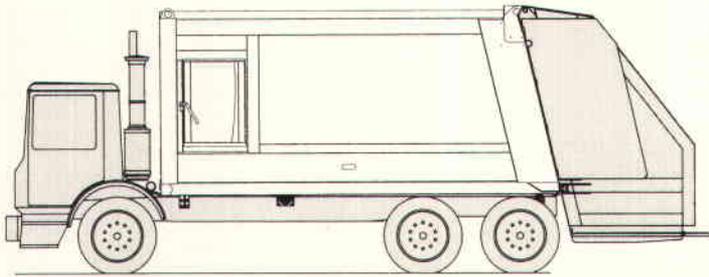
The raised ejector track on the DPF Formula[®] 5000 means longer wear, and the cast alloy shoes are easily serviced without removing the ejector panel.

Easy, Reliable Controls

Manual packing controls allow the operator to stop, start, or reverse either the upper panel or blade at any point in the packing cycle. A normal packing cycle is completed in two steps with one-hand operation. With a reload time of 9 to 11 seconds, the DPF Formula[®] 5000 is fast and efficient. A variety of container handling options are available, including the roll bar and lip-and-latch kit shown here.

S P E C I F I C A T I O N S

All designs, specifications and components are subject to change at the manufacturer's sole discretion at any time without notice. Data published herein is for information purposes only and shall not be construed to warrant suitability of the unit for any particular purpose, as performance may vary with the conditions encountered. The only warranty is our standard written warranty for this product at the time of shipment.



DuraPack™ Family Formula® 5000 High Compaction Rear Loader

HYDRAULIC SPECIFICATIONS	
PUMP	
Type	High pressure gear.
Max. operating pressure	2500 psi
GPM at working RPM	26 GPM (98 liters/min. @1100 rpm)
OIL RESERVOIR	
Tank capacity	18, 20 & 25 yd. – 34 gallons (129 liters) 27 & 32 yd. – 45 gallons (170 liters)
Filters	100 Mesh (140 Micron) suction line replaceable 6 Micron return line with in-cab filter monitor
VALVES	
Shut-off	Gate valve in suction line between pump and reservoir
Packing control	Spool type.
Ejector and tailgate raise	Spool type.

CONSTRUCTION SPECIFICATIONS		
High Tensile Steel	Thickness	mm
Body sides	8 ga. ⁽³⁾	3.9
Body roof	10 ga. ⁽³⁾	3.4
Body floor	7 ga. ⁽³⁾	4.5
Body longitudinal	7 ga. ⁽¹⁾	4.5
Floor support members	7 ga. ⁽¹⁾	4.5
Hopper floor	3/16 in. ⁽²⁾	4.8
Carrier panel	3/16 in. ⁽²⁾	4.8
Hopper sides	3/16 in. ⁽²⁾	4.8
Packing blade	3/16 in. ⁽²⁾	4.8
Ejector panel	11 ga. ⁽³⁾	3.0

⁽¹⁾ 80,000 psi min. yield ⁽²⁾ 150,000 psi min. yield
⁽³⁾ 50,000 psi min. yield

CHASSIS REQUIREMENTS											
MODEL	MIN. GVWR	MINIMUM GAWR				USABLE CA		USABLE CT		MIN. Platform	
		Conventional		Cab-Over Engine		inches	mm	inches	mm	inches	mm
		Front	Rear	Front	Rear						
DPF 5000 - 18	39,000	11,000	29,000	13,000	26,000	124	3150	NA	NA	155	3937
DPF 5000 - 18	48,000	12,000	36,000	14,000	34,000	NA	NA	108	2473	155	3937
DPF 5000 - 20	51,000	13,000	38,000	15,000	36,000	NA	NA	126	3200	165	4191
DPF 5000 - 25	54,000	14,000	40,000	16,000	38,000	NA	NA	156	3962	200	5080
DPF 5000 - 27	57,000	15,000	42,000	17,000	40,000	NA	NA	167	4242	212	5385
DPF 5000 - 32	62,000	16,000	46,000	18,000	44,000	NA	NA	197	5004	240	6095

NOTES:
1) Any chassis sent to The Heil Co. with less than these minimum GVWR/GVARs will not be mounted. 2) Diesel engines require full variable speed governor.
3) If CA/CT is not as recommended, contact Heil Environmental Industries, Ltd. for applicable weight distribution and GVWR/GAWR requirements.

OPERATING CONTROLS	
Packing	Right side of tailgate
Tailgate raise	Forward left corner of body
Ejector	Forward left corner of body
P.T.O.	Inside cab
Engine speed-up	Forward left corner of body

TAILGATE SPECIFICATIONS									
HOPPER CAPACITY		LOADING SILL HEIGHT		HOPPER LOADING WIDTH		HOPPER OPENING HEIGHT		CYCLE TIME	
yd ³	m ³	inches	mm	inches	mm	inches	mm	Complete	Reload
3.0	2.29	3.8	97	80	2032	55	1397	28-32	9-11

BODY SPECIFICATIONS														
MODEL	BODY CAPACITY		OVERALL LENGTH		OVERALL LENGTH Tailgate Raised		OVERALL WIDTH		OVERALL HEIGHT Above Frame		OVERALL HEIGHT Tailgate Raised		GROSS WEIGHT Approximate	
	yd ³	m ³	inches	mm	inches	mm	inches	mm	inches	mm	inches	mm	lbs.	kg.
DPF 5000 - 18	18	13.7	225	5715	275	6985	96	2438	96	2438	208	5283	14,500	6,577
DPF 5000 - 20	20	15.3	235	5969	285	7239	96	2438	96	2438	208	5283	14,800	6,714
DPF 5000 - 25	25	19.1	270	6858	320	8128	96	2438	96	2438	208	5283	15,300	6,940
DPF 5000 - 27	27	20.6	282	7163	332	8433	96	2438	96	2438	208	5283	15,700	7,122
DPF 5000 - 32	32	24.4	310	7874	360	9144	96	2438	96	2438	208	5283	16,400	7,439

CYLINDERS																		
MODEL	TAILGATE RAISE (2)				PACKING BLADE (2) Double Acting				UPPER PANEL (2) Double Acting				EJECTION (1) Double Acting Telescopic					
	BORE		STROKE		BORE		STROKE		BORE		STROKE		MODEL	STAGES	BORE		STROKE	
	inches	mm	inches	mm	inches	mm	inches	mm	inches	mm	inches	mm			inches	mm	inches	mm
ALL	4	102	26	660	5.5	140	24	609	5	127	36	914	DPF 5000-18	4	6	152	95.5	2426
													DPF 5000-20	4	6	152	105.2	2672
													DPF 5000-25	4	6	152	134.1	3406
													DPF 5000-27	4	6	152	145.8	3703
													DPF 5000-32	5	7	178	173.6	4410



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P.O. Box 8676
Chattanooga, TN 37414, USA
1-800-824-4345 Fax: (423) 855-3478
www.heil.com



DuraPack™ Half/Pack®

Front Loader



An Enduring Performance.

HEIL ENVIRONMENTAL
INDUSTRIES, LTD.

A DOVER INDUSTRIES COMPANY

DuraPack™ Half/Pack

The Front Loader That Shaped The Industry



State-of-the-Art

Heil uses advanced robotic welding for many key components, like the Half/Pack's 8,000 pound rated arms and the reinforced tailgate. The result is a more precise fit, cleaner looking welds, and more consistency from part to part, and unit to unit.



Making Your Life Easier

In the pioneering spirit that has been Heil for almost 100 years, Half/Pack® front loaders feature our patented clamp-

on arm. In the event of arm damage, the replacement arm can be attached in a fraction of the time it takes to replace weld-on or bolt-on arms. The four sets of two-piece bronze alloy bearings are also easily replaced.



Built For The Long

Our famous interlaced double-walled hopper sides are examples of Heil strength of high tensile steels. Where it's needed most





try



After 16 years and over 7,000 units produced, the Half/Pack® front loader from Heil continues to be the standard to which all others are compared. Today's DuraPack™ Half/Pack® front loader is a marvel of engineering and efficiency, refined over the years to arrive at the pinnacle of productivity, durability, driver comfort and safety, and ease of maintenance.

Our newest Half/Pack® front loader features our patented clamp-on arms, John Deere cylinders, and the latest in electronic controls and on-board diagnostics. And of course, the features you've come to expect from Heil – like the interlaced subframe, high tensile steel construction, Shur-Lock™ tailgate locks, and more.

Best of all, the DuraPack™ Half/Pack® front loader is backed by Heil's worldwide network of distributors and service centers; plus the industry's first manufacturer based training center and, now, a new mobile training center to help you keep your equipment operating at its peak.

Legendary Heil quality and durability, with a century-old heritage of industry leadership and commitment to customer satisfaction – that's the Half/Pack® legacy.



Big Haul
and the
perfect
through the use
of strength



We could do less, but it wouldn't be a Heil... and you'd know the difference.

Quality Goes Beyond The Obvious

Little things can make all the difference when it comes to keeping your equipment on the route day after day. For example, in critical electrical components, Heil uses gold-tipped connectors that resist oxidation; our proximity switches are the highest quality available and even exceed military specs; hydraulic systems are protected with deceleration valves on arm cylinders; and Half/Pack's John Deere cylinders are built to the toughest tolerances in the business.



Safety Matters

Features like the Shur-Lock™ tailgate locks have long been a Heil standard. We take safety to the extreme in less visible ways, too – like the patented cylinder retention cables on eject



cylinders, to prevent the body sidewall from being compromised in the event of an accident; the tailgate mounted, sure-grip roof access ladder and more. When it comes to the safety of your operators, we think peace of mind is right up there with profit.





OSHKOSH TRUCK CORPORATION

2307 Oregon Street
Oshkosh, Wisconsin 54901
P.O. Box 2566
Oshkosh, WI 54903-2566



®



®

Karla M. Brekke

Export Sales Administrator

PHONE (920) 233-9490 FAX (920) 233-9367

E-MAIL: kbrekke@oshtruck.com

TO: Lisa Paroly

DATE: 27 Feb 2001

FAX: 415-956-6220

NUMBER OF PAGES SENT: 12

CC: Mike Dryden

SUBJECT: Quotation

Dear Lisa,

Per your request attached is the quotation numbers 1049, 1050, 1051 for four (4) 32 yd XC rear loaders, one (1) roll off and one 40yd front loader. Please take note that these quotations do not include commissions for anyone nor do they include freight charges. I can supply the freight quote to Algeria once I know the port destinations. If you have any questions please contact me.

Best Regards,

Karla M. Brekke

The documents accompanying this telecopy transmission contain information from Oshkosh Truck Corporation which is confidential and/or privileged. This information is intended to be for the use of the individual or entity named on this transmission sheet. If you are not the intended recipient, be aware that any disclosure, copying, distribution or use of the contents of this information is prohibited, and may constitute an invasion of the privacy of the intended recipient. If you have received this telecopy in error, please notify us by telephone immediately so that we can arrange for the retrieval of the original document at no cost to you.

OSHKOSH TRUCK CORPORATION

2307 OREGON STREET (54902)
POST OFFICE BOX 2566
OSHKOSH, WISCONSIN 54903-2566
920-235-9151



QUOTATION

BVA
Attn: Lisa Paroly
65 Battery Street Suite 200
San Francisco, CA 94111

Date: February 27, 2001
Quotation No.: 1051
Reference: Algeria

QUANTITY	DESCRIPTION	UNIT PRICE	TOTAL PRICE
One (1)	MTM 40yd Standard Front Loader with Mack chassis per the attached specifications.	US \$ 127,500.00	US \$127,500.00

TOTAL (FCA Dodge Center, Minnesota, U.S.A.) US \$127,500.00

Options not included in the price

- Dual Hopper Work Lights US \$ 250.00

Quotation Validity: This quote is only valid if accepted by both purchaser and MTM within 90 days of February 27, 2001.

Delivery: FCA Dodge Center, Minnesota 45 days after receipt of down payment and acceptable letter of credit by MTM, and dependent on current production schedule at time of contract award.

Payment Terms: 10% down payment, 90% via letter of credit. Alternate payment terms may be negotiated. Detailed payment terms are attached.

Note: This quotation is dependent upon approval of U.S. Export Control Regulations and may be subject to revocation at any time.

By:
Karla M. Brekke
Export Sales Administrator

By:
Scott L. Ney
Vice President & Treasurer

Date: February 27, 2001

Date: February 27, 2001

STANDARD FRONT LOADER SPECIFICATIONS

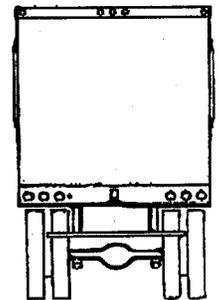
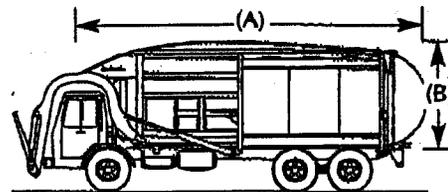


Body Specifications

MODEL	34YD	26m ³	36YD	27.5m ³	40YD	30.6m ³	43YD	32.9m ³
Body Capacity	24YD	18.4 m ³	26YD	19.9 m ³	30YD	22.9 m ³	33YD	25.2 m ³
Hopper Capacity	10YD	7.6 m ³						
Body Length Tailgate Closed (A)	291"	739.1cm	312"	792.5cm	348"	883.9cm	366"	929.6cm
Body Length Tailgate Open	325"	825.5cm	346"	886.5cm	382"	970.3cm	400"	1016cm
Overall Height Above Frame								
Arms Down (B)	116"	294.6cm	116"	294.6cm	116"	294.6cm	116"	294.6cm
Arms Up	117"	297.2cm	117"	297.2cm	117"	297.2cm	117"	297.2cm
Tailgate Open	144"	365.8cm	165"	419.1cm	165"	419.1cm	165"	419.1cm
Overall Height Above Ground								
Body Raised	263"	668cm	263"	668cm	280"	711.2cm	293"	714.2cm
Hopper Opening	80" x 97"	203 x 246cm						
Side Door Opening	24" x 30"	61 x 76.2cm						
Inside Fork Span	74"	188cm	74"	188cm	74"	188cm	74"	188cm
Seal Height	31"	78.7cm	31"	78.7cm	31"	78.7cm	31"	78.7cm

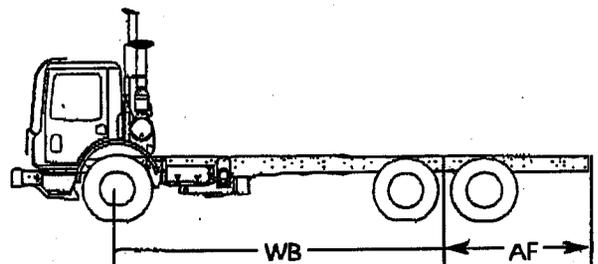
Estimated Body Weight 17,800 lbs. - 19,950 lbs. (8,074kg - 9,049kg)

*3YD Tailgate (21" Deep) vs. Standard 6YD Tailgate (42" Deep)



Chassis Requirements

	Axle	Wheelbase	Min. AF
34YD 26m ³	Tandem	180" 457.6cm	60" 152.4cm
36YD 27.5m ³	Tandem	180" 457.6cm	60" 152.4cm
40YD 30.6m ³	Tandem	210" 533.4cm	60" 152.4cm
43YD 32.9m ³	Tandem	210" 533.4cm	97" 500.4cm
(w Tag Axle)		197" 500.4cm	97" 500.4cm



Wheel Base (WB) dimensions are based on Cab Over-style chassis.

Construction Specifications

Body Sides:	1/8" (3.2mm) AR 500 Brinell
Body Roof:	10ga (3.4mm) AR 200
Body Floor:	3/16" (4.8mm) AR 360
Body Longitudinal:	2" x 6" 1/4" (51 x 152 x 6.4mm) HS Steel Tube
Floor Support Members:	10ga (3.4mm) Channel
Hopper Lower Side:	3/16" (4.8mm) AR 360
Hopper Upper Side:	10ga (3.4mm) AR 200
Hopper Floor:	1/4" (6.4mm) AR 360
Tailgate:	1/8" (3.2mm) AR 500 Brinell
Cab Canopy:	12ga (2.7mm) Steel
Packing/Eject Panel	
	Lower Panel: 5/16" (7.9mm) AR 360
	Upper Panel: 3/16" (4.8mm) AR 360
Packing/Eject Track:	1/4" (6.4mm) AR 400
Packing/Eject Shoes:	1/4" (6.4mm) AR 400
Arms (10,000 lb):	3/16" (4.8mm) HS
Torque Tube:	4-1/2" (114mm) O.D. x 3-1/4" (83mm) I.O.
	Pillow Block Bearings: 4 ea. 4-1/2" (114mm) x 3" (76mm) Bronze
Fork:	1-1/2" (38.1mm) Mild Steel
Estimated Body Weights	17,800 lbs. - 19,950 lbs. (8,074 - 9,049kg)

Cylinder Specifications

	Stages	Bore	
34YD Packer Eject	4	6-1/4"	(158.8mm)
36YD Packer Eject	4	6-1/4"	(158.8mm)
40YD Packer Eject	4	6-1/4"	(158.8mm)
43YD Packer Eject	4	6-1/4"	(158.8mm)
Packer/Dump Model		6"	(152.4mm)
Body Dump		6-1/4"	(158.8mm)
Tailgate		3-1/4"	(82.6mm)
Top Door		2"	(50.8mm)
Fork		3-1/2"	(88.9mm)
Arm		4-1/2"	(114.3mm)
Optional Cylinders			
	Adjustable Forks	2"	(50.8mm)
	Service Body Lift	2-7/8"	(73.2mm)

Hydraulic Specifications

Pump:	Commercial Intertech with "Pack and Go" Flow Control System
Maximum Operating Pressure:	2,250 psi (158.2 kg/sq cm)
Working Flow and RPM:	50 gpm (189.3 L) @ 1,300 RPM
Oil Reservoir:	50 Gallons (189.3 L)
Filtration:	Suction Filter - 100 Mesh Return Filter w/ Bypass - 20 Micron Microglass Breather Filter - 10 Micron
Spool Valves:	Commercial Intertech VA35 Shut-Off - Gate Valve

Performance Specifications

Container Dump Cycle Time:	18 - 20 Seconds
Packer Cycle Time:	28 - 30 Seconds
Compaction Force	
Full Eject:	138,058 lbs. (62,623 kg)
Gravity Dump:	127,234 lbs. (57,713 kg)

OSHKOSH TRUCK CORPORATION

2307 OREGON STREET (54902)
POST OFFICE BOX 2566
OSHKOSH, WISCONSIN 54903-2566
920-235-9151



QUOTATION

BVA
Attn: Lisa Paroly
65 Battery Street Suite 200
San Francisco, CA 94111

Date: February 27, 2001
Quotation No.: 1049
Reference: Algeria

QUANTITY	DESCRIPTION	UNIT PRICE	TOTAL PRICE
Four (4)	MTM 32yd XC Rear Loaders with Mack chassis per the attached specifications.	US \$ 114,500.00	US \$458,000.00

TOTAL (FCA Dodge Center, Minnesota, U.S.A.)..... US \$458,000.00

Options not included in the price

- Dual Hopper Work Lights US \$ 250.00

Quotation Validity: This quote is only valid if accepted by both purchaser and MTM within 90 days of February 27, 2001.

Delivery: FCA Dodge Center, Minnesota 45 days after receipt of down payment and acceptable letter of credit by MTM, and dependent on current production schedule at time of contract award.

Payment Terms: 10% down payment, 90% via letter of credit. Alternate payment terms may be negotiated. Detailed payment terms are attached.

Note: This quotation is dependent upon approval of U.S. Export Control Regulations and may be subject to revocation at any time.

By: *KM Brekke*
Karla M. Brekke
Export Sales Administrator

By: *Scott L. Ney*
Scott L. Ney
Vice President & Treasurer

Date: February 27, 2001

Date: February 27, 2001



**McNEILUS TRUCK AND MANUFACTURING, INC.
STANDARD PAYMENT TERMS**

These payment terms are an integral part of the quotation proposal to which they are attached.

- * % Down payment in U.S.D. funds. Funds should be sent to us via wire transfer as follows
McNeilus Truck and Manufacturing, Inc., C/O Bank of America, 231 S. LaSalle Street,
Chicago, IL 60697, ABA # 071000039, Acct # 86668-11010, SWIFT: BOFAUS44. **Please
reference Intl Quote No. on wire transfer.**

- * % Against a confirmed/irrevocable letter of credit, payable in U.S. Dollars at SIGHT, at the
counter of the U.S. bank (payee/drawee) against presentation of shipping documents at
the U.S. bank, confirmed through a prime U.S. bank and acceptable to McNeilus Truck
and Manufacturing, Inc.
or
Against a confirmed irrevocable ISSUANCE (time) letter of credit, payable in U.S. Dollars.
Customer and McNeilus Truck and Manufacturing, Inc to agree on the tenor of a time
draft. Payable against presentation of shipping documents and the acceptance /
discounting of a time draft at an international bank acceptable to McNeilus Truck and
Manufacturing, Inc.

*Please reference quotation proposal for percentages (%).

**All banking charges should be for the customer (applicant) account. Order to be entered
for production only after receipt of down payment AND acceptable letter of credit at our
office.**

In the event of cancellation of this order for any reason by customer, no deposit, down payment
or other payment shall be refunded since each unit is manufactured to meet the customer's
unique specifications.

We prefer the confirming U.S.A. bank to be one of the following:

- | | | | |
|-----------------------------------|-----------------|-------------------------------|-------------------|
| *Bank of America | *ABN Amro Bank | *Bank of Scotland | *Northern Trust |
| *Marshall & Ilsley Bank | *Comerica Bank | *LaSalle National | *First Union |
| *Bank of Montreal | *Banque Paribas | *US Bank | *Bank of New York |
| *Fuji Bank, Limited | *Bank One | *Harris Trust and Saving Bank | |
| *Firststar Bank of Milwaukee, N.A | | | |

Letter of Credit must be subject to the Uniform Customs and Practice for Documentary Credits,
International Chamber of Commerce Publication in effect at the time of the opening of the letter
of credit.

If applicable, letter of credit to allow shipment from any North American port and should not
specify flag or vessel or steamship line to be used to expedite movement of freight. Partial
shipments and transshipments are to be permitted. We reserve the right to select our own
freight forwarding agents.

Name of beneficiary should appear as follows:

McNeilus Truck and Manufacturing, Inc. - Corporate Int'l Finance Office
2307 Oregon Street, Oshkosh, WI 54902
Phone: (920) 236-6883

Shipping terms and responsibilities will be governed by the International Chamber of Commerce Incoterms Publication in effect at the time of the opening of the letter of credit.

Letter of credit to be payable against the following documents:

Sight Draft

Commercial Invoice

Full Set of Bills of Lading (necessary for Incoterms CPT, CIP, DDU, DDP)

Packing List

Certificate of Origin (if necessary)

Insurance Certificate (if necessary)

NOTE: Make notification by fax (Fax no. (920) 233-9294 ATTN: International Finance) if any other document(s) will be required in the letter of credit to be reviewed in advance of the letter of credit being opened.

Shipping terms should be referenced as outlined in the attached quotation proposal.

Delivery period appearing in the attached quotation proposal shall commence after receipt AND acceptance of the letter of credit by McNeilus Truck and Manufacturing, Inc. Expiry date should be 30 days after the end of the delivery period. Period for presentation of documents to be 21 days after bill of lading/certificate of receipt date.

This quotation is contingent upon the customer and McNeilus Truck and Manufacturing, Inc. complying with all of the export laws and regulations of the United States. If any such law or regulation cannot be complied with, or if this equipment is prohibited from being exported at some later time by the United States government, this quotation and subsequent order(s) received will become null and void.

In order to avoid any delays in processing your order and to avoid any reason for amendments to the letter of credit after our receipt, we welcome the opportunity to review your proposed draft of how the letter of credit will appear in final form. Please forward your suggested letter of credit format to Fax no. (920) 233-9294 ATTN: International Finance and we will reply with our approval or comments as appropriate.

We reserve the right to request an end-use certification (i.e. end-user name, country, intended vehicle use, etc.) from customer and/or the end-user prior to acceptance of an order from customer.

Alternative payment arrangements are available upon request. You may contact Mr. Salim Hawi, Manager-Corporate International Financial Services at Telephone: (920) 233-9432, Fax: (920) 233-9432, or Email: shawi@oshtruck.com to discuss alternative proposals.

Acceptance of final payment terms will be reviewed upon receipt of your purchase order.



HIGHWAY 14 EAST
POST OFFICE BOX 70
DODGE CENTER, MINNESOTA 55927-0070
507-374-6321

QUOTE NO: ^F5^

TO: ^F1^
^F2^
^F3^

DATE: ^F6^

ATTN: ^F4^

We are pleased to submit the following for your consideration:

MODEL	2001 MACK MR690 Wheelbase: 210" Platform: 297" Afterframe: 90"
ENGINE & EQUIPMENT	Mack EM7-300-E-TEC, 300 HP @ 1750 RPM 3 - Bulldog 12 Volt (650/1950 CCA) Mack Batteries: Single Vertical Exhaust Delco 500 39MT, Electric 12 Volt Starter Delco 12 Volt 130 Amp Alternator (22SI) Vernier-Type Hand Throttle Control Aluminum Flywheel Housing 15" Single Element Air Cleaner Exhaust Rain Cap Crankshaft PTO Adapter Kysor Alarm System w/Light & Buzzer Air Dryer Bendix AD-9, Heated Meritor Wabco AntiLock Brake System Air Compressor, Meritor/Wabco 318 14.0CFM
TRANSMISSION & CLUTCH	Allison HD4560P, 6 Speed Automatic Transmission Transmission Cooler Oil Resistant Transmission Mounts Vocational Package-Allison, Special Refuse Service. Single Selector Dana/Spicer 1760 Driveshaft w/Coated Splines Dana/Spicer 1710 HD Interaxle Driveshaft w/Coated Splines
FRAME & EQUIPMENT	13.25" x 3.25" x .3125" Frame Rails 1/4" Steel Frame Reinforcement Inside 10" Front Frame Extension Swept Back Steel Front Bumper, Channel Type Front Tow Device - Pin Web Channel Type Crossmember, Behind Rear Axle Skid Plate Under Bumper & Radiator
FRONT AXLE & EQUIPMENT	Mack FAW20 Front Axle (20,000# Capacity) Meritor "S" Cam Type Brakes 16.5" x 6" Q+ w/Dust Shields Multileaf Springs (20,000# Capacity) 592S Shephard Integral Power Steering HalDEX Automatic Slack Adjusters Static Load Cushions Front Wheel Seals

Continuation of Quote No: ^F5^

REAR AXLE & EQUIPMENT

Mack S462 Rear Axle (46,000# Capacity)
4.64 Axle Ratio
Mack SS462 Multileaf Tandem Rear Suspension
Bronze Trunnion Bushing
Transverse Torque Rod
Oil Seals, Chicago Rawhide
Meritor "S" Cam 16.5" x 7" Q+ Rear Brakes w/Dust Shields
Haldex Automatic Slack Adjusters
Power Divider Lockout In Cab Manual Air Valve
w/Warning Buzzer or Light
Anti-Sway Springs

TIRES & WHEELS

Front Tires: Goodyear 425/65R22.5 G286 18 Ply
Rear Tires: Goodyear 11R22.5 G124 14 Ply
Front Wheels: 22.5" x 12.25", Hub Piloted
Rear Wheels: 22.5" x 8.25", Hub Piloted (10-hole)

FUEL TANK

80 Gallon, 24" Diameter RH Steel Fuel Tank

CAB & EQUIPMENT

Low Profile Cab
West Coast Mirrors, Heated, Bright Finish, LH & RH
LH & RH Convex Mirror, Bright Finish
Air Horn Twin Trumpet
Cab Lift/Tilt Mounted on RH Fenders Bracket
Roof Access, Cab Ladder & Anti-Skid Roof
"MC" Doors, LH & RH Roll-Up Windows
Bostrom 905L Mid-Back Talladega Driver's Seat
Fixed Mack Mid Back Riders Seat
Lap & Shoulder Seat Belts (Both Seats)
Mack Integral Air Conditioner/Heater
Argent Silver Finish Grille

INSTRUMENTS

Hobbs (or Equal) Engine Hourmeter
English Display Gauges
Speedometr w/Trip Odometer, Electronic
Engine Tachometer, Electronic without Hourmeter
Transmission Oil Temperature
Transmission Oil Level Sensor
Turn Signal Switch w/Dimmer Switch
Windshield Wipers, 2 Speed Electric w/Intermittent
Electric Circuit Protection Package

WARRANTIES

Mack - All Chassis - 12 Months OR 100,000 Miles
Mack - E7 Engines - 36 Months OR 300,000 Miles
Allison HD Trans - 24 Months/Unlimited Miles

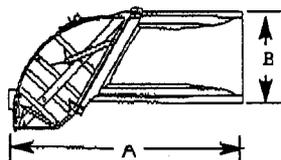
PAINT

Cab: ^F20^
Frame: Black

01PM5/112500

ASK ABOUT OUR FASTNGI

STANDARD REAR LOADER SPECIFICATIONS



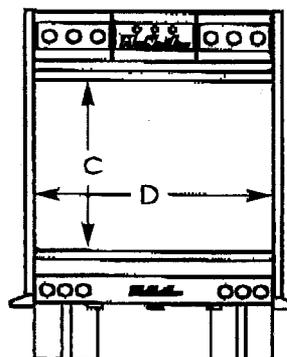
Body Specifications

		17YD	13m ³	20YD	15m ³	25YD	19m ³	32YD	24.5m ³
Overall Length w/o Guides* (A)		222"	564cm	240"	610cm	272"	691cm	316"	803cm
Overall Length Tailgate Raised*		267"	678cm	285"	724cm	317"	805cm	362"	920cm
Overall Height Above Chassis Frame (B)		100-1/2"	255cm	"	"	"	"	"	"
Overall Height w/ Reeving Cylinder		108"	274cm	"	"	"	"	"	"
Overall Height Tailgate Raised		157"	399cm	"	"	"	"	"	"

*Length includes 5" (127mm) spacing between cab and refuse body.

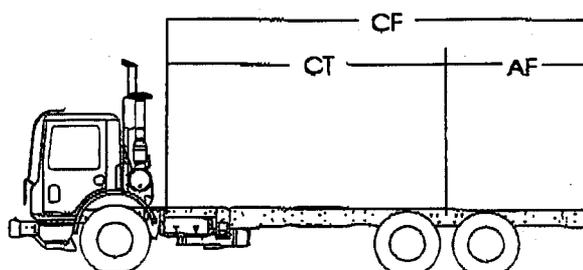
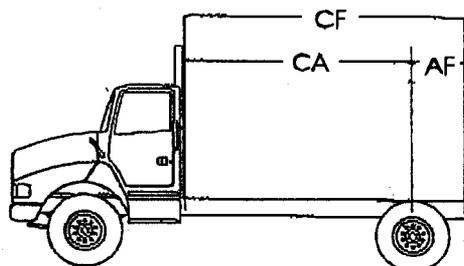
Tailgate Specifications

Hopper Capacity		3.0yd ³	2.9m ³
Hopper Opening (C)		55-1/2"	141cm
Hopper Width (D)		80"	203cm
Seal Height		50"	127cm
Loading Sill Height Below Frame Chassis			
Single Axle		3/4"	19mm
Tandem Axle		3-3/8"	86mm



Chassis Requirements

	Axle	Usable CA	Usable CT	Min. AF	CF (CA+AF)
17YD	Single	131" 333cm	---	35" 89cm	166" 422cm
20YD	Single	150" 381cm	---	35" 89cm	185" 470cm
17YD	Tandem	---	114" 290cm	55" 139cm	169" 429cm
20YD	Tandem	---	132" 294.6cm	55" 139cm	187" 475cm
25YD	Tandem	---	163" 335cm	55" 139cm	218" 554cm
32YD	Tandem	---	206" 335cm	55" 139cm	261" 409cm



CA - CT refers to: clear straight frame behind obstacles such as transmission, hump, filler, stacks, etc.

Construction Specifications

Body Sides:	10ga AR (3.41mm) and 1/8" - 500 Brinell	
Body Roof:	10ga AR (3.41mm)	
Body Floor:	3/16" AR Steel (4.76mm)	
Body Longitudinal:	1/4" (6.4mm) HS Steel	
Floor Support Members:	7ga (4.6mm) and 3/16" (4.76mm) HS Steel	
Front Head:	10ga (3.41mm)	
Hopper Floor:	1/4" AR 200 (6.4mm)	Slide Panel: 3/16" (4.76mm) HS Steel
Hopper Sides:	3/16" AR 200 (4.76mm)	Slide Shoes:
Packing Panel:	1/4" AR (6.4mm)	Lower: 14" x 4" x 1" (356 x 102 x 25mm) HPP
Ejector Panel:	11ga (3mm)	Upper: 14" x 4" x 1" (356 x 102 x 25mm) HPP
Estimated Body Weights:	13,800 lbs. - 16,900 lbs. (6273 - 7682 kg)	Ejector Shoes: 12" x 4" x 1-1/2" (305 x 102 x 38mm) HPP

Cylinder Specifications

	Standard	Heavy Duty
Tailgate Cylinders (2)	2-7/8" x 2-1/2" (73 x 64mm)	2-7/8" x 2-1/2" (73 x 64mm)
Slide Cylinders (2)	4-1/2" x 3-1/2" (114 x 89mm)	5" x 4" (127 x 102mm)
Packer Cylinders (2)	4" x 3" (102 x 76mm)	4-1/2" x 3-1/2" (114 x 89mm)
Cycle Times	16 -to- 18 Seconds	20 -to- 22 Seconds

Ejector Cylinder

	Stages	Bore
17YD (13m ³)	3	6-1/4" (159mm)
20YD (15m ³)	3	6-1/4" (159mm)
25YD (19m ³)	4	7-1/4" (184mm)
32YD (24m ³)	4	8-1/4" (210mm)
Tipper Cylinder (Optional)		3" x 1-3/4" (76 x 45mm)
Reeving Cylinder (Optional)		5" x 4" (127 x 102mm)

Hydraulic Specifications

Pump	Commercial Intertech with "Pack and Go" Flow Control System
Maximum Operating Pressure:	2,450 psi (172 kg/cm ²)
Working Flow and RPM	35 gpm (132.5L) @ 1,300 RPM
Oil Reservoir	17YD (13m ³) - 20YD (15m ³) — 40 Gallons (151.4L) 25YD (19m ³) - 32YD (24m ³) — 50 Gallons (189L)
Filtration:	Suction Filter - 100 Mesh Return Filter w/ Bypass - 20 Micron Microglass • Breather - 10 Micron
Spool Valves:	
Tailgate/Ejector	Commercial Intertech VA35
Packer/Slide	Commercial Intertech VA35
Shut-Off	Gate Valve

OSHKOSH TRUCK CORPORATION

2307 OREGON STREET (54902)
POST OFFICE BOX 2566
OSHKOSH, WISCONSIN 54903-2566
920-235-9151



QUOTATION

BVA
Attn: Lisa Paroly
65 Battery Street Suite 200
San Francisco, CA 94111

Date: February 27, 2001
Quotation No.: 1050
Reference: Algeria

QUANTITY	DESCRIPTION	UNIT PRICE	TOTAL PRICE
One (1)	MTM, 60,000 pound capacity Roll off with Mack chassis per the attached specifications.	US \$ 100,500.00	US \$100,500.00
TOTAL (FCA Dodge Center, Minnesota, U.S.A.).....			<u>US \$100,500.00</u>

Quotation Validity: This quote is only valid if accepted by both purchaser and MTM within 90 days of February 27, 2001.

Delivery: FCA Dodge Center, Minnesota 45 days after receipt of down payment and acceptable letter of credit by MTM, and dependent on current production schedule at time of contract award.

Payment Terms: 10% down payment, 90% via letter of credit. Alternate payment terms may be negotiated. Detailed payment terms are attached.

Note: This quotation is dependent upon approval of U.S. Export Control Regulations and may be subject to revocation at any time.

By:
Karla M. Brekke
Export Sales Administrator

By:
Scott L. Ney
Vice President and Treasurer

Date: February 27, 2001

Date: February 27, 2001

McNEILUS



Metro-Pak™
Rear Loader



Standard
Rear Loader



XC
Rear Loader



Tag Axle
Rear Loader

McNeilus®

Rear Loaders

Quality

McNeilus prides itself with producing rear loaders designed to work longer, harder, and under conditions that force our competition back to the garage...early. From the engineering stage to when the "rubber meets the road," McNeilus Rear Loaders are designed to tackle the toughest routes consistently, efficiently, and with minimal down time. Bottom line, if it doesn't meet these requirements, it's not a McNeilus Rear Loader.

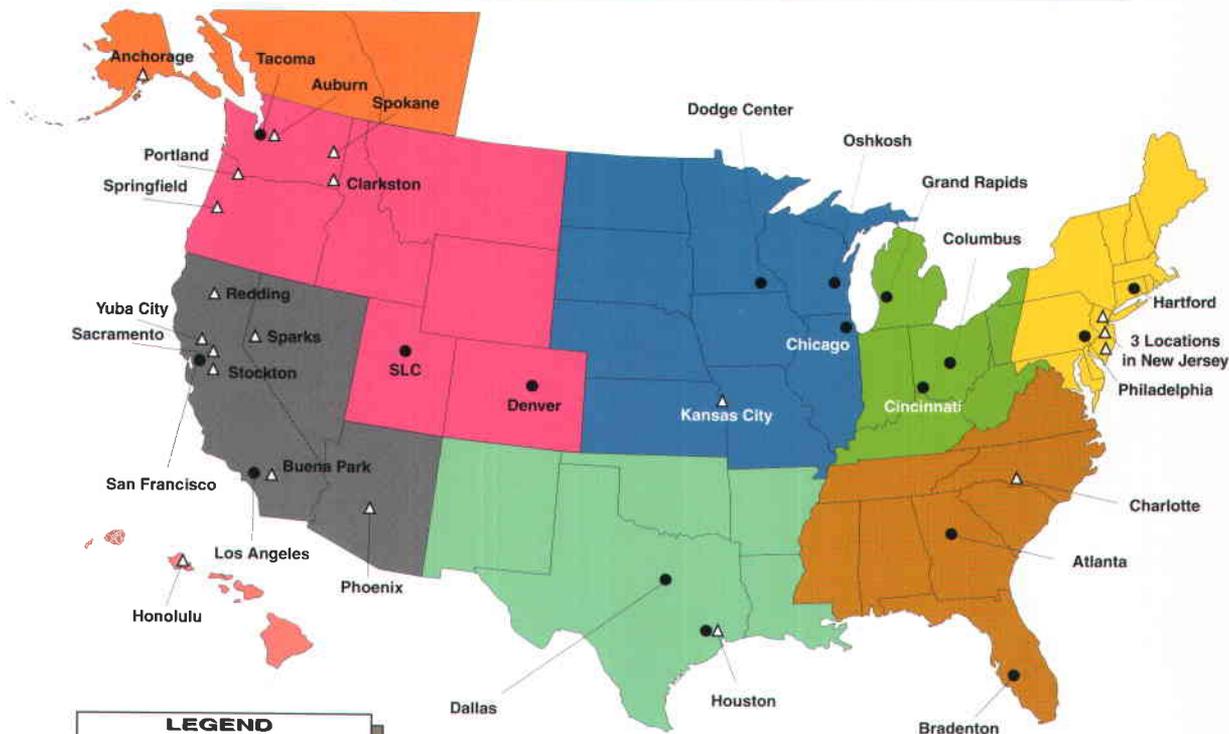


At McNeilus, we are constantly looking at ways to do things better, faster, and more efficiently to help our customers add to their bottom line. We have long led the industry with products that easily adapt the ever-changing refuse industry. This has been accomplished by listening to our customers and designing products that fit their needs consistently. Regardless of your equipment needs, let us know your specific requirements. More than likely, we have the refuse equipment to meet your needs.



Innovation

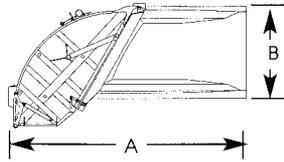
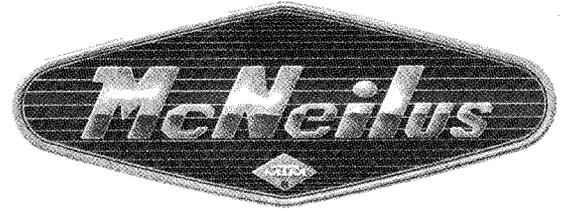
McNeilus®



Service

The combination of 17 branches and 20 authorized service centers has rapidly extended our service arm. With several more additions planned for 2000 and beyond, you can count on McNeilus to handle your service needs.

STANDARD REAR LOADER SPECIFICATIONS



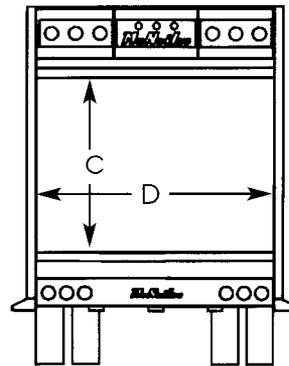
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Overall Height w/ Reeving Cylinder	108"	274cm	"	"	"	"	"	"
Overall Height Tailgate Raised	157"	399cm	"	"	"	"	"	"

*Length includes 5" (127mm) spacing between cab and refuse body.

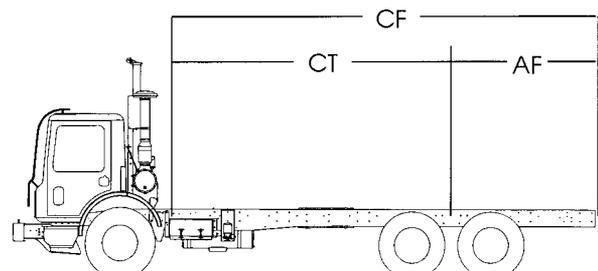
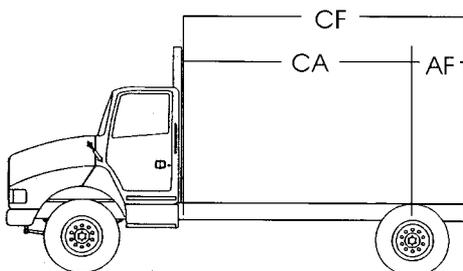
Tailgate Specifications

Hopper Capacity	3.0yd ³	2.9m ³
Hopper Opening (C)	55-1/2"	141cm
Hopper Width (D)	80"	203cm
Seal Height	50"	127cm
Loading Sill Height Below Frame Chassis		
Single Axle	3/4"	19mm
Tandem Axle	3-3/8"	86mm



Chassis Requirements

	Axle	Usable CA	Usable CT	Min. AF	CF (CA+AF)
17YD	Single	131" 333cm	---	35" 89cm	166" 422cm
20YD	Single	150" 381cm	---	35" 89cm	185" 470cm
17YD	Tandem	---	114" 290cm	55" 139cm	169" 429cm
20YD	Tandem	---	132" 294.6cm	55" 139cm	187" 475cm
25YD	Tandem	---	163" 335cm	55" 139cm	218" 554cm
32YD	Tandem	---	206" 335cm	55" 139cm	261" 409cm



CA - CT refers to: clear straight frame behind obstacles such as transmission, hump, filler, stacks, etc.

Construction Specifications

Body Sides:	10ga AR (3.41mm) and 1/8" - 500 Brinell	
Body Roof:	10ga AR (3.41mm)	
Body Floor:	3/16" AR Steel (4.76mm)	
Body Longitudinal:	1/4" (6.4mm) HS Steel	
Floor Support Members:	7ga (4.6mm) and 3/16" (4.76mm) HS Steel	
Front Head:	10ga (3.41mm)	
Hopper Floor:	1/4" AR 200 (6.4mm)	Slide Panel: 3/16" (4.76mm) HS Steel
Hopper Sides:	3/16" AR 200 (4.76mm)	Slide Shoes:
Packing Panel:	1/4" AR (6.4mm)	Lower: 14" x 4" x 1" (356 x 102 x 25mm) HPP
Ejector Panel:	11ga (3mm)	Upper: 14" x 4" x 1" (356 x 102 x 25mm) HPP
Estimated Body Weights:	13,800 lbs. - 16,900 lbs. (6273 - 7682 kg)	Ejector Shoes: 12" x 4" x 1-1/2" (305 x 102 x 38mm) HPP

Cylinder Specifications

	Standard	Heavy Duty
Tailgate Cylinders (2)	2-7/8" x 2-1/2" (73 x 64mm)	2-7/8" x 2-1/2" (73 x 64mm)
Slide Cylinders (2)	4-1/2" x 3-1/2" (114 x 89mm)	5" x 4" (127 x 102mm)
Packer Cylinders (2)	4" x 3" (102 x 76mm)	4-1/2" x 3-1/2" (114 x 89mm)
Cycle Times	16 -to- 18 Seconds	20 -to- 22 Seconds

Ejector Cylinder

	Stages	Bore
17YD (13m ³)	3	6-1/4" (159mm)
20YD (15m ³)	3	6-1/4" (159mm)
25YD (19m ³)	4	7-1/4" (184mm)
32YD (24m ³)	4	8-1/4" (210mm)
Tipper Cylinder (Optional)		3" x 1-3/4" (76 x 45mm)
Reeving Cylinder (Optional)		5" x 4" (127 x 102mm)

Hydraulic Specifications

Pump	Commercial Intertech with "Pack and Go" Flow Control System
Maximum Operating Pressure:	2,450 psi (172 kg/cm ²)
Working Flow and RPM	35 gpm (132.5L) @ 1,300 RPM
Oil Reservoir	17YD (13m ³) - 20YD (15m ³) — 40 Gallons (151.4L) 25YD (19m ³) - 32YD (24m ³) — 50 Gallons (189L)
Filtration:	Suction Filter - 100 Mesh Return Filter w/ Bypass - 20 Micron Microglass • Breather - 10 Micron
Spool Valves:	
Tailgate/Ejector	Commercial Intertech VA35
Packer/Slide	Commercial Intertech VA35
Shut-Off	Gate Valve

*Body Sizes:
17 - 20 Yards*



The Metro-Pak is the perfect refuse vehicle for getting in and out of tight spots or for handling the small neighborhood routes. In body sizes ranging from 17 - 20 yards, the Metro-Pak mounts easily on any Class 8 single axle chassis. The Metro-Pak makes sense residing in almost any fleet and won't break the bank.

METRO-PAK FEATURES

- **Body Weight under 10,000 lbs.**
- **20 - 22 Second Complete Cycle Time**
600 lb./yard Est. Typical Load Avg.*
- **Overall Height (mounted on most chassis): 11'**
- **Body Constructed of TemperFlex™ Steel**
- **Air Operated PTO**
- **Standard 23" x 29" Side Access Door for Easy Cleaning**

Call for Pricing and Availability

* Packing density will vary with material.



- **Multipoint Cylinder Mount for Even Distribution of Force**



- **Standard Integrated Safety Stands and Rubber Tailgate Seal**



- **Flip-Up Service Panel for Easy Access to Tailgate Components**

OPTIONS

- **Spool Winch**
- **Container Tipper**
- **Cart Tipper**
- **Cameras**
- **Scales**
- **Work Lights**

Metro-Pak

**Body Sizes:
17, 20, 25 and 32 Yards**



Standard

COMPACTION SPECS

- **Standard:** 16 - 18 Second Complete Cycle Time
750 - 800 lb./yard Est. Typical Load Avg.*
- **Heavy Duty:** 20 - 22 Second Complete Cycle Time
900 - 1,000 lb./yard Typical Load Est. Avg.*

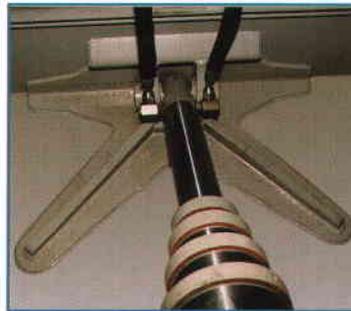
STANDARD FEATURES

- **Estimated Body Weight:** 13,800 - 16,900 lbs.
- **Overall Body Height (mounted on most chassis):** 11' 9" or 12' 4" with Reeving Cylinder
- **3 Cubic Yard Hopper**
- **"Pack on the Go" Hydraulics**
- **Body Construction Features 230,000 psi 500 Brinell AR Steel**
- **SMART-PAK™ Hydraulics**

* Packing density will vary with material.



- **Center-Mount Ejector** – The Center-Mount design eliminates the torque normally found in packing and ejecting. McNeilus' unique ejector shape distributes the pack evenly. The multi-point bearing blocks are made of durable composite and are located above the floor to remain clear of material.



- The Standard, Heavy Duty and XC Rear Loaders come equipped with the long lasting Upper and Lower Composite Slide Shoe. With the easy access port, maintenance is at your fingertips

- **Hydro-Cush™ Cylinders**
The unique design of the packer and slide cylinders in the McNeilus Rear Loaders are hydraulically cushioned to help eliminate cylinder shock when the cylinder reaches the end of its stroke. To our customers it means longer life and less wear to the system.

**Body Sizes:
25 - 32 Yards**



OPTIONS

- Cart Tipper
- Container Tipper
- Reeving Cylinder
- Spool Winch
- Camera Systems
- On-Board Scales
- Pusher Axle Configurations
- Additional Work Lights
- Wash-Out Tank
- Custom Paint/Decals

Call for Pricing and Availability

* Packing density will vary with material.

COMPACTION SPECS

- **XC: 26 - 28 Second Complete Cycle Time**
1,000 - 1,200 lb./yard Typical Load Est. Avg.*



- Container Tipper – High density composite rollers allow for smooth operation with less container wear.



- Cart Tipper – Integrated into the tailgate does not hinder commercial container collection.

XC FEATURES

- **Estimated Body Weight: 17,800 - 18,400 lbs.**
- **Overall Body Height (mounted on most chassis): 11' 9" or 12' 4" with Reeving Cylinder**
- **3.5 Cubic Yard Hopper**
- **"Pack on the Go" Hydraulics**
- **Body Construction Features 230,000 psi 500 Brinell AR Steel**
- **SMART-PAK™ Hydraulics**

XC

Body Sizes:
25 - 32 Yards



The McNeilus Tag-Axle Rear Loader was developed for those customers needing maximum hauling capacity in states where weight is a factor. With a GVW of 59,000 lbs., the Tag-Axle Rear Loader helps distribute the load to maximize route collection.



16,500 lbs.

228" WB

26' 9"

66"

34,000 lbs.

8,500 lbs.

59,000 GVW

Tag Axle

Common Sense Components



Weather-Pak Connectors



Commercial Intertech Spool Valves and Pumps



Aeroquip Hoses and Fittings



Truck-Lite Lights



Hydra-Zorb & Stauff Clamps

Field Tested...Customer Proven

- The McNeilus Rear Loader is a rugged design built with McNeilus Quality throughout. The McNeilus Rear Loader is a dependable packer you can build and grow your business on. We've gone the extra mile in bringing you a product that works on the toughest route.

Design and Workmanship

- McNeilus has long placed major emphasis on integrating our designs with components that consistently meet or exceed our customers expectations. Workmanship must go hand in hand with this philosophy...and at McNeilus, it always has.

Component Specification and Placement

McNeilus Refuse Bodies represent a "common sense" merging of components and materials that work together to provide optimal performance.



A McNeilus Rear Loader...

Right for the Driver, Maintenance Specialist, and the Owner!

Leasing

Why Lease?

- Improves Cash Flow
- Preserves Working Capital
- Reserves Credit Lines
- Offers Tax Advantages

Why Lease From McNeilus?

- Competitive Rates
- Flexible Terms
- Offer Lease Assignments

Get the Facts!

- Call Jon Olson at:
507-374-6321



Parts & Service

Protect your rear loader investment by accepting nothing less than genuine McNeilus Replacement Parts. Rest assured that the same attention to detail found in your rear loader can be found in your replacement parts. In addition to parts, our dedicated service staff is ready to assist you via our **TOLL-FREE Hot Line at: 1-877-PACK-MTM** 24-hours-a-day/seven-days-a-week! Contact your nearest branch for more information.



McNeilus

CORPORATE HEADQUARTERS
McNeilus Truck and Manufacturing Co.
Hwy. 14 East • Dodge Center, MN 55927
Phone: (507) 374-6321 • FAX: (507) 374-2904
www.mcneiluscompanies.com

BRANCH LOCATIONS

CA: (Phone) 909-370-2100 • (FAX) 909-370-0739 • CO: (Phone) 303-287-7486 • (FAX) 303-287-2780 • GA: (Phone) 770-489-0707 • (FAX) 770-489-9511
OH: (Phone) 614-868-0760 • (FAX) 614-868-0498 • PA: (Phone) 610-286-0400 • (FAX) 610-286-2094 • TX: (Phone) 972-225-2313 • (FAX) 972-225-4407
UT: (Phone) 801-954-8709 • (FAX) 801-954-8756 • WA: (Phone) 253-536-0260 • (FAX) 253-536-0483

McNEILUS



McNeilus[®]

Front Loaders

Quality

McNeilus prides itself with producing front loaders designed to work longer, harder, and under conditions that force our competition back to the garage...early. From the engineering stage to when the "rubber meets the road," McNeilus Front Loaders are designed to tackle the toughest routes consistently, efficiently, and with minimal down time. Bottom line, if it doesn't meet these requirements, it's not a McNeilus Front Loader.



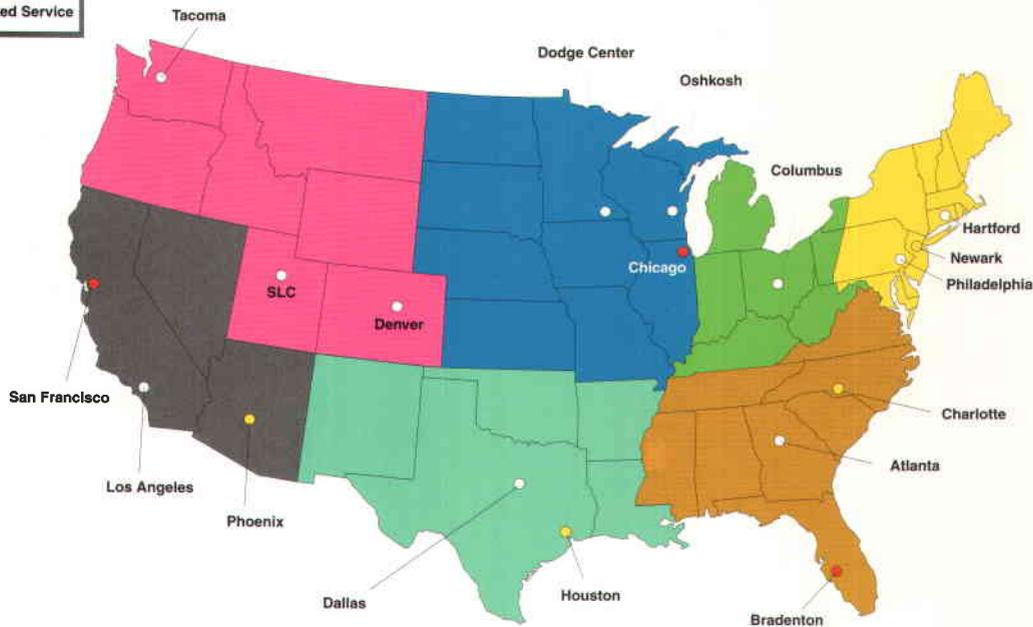
At McNeilus, we are constantly looking at ways to do things better, faster, and more efficiently to help our customers add to their bottom line. We have long led the industry with products that easily adapt the ever-changing refuse industry. This has been accomplished by listening to our customers and designing products that fit their needs consistently. Regardless of your equipment needs, let us know your specific requirements. More than likely, we have the refuse equipment to meet your needs.



Innovation

McNeilus®

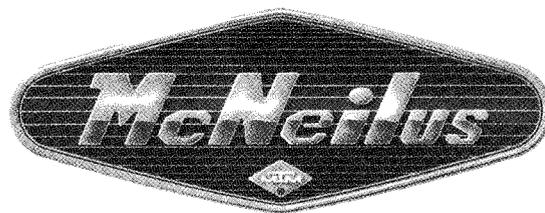
LEGEND	
○	Existing Locations
●	New Locations
●	Authorized Service



Service

The combination of eight new McNeilus branches and authorized service centers has rapidly extended our service arm. With several more additions planned for 2000 and beyond, you can count on McNeilus to handle your service needs.

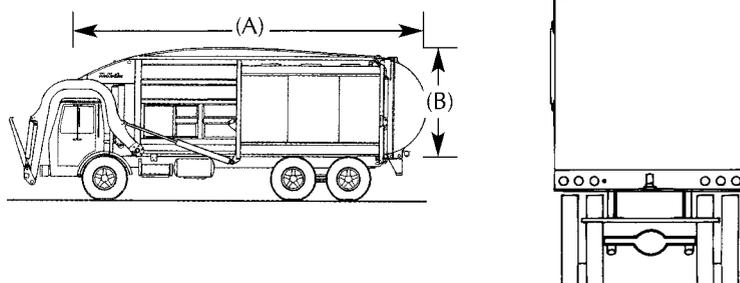
STANDARD FRONT LOADER SPECIFICATIONS



Body Specifications

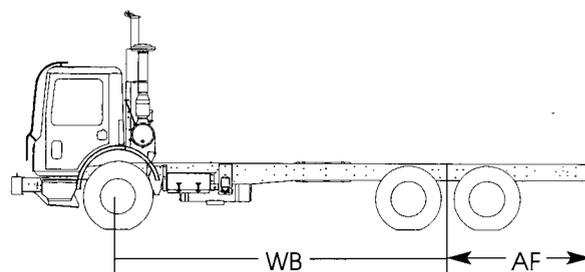
MODEL	34YD	26m ³	36YD	27.5m ³	40YD	30.6m ³	43YD	32.9m ³
Body Capacity	24YD	18.4 m ³	26YD	19.9 m ³	30YD	22.9 m ³	33YD	25.2 m ³
Hopper Capacity	10YD	7.6 m ³	10YD	7.6 m ³	10YD	7.6 m ³	10YD	7.6 m ³
Body Length Tailgate Closed (A)	291"	739.1cm	312"	792.5cm	348"	883.9cm	366"	929.6cm
Body Length Tailgate Open	325"	825.5cm	346"	886.5cm	382"	970.3cm	400"	1016cm
Overall Height Above Frame								
Arms Down (B)	116"	294.6cm	116"	294.6cm	116"	294.6cm	116"	294.6cm
Arms Up	117"	297.2cm	117"	297.2cm	117"	297.2cm	117"	297.2cm
Tailgate Open	144"	365.8cm	165"	419.1cm	165"	419.1cm	165"	419.1cm
Overall Height Above Ground								
Body Raised	263"	668cm	263"	668cm	280"	711.2cm	293"	714.2cm
Hopper Opening	80" x 97"	203 x 246cm	80" x 97"	203 x 246cm	80" x 97"	203 x 246cm	80" x 97"	203 x 246cm
Side Door Opening	24" x 30"	61 x 76.2cm	24" x 30"	61 x 76.2cm	24" x 30"	61 x 76.2cm	24" x 30"	61 x 76.2cm
Inside Fork Span	74"	188cm	74"	188cm	74"	188cm	74"	188cm
Seal Height	31"	78.7cm	31"	78.7cm	31"	78.7cm	31"	78.7cm
Estimated Body Weight	17,800 lbs. - 19,950 lbs. (8,074kg - 9,049kg)							

*3YD Tailgate (21" Deep) vs. Standard 6YD Tailgate (42" Deep)



Chassis Requirements

	Axle	Wheelbase	Min. AF
34YD 26m ³	Tandem	180" 457.cm	60" 152.4cm
36YD 27.5m ³	Tandem	180" 457.cm	60" 152.4cm
40YD 30.6m ³	Tandem	210" 533.4cm	60" 152.4cm
43YD 32.9m ³	Tandem	210" 533.4cm	97" 500.4cm
(w Tag Axle)		197" 500.4cm	97" 500.4cm



Wheel Base (WB) dimensions are based on Cab Over-style chassis.

Construction Specifications

Body Sides:	1/8" (3.2mm) AR 500 Brinell
Body Roof:	10ga (3.4mm) AR 200
Body Floor:	3/16" (4.8mm) AR 360
Body Longitudinal:	2" x 6" 1/4" (51 x 152 x 6.4mm) HS Steel Tube
Floor Support Members:	10ga (3.4mm) Channel
Hopper Lower Side:	3/16" (4.8mm) AR 360
Hopper Upper Side:	10ga (3.4mm) AR 200
Hopper Floor:	1/4" (6.4mm) AR 360
Tailgate:	1/8" (3.2mm) AR 500 Brinell
Cab Canopy:	12ga (2.7mm) Steel
Packing/Eject Panel	
	Lower Panel: 5/16" (7.9mm) AR 360
	Upper Panel: 3/16" (4.8mm) AR 360
Packing/Eject Track:	1/4" (6.4mm) AR 400
Packing/Eject Shoes:	1/4" (6.4mm) AR 400
Arms (10,000 lb):	3/16" (4.8mm) HS
Torque Tube:	4-1/2" (114mm) O.D. x 3-1/4" (83mm) I.O.
	Pillow Block Bearings: 4 ea. 4-1/2" (114mm) x 3" (76mm) Bronze
Fork:	1-1/2" (38.1mm) Mild Steel
Estimated Body Weights	17,800 lbs. - 19,950 lbs. (8,074 - 9,049kg)

Cylinder Specifications

	Stages	Bore	
34YD Packer Eject	4	6-1/4"	(158.8mm)
36YD Packer Eject	4	6-1/4"	(158.8mm)
40YD Packer Eject	4	6-1/4"	(158.8mm)
43YD Packer Eject	4	6-1/4"	(158.8mm)
Packer/Dump Model		6"	(152.4mm)
Body Dump		6-1/4"	(158.8mm)
Tailgate		3-1/4"	(82.6mm)
Top Door		2"	(50.8mm)
Fork		3-1/2"	(88.9mm)
Arm		4-1/2"	(114.3mm)
Optional Cylinders			
	Adjustable Forks	2"	(50.8mm)
	Service Body Lift	2-7/8"	(73.2mm)

Hydraulic Specifications

Pump:	Commercial Intertech with "Pack and Go" Flow Control System
Maximum Operating Pressure:	2,250 psi (158.2 kg/sq cm)
Working Flow and RPM:	50 gpm (189.3 L) @ 1,300 RPM
Oil Reservoir:	50 Gallons (189.3 L)
Filtration:	Suction Filter - 100 Mesh Return Filter w/ Bypass - 20 Micron Microglass Breather Filter - 10 Micron
Spool Valves:	Commercial Intertech VA35 Shut-Off - Gate Valve

Performance Specifications

Container Dump Cycle Time:	18 - 20 Seconds
Packer Cycle Time:	28 - 30 Seconds
Compaction Force	
Full Eject:	138,058 lbs. (62,623 kg)
Gravity Dump:	127,234 lbs. (57,713 kg)

Features

Common-sense components coupled with quality workmanship and steel specifically utilized for lasting performance.



Inverted Cab Shield



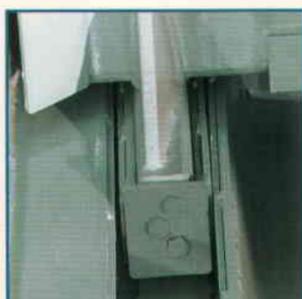
Aerodynamic Debris Guard



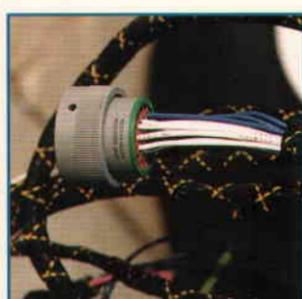
Solid State Logic Board Controls



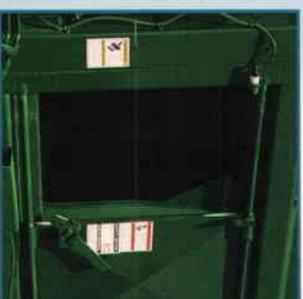
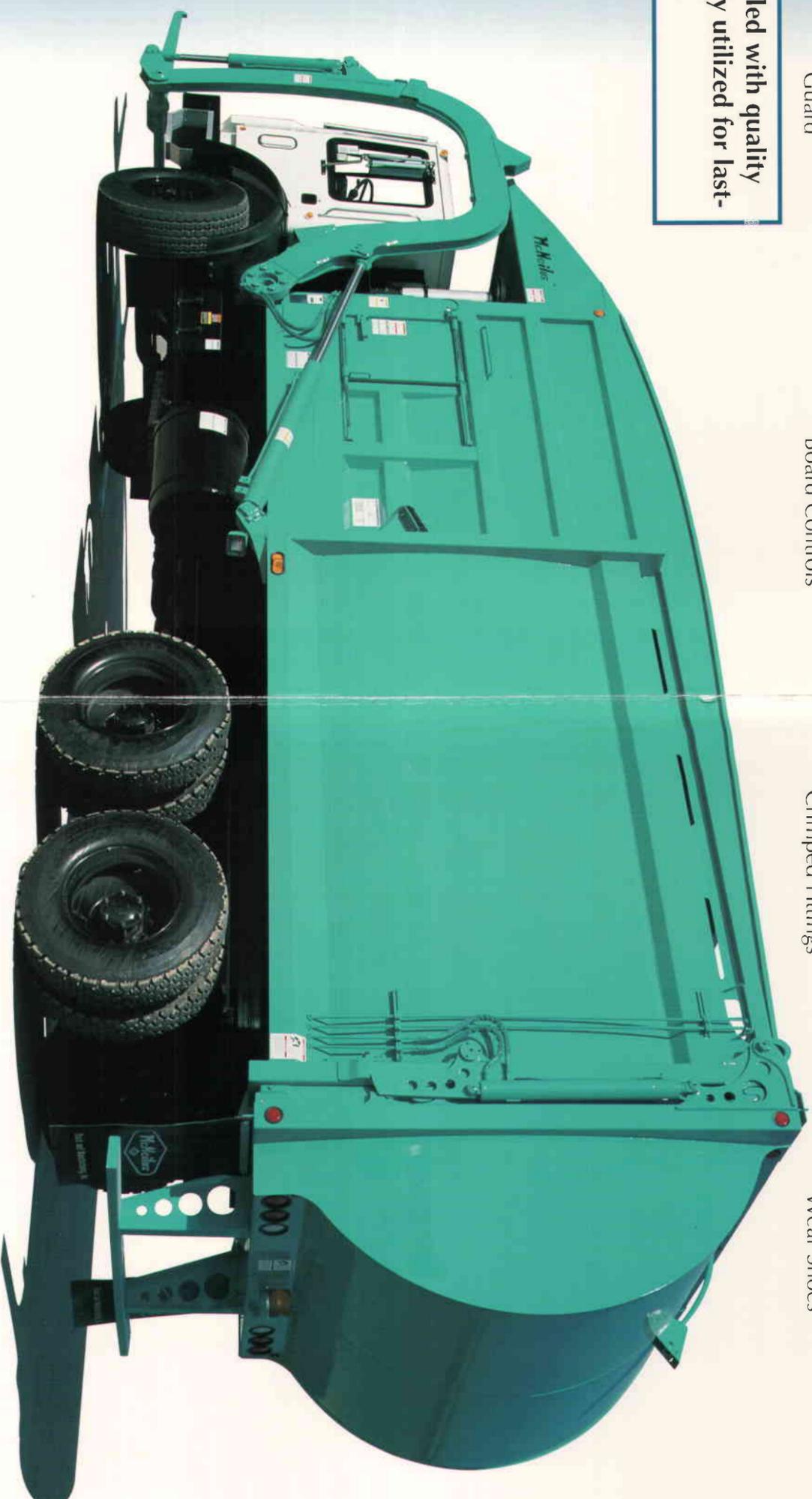
Aeroquip Hoses and Crimped Fittings



One-Piece Bolt-On Wear Shoes



Chaff-Resistant Function-Coded Wiring Harness



Safety Interlocked Sliding Side Door



Adjustable Ergonomic Joystick



Bolt-On Arms and Nylatron Bushings on Arm and Fork Torque Tubes



Eight-Point Locking Tailgate and Zinc-Plated Tubing



Commercial Front-Mount Pump

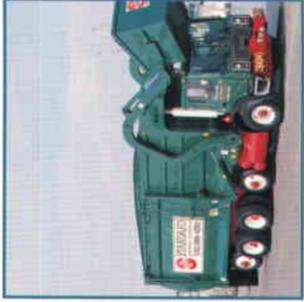
Options



Residential Package



Camera Packages



Auxiliary Axles



Body Service Lift



Scales



Washout Tanks



Strobe and Work Lights



Air-Ware™ Air-Operated Controls



Custom Paint and/or Decals

ASK ABOUT OTHER
OPTIONS!



Body Sizes: 36 - 40 - 43 Yard Configurations
Full Eject (Standard) or Gravity Dump Models Available

Leasing

Why Lease?

- Improves Cash Flow
- Preserves Working Capital
- Reserves Credit Lines
- Offers Tax Advantages

Why Lease From McNeilus?

- Competitive Rates
- Flexible Terms
- Offer Lease Assignments

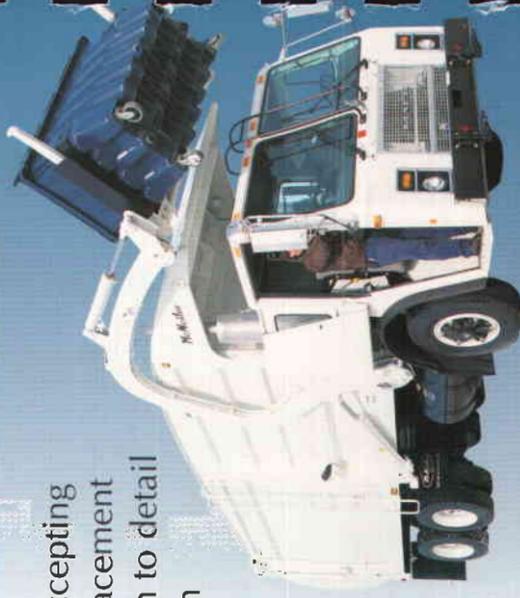
Get the Facts!

- Call Jon Olson at:
507-374-6321



Parts & Service

Protect your front loader investment by accepting nothing less than genuine McNeilus Replacement Parts. Rest assured that the same attention to detail found in your front loader can be found in your replacement parts. In addition to parts, our dedicated service staff is ready to assist you via our **TOLL-FREE Hot Line at: 1-877-PACK-MTM** 24-hours-a-day/seven-days-a-week! Contact your nearest branch for more information.



McNeilus®

CORPORATE HEADQUARTERS
McNeilus Truck and Manufacturing Co.
Hwy. 14 East • Dodge Center, MN 55927
Phone: (507) 374-6321 • FAX: (507) 374-2804
www.mcneiluscompanies.com

BRANCH LOCATIONS

CA: (Phone) 909-370-2100 • (FAX) 909-370-0739 • CO: (Phone) 303-287-7486 • (FAX) 303-287-2780 • GA: (Phone) 770-489-0707 • (FAX) 770-489-9511
OH: (Phone) 614-868-0760 • (FAX) 614-868-0498 • PA: (Phone) 610-286-0400 • (FAX) 610-286-2094 • TX: (Phone) 972-225-2313 • (FAX) 972-225-4407
UT: (Phone) 801-954-8709 • (FAX) 801-954-8756 • WA: (Phone) 253-536-0260 • (FAX) 253-536-0483

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The Future Is Now With The

Roll-Off

From McNeilus



The Future Is Now With McNeilus

Roll-Off Specifications

Standard Features

- Commercial Intertech® VA-20 3-Section Spool Valve
- Inside Air - Outside Pneumatic Controls
- Retractable Bumper
- Interchangeable Hydraulic Cylinders
- Interchangeable Fenders
- Easy-Access Sheaves
- Aeroquip® Hoses and Fittings
- Commercial Intertec® P51 Hydraulic Pump
- Weather-Pak® Electrical Wiring Connectors



- Solid Positive Manual Container Lock!



- Maintenance friendly 3-3/4" side rollers (five per side)!



- Manual outside controls!
- Pneumatically activated inside controls!
- Additional hydraulic section for future options standard!



Models: Rigid Tail ■ Extendible Tail ■ Vertical Lift
50,000, 60,000 and 80,000 lb. Capacity
Available

Additional Axle and Pup Configurations
Available!

- 7/8" cable (Standard)!



- Five High Strength interchangeable 11" cast steel sheaves with aluminum bronze bushings!
- Four interchangeable 6-1/4" bore double acting hoist and lift cylinders!



- Heavy duty upper lift cylinder mounts!
- 1/4" formed roller guides!

- 10" x 4" x 1/2" VariFlex™ Tubing!

Heavy Duty Cylinder
Standard!



- Extra Strength 2-1/2" rear pivot pin, with Heavy Duty 5/8" hinge plates!
- Dual ratchet-type tie downs standard!
- Work Lights and Sealed Truck-Lites®!



Designed with Quality, Value and Durability

- Designed with Customer Input
- Interchangeable Cylinders, Rollers and Fenders Means Fewer Stocked Parts in Inventory
- McNeilus Roll-Off Backed by Quality Service Staff and Genuine McNeilus Parts
- Variety of Models and Axle Configurations to Choose From
- Tarp and Wet Kit (PUP) Options Available
- **McNeilus Offers In-House Financing**

High Strength Interchangeable Rollers

Heavy Duty Container Guides

One Cylinder Fits All!

48" Tool Box (optional)

10" x 4" x 1/2" Heavy Duty VariFlex™ Tubing



Power Beyond Outlet (Standard)

(provides hydraulic power for options, i.e., tarpers, wet kits, etc.)

Retractable Rear Bumper

Inside [Pneumatic]-
Outside [Manual]
Controls

Interchangeable Fenders



*Extendible Tail and Vertical Lift Models Available

CORPORATE HEADQUARTERS
McNeilus Truck and Manufacturing Co.
Hwy. 14 East, Dodge Center, MN 55927

Phone: (507) 374-6321 • FAX: (507) 374-2904

BRANCH LOCATIONS

CA: (Phone) 909-370-2100 • (FAX) 909-370-0739 • CO: (Phone) 303-287-7486 • (FAX) 303-287-2780 • GA: (Phone) 770-489-0707 • (FAX) 770-489-9511
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WA: (Phone) 253-536-0260 • (FAX) 253-536-0483

Appendix F | Vermicomposting Information

Appendix F

KISS Plan for vermicomposting on a modern dairy or horse farm

Copyright by Jim Jensen, YELM Earthworm & Castings Farm, 1997 yelmworms@aol.com. Permission granted to copy or post with complete attribution in whole, without addition, deletion, or substitution.

SUMMARY: The KISS—Keep It Simple & Save—plan for vermicomposting for farmers and others uses established methods (an extended windrow) and available equipment (a front end loader) to process large volumes of organic material into vermicompost. The plan suggests easy, appropriate technology to manage environmental factors and control quality. The KISS plan is based on several years of research and experience in vermiculture and vermicomposting. The plan may be adapted to other situations or applications.

BENEFITS: Farmers and others will benefit from several advantages of this method:

- It is simple; no special training is required.
- Low, low, low start-up cost—it uses existing equipment and available space.
- No turning, no odors—the worms do all the processing, naturally.
- The resulting vermicompost, rich in worm castings, is more valuable to farmers, landscapers, and home gardeners than raw manure. It provides stable organic matter, conserves moisture, improves soil conditions in many ways, and enhances the growth and yields of most types of plants. (Current market value is upwards of \$30-\$90 per cubic yard.)

STEP 1: WINDROW PREPARATION

A windrow is a long row of material (e.g., 4 to 10 feet wide, by 2 to 3 feet high, by some appropriate length). The length can vary depending on the availability of gently sloping space, ease of material handling, or other factors. Longer windrows will cost a little more for supplies.

To start a windrow, spread a 12 to 18 inch layer of manure solids, with or without bedding, along one end of your available space. Inoculate the windrow with high-quality redworms—*Eisenia fetida* (from a breeding or active pile). For this first row, apply up to 1 lb. redworms per sq. ft. of windrow surface area. Add 2 to 3 inch layers of manure every week (3 to 6 inch layers in colder weather) to gradually increase the depth of the windrow. Each windrow should be large enough to handle these thin layers of material each week. With a thermometer, make sure that the layers of feed do not get hotter than 35°C (~95°F).

Remember the following:

- This plan is for farm-scale volumes of manure. Larger volumes can help protect the worms from adverse conditions and predators. Enclosed bins are still recommended for home- or school-based vermicomposting.
- A hard or concrete surface is easier to work on, especially in wet weather, and may even be required to control runoff.
- As you extend the windrow (Step 2), leave a way to reach the finished castings.
- This method does not generate high heat. This is acceptable for many types of dairy

and horse manure. If heat treatment is needed to control pathogens or weeds, simply precompost the material before feeding it to the worms.

STEP 2: EXTENDING THE WINDROW

After the first windrow is established and layered to around 2 to 3 feet thick, it is time to extend the windrow. Add the next layers of manure along one side, directly next to and against, the first windrow. The worms in the first pile will gradually migrate toward the fresher feed. Continue adding the fresh manure alongside until you have formed a second complete windrow. Repeat this step, extending the number of windrows to the limits of your need or space. The worms will continue migrating laterally through the windrows, leaving rich vermicompost in their wake.

STEP 3: MAKING QUALITY CASTINGS

Redworms tolerate a range of environmental conditions before suffering serious losses. Nonetheless, providing the optimum conditions for worm health and growth can assure maximum decomposition and transformation of organic wastes. Research from around the world and practical considerations suggest the following optimum conditions for redworms:

- Temperature: 15 to 20°C (60 to 70°F)
- Moisture content: 65 to 80 percent
- Oxygen requirement: aerobically
- pH: > 5 and < 9

Keep the worms well-fed and comfortable, and they'll make quality castings in the decomposed manure/bedding. Their active burrowing habits naturally aerate the windrows, providing good control of odors. Leaving each windrow for a little longer time before harvesting assures the vermicompost will be more broken down, more stable, and have more worm castings present.

STEP 4: MOISTURE AND IRRIGATION

Moisture is also critical to the well-being of your working worms. A simple method for applying moisture on a farm is through a sprinkling hose or other sprinkling/misting irrigation system. Run it the length of your windrow. Try to moisten evenly, i.e., keep the surface moist, but don't let the bottom become soggy.

STEP 5: WINDROW COVER

A suitable compost cover, placed over the active windrow, is critical to preserving valuable nutrients in the vermicompost. Rather than nutrients leaching out and possibly contaminating ground or surface waters, they should be retained in the vermicompost in ways that are valuable for plants. Various types of tarps or fabrics could be used to shed excess rainfall and prevent leaching, while maintaining aerobic conditions. A few companies advertise fabric covers for composting. They may also be useful for vermicomposting. They include:

- Top-Tex Compost Cover, from Autrusa Co., Blue Bell, PA, 610-825-2973, autrusa@aol.com
- Compostex Cover, from Texel, Burlington, VT, 802-658-2958, wisluria@together.net
- Compogard Cover, from W.L. Gore & Associates, Inc., Elkton, MD, 410-392-3300

Covering the windrows of finished castings prior to use also retains nutrients and helps prevent weeds from spreading.

STEP 6: HARVESTING

Because the worms concentrate in the freshest, most active windrow, after 2 to 6 months the first windrow and each subsequent windrow will become ready to use. It can be spread with a loader or manure spreader. Coarse material, if any, can be screened out to produce a fine, marketable soil amendment.

Call for Details or Assistance

206-352-9565 (office)

206-352-9566 (fax)

360-894-0707 (farm)

877-339-6767 (toll-free order line)

**Appendix G | Sanitary Landfill Site
Information**

Appendix G

1. ANALYSIS OF THE INITIAL STATE

1.1 SITUATION GEOGRAPHIQUE AND ACCESS TO THE SITE

1.1.1. Geographical situation

The potential site for the installation of solid processing waste of the town of Jijel is in the commune of Kaous, to 17 km in the south of the town of Jijel, it belongs to the commune of Kaous. The ground is in the basin of Jijel, on a ground in gullying characterized by an accelerated erosion. The site is to approximately 1,5 km since the departure of the CV3. The geographical limits of the site are: - In North, west and South: agricultural land; - A Is, local road CV3 (driving path towards secondary agglomeration (ACE) of Ben Saber of the commune of Kaous). The coordinates Lambert X = 745,750 Y = 4073,125 Z = 116 m The maximum surface assigned to the future installation of solid processing waste of the town of Jijel is of 12 ha, and that starting from the limit of the CV3. The delimitation of the surface assigned to the installation of solid processing waste will be defined after execution of the topographical survey of the assiette of the ground. Nevertheless, we recall you that the card d'état major, 1/25.000 of the area of Jijel submitted you by DHL, on which figure the potential site

1.1.2. Access to the site

The site is accessible by taking the local road CV3 which takes departure of the path of wilaya CW N°150. The site is to approximately 1,5 km, on the right driving CV3 towards Béni Saber (scattered zone of the commune of Kaous). CV N°3 is a path serving El Djerf (mechta commune of Jijel) and Ben Saber and Djebra (mechtas of the commune of Kaous). National road RN 77 occurs of the RN 43. It is a linear of 47 km and constitutes the North-South connection (place head of Jijel Wilaya de Sétif and Mila). The RN 77 crosses the place head of the commune of Kaous and provides the function of forwards and service road. Does the RN 77 present a good state and it is attended too much by the inter-commune traffic (place head of Jijel Kaous and Texenna) and by the regional traffic. Local road CV3 is a linear of 9 km, its origin is located at kilometeric bridge km No 3 + 250 of the CW150. It is covered on 7,9 km but its state is degraded. According to the service of public works of the wilaya of Jijel, the CV3 requires work of refitting. The path of wilaya CW150, takes departure on the level of the Moussa village and is connected to the RN77 after having traversed 12 km. CW 150 presents a slight coating which in an average state. The counting of the vehicles for the year 1991 gave the following figures: 5.020 vehicle for the CW150 and 2.000 vehicle for the CV3.

A project d'évitement Southern of the town of Jijel (stage d'avant summary project) is in hand. The section is a linear of 14,3 km; begin with an exchanger on the level from l'Oued Kissir and is connected by a second exchanger to the level of the RN43. the layout of l'évitement southern of Jijel is far from the potential site.

1.2 CLIMATOLOGICAL CHARACTERISTIQUES

For the climatic characteristics the climatic parameters considered to be necessary for our project are precipitations, the temperatures and the winds. · precipitations can involve the pollution of the

courses d'eau or the tablecloths if they exist, by infiltration of surface waters, involving with them cut-off waters; · the temperatures intervene in the fermentation of waste · the winds intervene in the dispersion of smoke, the odors and light waste (papers, plastic film, dust?) The area of Jijel enjoyed d'un Mediterranean climate characterized by a hot and wet summer and a soft and rainy winter. The annual total of rain exceeds the 1200 mm for a total number of day of 11 day old rain. The rainy period is spread out mid-October in mid-April. The hottest month is August and the most cold month that of December. The annual average temperature borders 18°C. As regards the winds: two dominant directions are observed: 1 North-western Direction: month d'octobre in the month d'avril; 2 North-eastern Direction. May in September. The force of the winds varies from 2,5 to 4,2 on l'échelle Beaufort " light wind " .

1.3 HYDROLOGICAL CHARACTERISTIQUE The potential site is in the commune of Kaous characterized by a relatively significant hydrographic network. The hydrographic network is represented in the area catchment BV N°03 and more precisely in under area catchment N° 03-03 (coastal jijel) whose principal wadi is wadi El Mencha. Many wadis and chaabats are present. The Mencha wadi in the East and the Kissir wadi in the west are most significant through the communal territory of Kaous. Other wadis are generally dry as wadi El Kantra which pours in the sea. The wadi El Kantra is the small brook, longest, takes its origin on the level of the commune of Kaous and crosses the commune of the south to North after having collected water Ksara wadi and wadi kella. L'oued also receives water of chaabat Semmara. The zone of the project is drained by surface water of the large area catchment number 03, under area catchment number 03-03: area catchment cotier of jijel. The direction d'écoulement of the wadis is of direction South-North and flow afterwards in the sea. The river nearest to the potential site is a chaabat tributary with Ksara wadi: wadi El Kantra. The surface of its catchment area is of 22 km² and the annual average contributions are 20 Million m³ per annum. The wadi El Kantra crosses sandy formations of l'éocene and pliocene of the coastal plain.

1.4 CARACTERISATION GEOLOGIQUE AND HYDROGEOLOGIQUE (see geological draft and legend sent by E-mail) the geology of the area of Jijel is characterized by a mesozoic sedimentary cover and the Paleogene which constitutes the dorsal kabyle which rests on the base metamorphic kabyle antécambrien with paleozoic. This last can be with or without sedimentary cover. The lithological card of the area of Jijel made it possible to release two outcrops to know: - lower miocene of Burdigalien where marls are found gray, sometimes sand spreader. This type of formation is impermeable. - higher Eocene? Oligocene of the numidien. This formation is characterized by a clay alternation and sandstone. Geology on the level of the site: The potential site is at the place of Miocène of impermeable Burdigalien. This formation is characterized by the presence of silstones mudstones, calcaireuses clays, marls, marl-limestones, conglomerates with small rollers, likings coarse, detrital limestones. The character hydrogeologic of this geological formation is far from the permeable one, because of the presence of small rollers which support routes for surface water, to impermeable. No drilling neither well is present on the ground of the potential site nor on its immediate neighbourhoods.

Downstream from the potential site, on the level of the Ksara wadi, is a potential site for a reserve collinaire. It y place to take all measurements necessary in order not to contaminate water of this wadi which whose future one can contaminate reserve, once carried out.

1.5 SEISMOLOGICAL CHARACTERISTIQUES

According to the Algerian payment parasismic, elaborate in 1983, the area of Jijel is in the zone average d'intensity: zone II This zone is defined by an intensity of IV to V (fright of the people).

1.6 AGRONOMIC CHARACTERISTIQUES AND OCCUPATION OF THE GROUND

The potential site is on a ground whose agricultural potentialities are average with weak: accelerated erosion and ground in gulying (slope between 12,5 and 25%). The site belongs to the zone with major constraints for the development of l'agriculture (according to the card of the constraints and potentiality, PDAU of Kaous). It s'agit of grounds with bad texture (calcareous, marl and clay). From the occupation point of view of the ground, the potential site is on the territory of

Exploitation individual Agricole (EAI) of AMIROUCHE (surface of 19 hectares). It is surrounded by agricultural land belonging to socialist agricultural field (DAS) AYAD MOULOUD; in north collective agricultural exploitation N°1 of AYAD (surface of 41,23 hectares) and in south-west by EAI of CHAB (surface of 50,57 hectares). Ensemble of these grounds is affected with the fodder crops (pasture). According to our investigations near the service of agriculture of the commune of Jijel, these grounds occupied by the fodder crops, a little cereal, the dry vegetable cultures (chickpea etc.) and one also finds some trees of olive there (oléastre) and a few rustic feet of plantation (fig tree).

1.7 FAUNISTIC AND FLORISTIC CHARACTERISTIQUE The potential site is invaded by species pushing naturally, one finds of it olive-tree wild, dwarf palm tree. One finds also undergrowth made up of mastic tree and calycotome. The animal species met by agents of the service of the forests of Jijel are: the wild boar, the hare, the rabbit, the partridge, reptiles, the mongoose, the jackal, the fox and the raptor protected kestrel. If the site is exploited in controlled discharge, that does not constitute a negative impact for fauna in place, that Ci will move elsewhere. However if the site is exploited in an uncontrolled way, it will constitute a medium of attraction of savage animals, vectors of dangerous diseases.

1.8 DWELLINGS AROUND THE SITE The closest dwellings with the potential site belong to the scattered zone of the commune of Kaous. O A approximately 350 m with flight d'oiseau is an agricultural cooperative d'élevage bovine pertaining to private; O A 2,7 km, with l'Ouest is a track carrossable which can be arranged like tracks d'accès for l'exploitation of the discharge (according to Mister the vice-president d'APC of Jijel); O A approximately 2 km in south-west is a farm deprived on the level of the node d'une small hill. Our discussion with the technical director of l'APC of Kaous assure us the dissatisfaction with the local population for l'installation d'une discharge on the level of the potential site.

In years 84, when the decision to pour waste on the level of this site was made, the population s'est expressed and protested against the presence of this discharge on its territory, which has constrained the local authorities d'ou stop of discharges and transfer towards the site of Mezghitane.

1.9 OTHERS RESEAUX The feeder systems into drinkable (AEP) and the network of cleansing are limited to the agglomerations place head of Jijel and Kaous. The secondary agglomerations and the scattered zones are not connected to the network of AEP and the network of cleansing. In the neighbourhoods of the potential site, drinking water l'alimentation is done by collecting of the sources and the d'eaux rejections worn are done directly in nature or well in pits skeptics. Electrical supply network: the zone of the potential site is fed in electricity by the line the Medium Average one (30 Kv) coming from the station to l'Emir Abdelkader. Public L'éclairage misses. Natural gas network: the zone of the potential site n'est supplied with a natural gas network. Gas butane L'alimentation is ensured starting from the private station of service, located at the south of the place head of the commune of Kaous and by private shops which s'approvisionnement deposit of Taher.

CARACTERISATION OF POLLUTION

1.9.1 The composition of waste of JIJEL Waste which will be put in discharge at the level of the potential site results from the households, the trade and the sweeping of the streets and public places as well as the waste compared to the household refuse of the hospitals. The results of l'étude of characterization of waste of the town of Jijel (carried out by BVA/NEE 03/2000) are as follows: Paper: 9,6 % · Glass: 0,9 % · Metals: 1,9 % · Plastic: 8,3 % · organic Matter: 70,3% · special Waste: 1,4 % The daily tonnage of solid waste generated by the town of Jijel is estimated at 72 Tonnes / day

1.9.2 Estimate of pollution In the estimate of the flows, we consider the following flows: · Flows of surface waters · Flows of water of percolats · Flows of infiltration · Flows of storage

has Flow of streaming of rain water The flow of streaming is estimated by the rational method, it is the method most usually used. $Q_r = K C I A$ (m^3/s) K: coefficient minorator I: average intensity = 85,17 l/s/ha C: coefficient of streaming: 65 % (compacted ground) a: surface of the racks filled by waste (approximately) = 11 ha $Q_r = 0,6 m^3/s$ B Flow of the lixiviat or flow of the water brought by waste The rate d'humidity of waste of the town of jijel (ANRH, April 2000) is 48,5 %. This percentage represents the d'eau quantity contained in waste and which goes percoler after compaction. · daily tonnage: 72 T/j with · Thus one a: $72 \times 0,485 = 35 T/j = 34920$ water kg/j are equivalent of $34920 l/j = 34,92 m^3/j = 0,0004042 m^3/s$ $Q_l = 0,0004 m^3/s$ According to these estimates, one can notice that the flow of streaming is more significant than the flow of percolation brought by waste, in spite of the small quantity of this flow, it is significant that this water brought by waste is treated.

C Flow of infiltration $Q_t = Q_r + Q_l$ Q_t = total Flow in m^3/s Q_l = Flow of infiltration in m^3/s $Q_t = I X A$ I: average intensity: 85,17 l/s/ha a: surface of the racks filled by waste 11 ha $Q_t = 936,87 L / S$ $Q_l = Q_t - Q_r$ $Q_l = 0,33 m^3/s$ D - Flow of storage $Q = Q_r + Q_l - IQ$ $Q = 0,27 m^3/s$ 1.9. synthesis To conclude on the analysis from the initial state we had the advantages and the disadvantages of the site suggested

Advantage Disadvantage Hydrology the water pollute can be easily collect by l'installation d'un system of drain risk of pollution des water of wadi El Kantra and risk of pollution of reserve d'eau on wadi Ksara a once carry out Hydrogeology Formation geological very little permeable with impermeable No drilling nor well on level of site Accessibility Local road vicinal CV 3 The CV 3 require some work of refitting Capacity 11 ha If the capacity be insufficient, require some earthwork de terrassement in-depth Circulation in the vicinity proximité immediate FaibleTrafic lower with 600 véhicules/jour (counting 85 - 90) Situation of site in their context of habitat and of economy Not of dwelling near site. Ground with average potentiality with weak presence of agricultural land in the neighbourhoods of the site

Concerning l'incineration of medical waste of l'hôpital of jijel: L'incinerator who be broken down at the time of the visit of BVA with jijel was repaired near company ECFERAL? ALGIERS and it are currently functional. It manages to incinerate approximately 100 kg of toxic medical waste. Does L'incinerator function tous.les.jours except Fridays (6/7 days) of 08 H of the morning to 14 h. the second incinerator broke down since July 2000 (in repair at ECFERAL? ALGIERS). The back bricks are deteriorated. L'economist of l'hôpital of Jijel declared us qu'en reason of the low capacity of l'incinerator, the not treated total quantity of generated waste n'est. For that, waste is burned on the level of the site of the discharge of Mezghitane.

Other Site Information

Geographical situation:

The city of Jijel passed to the rank of wilaya after the administrative carving of 1974 and the township of Jijel became chief place of wilaya.

Situated in the center of the wilaya, the town of Jijel is an inshore city of its big tourist role for the attraction of adjacent wilaya tourists as Constantine, Sétif, Mila and for others wilayas of the South of algeria.

Of a total surface of 6566 that has the town of Jijel, it is limited:

- At the north by the Mediterranean Sea,
- At the East by the town of the emir Abdelkader,
- At the west by the town of Kaous,
- At the South by the town of Aouana El.

The relief of the town of Jijel is divided in three left: the coastal plains, the pouring and mountains especially represented by Djebel Mezraitin.

About the hydrographic view, many rivers and small rivers which are called chaabat are present. The Menchas river at the East and the Kissir river at the west are the most important in the local territory.

Other rivers are the most often to dry as O. El Kantra, O. Maatasse, o. MADANI, O. ERRAMANE, O. MERABAA, O. TAKLIATE, O. TAZANET, O. ELKALA, O. MAGHRIS, O. Kessara.

The Kantara river is a small stream, longest, takes its origin at the level of the town of Kaous and cross the town of the South to the North after having collected the waters of three rivers: O. KESSARA, O. Elkella and O. Madani. The EL Kantara river crosses formations made of sandstone of the Eocène and the Pliocène of the inshore plain of the region.

The Maghriss river pours out its waters into O. Mencha. The O. Maatasse takes its origin in Djebel Mezraitin and head toward the sea while transporting water of O. Erramane. The Merabaa river takes its origin at the level of the Djebel Elhaddada and pour out into the sea of quoted it West of the town. The O. Tazenat flows O. Takyalet that pours out into Kissir River to the west of the town. it also exists numerous small rivers called chaabats that pour out into the quoted rivers high or directly into the sea. The zone of the project is drained by the ground-waters of the pouring big basin number 03, under-basin pouring number 03-03. The nearest river to the potential site is chabet Kasara, rivers flow of the river El Kantara (as shown in the hydrographic map). The area of the basin pouring the oued El Kantara is 22 km² with the yearly middle contributions of 20 millions of m³ by year. The river El Kantara crosses formations made of sandstone of the éocène and the pliocène of the inshore plain.

Geology near the potential site:

The geology of the region of Jijel is characterized by a cover sedimentary mésozoïque and paléogène that constitute the dorsal kabyle that rests on pedestal kabyle metamorphic antecambrien to patéozoïque. The pedestal kabyle can be with or without sedimentary cover.

The lithologique map of the Jijel region permitted clearly two outcrop. It is about:

- The lower miocène of the Burdigalien where we finds the gray marls, sometimes sandy. This type of formation is impervious.
- The superior éocène-oligocene of the numidien. This formation is characterized by an alternation of clay and sandstone.

The potential site is at the place of the Miocène Burdigalien impervious. This formation is characterized by the presence of silstones argilites, clays calcaireuses, marnes, marnes - chalky, conglomerates to small pebbles, coarse with detrital limestones.

The hydrogéologic character of this geological formation is of very little permeable, because of the existing of small pebble that encourages the progress for the waters of surface, to raincoat.

No forage and no well are not present on the land of the potential site nor on its immediate surroundings.

Downstream the potential site, at the level of the potential site there is a retained collinaire of the Ksara river. In this place we must take all necessary measures in order to don't contaminate the water of this river that if at the future can contaminate the retained collinaire, once achieved.

The city of Jijel is nourished from three tablecloth waters: tablecloth of Mencha oued (1,7 Million cubic meter), tablecloth of oued Djen Djen (10 Million cubic meter) and tablecloth of Kissir oued (1,5 Million cubic meter).

The below table indicates the existing reserve collinaires on the administrative territory of the town of Jijel. These reserve collinaires are affected to the irrigation.

Denomination	Coordinated			Capacity (m3)	Rate of exploit.	Irrigable surface	Year. Stake service
	X	Y	Z				
Kharouba 1	775.880	393.000	28.00	100.000	18%	20,00 ha	08/1985
Kharouba 2	775.700	393.040	32.00	90.000	60%	18,00 ha	11/1985
Boumechris	777.000	391.850	36.00	200.000	75%	40,00 ha	08/1989

The sismicity:

The Algerian regulation parasismique, elaborates in 1983 after the earthquake of el Asnam (October 1980), sequence the region of Jijel in the zone of an equal intensity to 2, either one of middle intensity. The national territory is divided in four sismical regions:

Zoning	Intensity
Zone 3	Strong
Zone 2	Average
Zone 1	Weak
Zone 0	No seismic

The Algerian parasismique regulation, elaborates in 1983 after the earthquake of El intervening Asnam in October 1980, sequence the region of Jijel in the zone of an equal intensity to 2 (middle intensity zone). The middle sismicité zone constitutes dangers for the urbanization if norms parasismiques are not adopted.

On the geological plan, the soft soils is constituted of pieces of furniture of alluvium non strengthened sands, of tender rocks, of clayey and marly soils have a very strong person sensitivities to the telluric jolts. So all construction erected on these risks the downfall contrary to the one built on a chalky sunstoned or granitical soil,.

The telluric jolts influential also on the morphology of lands. Slips are important on soils pieces of furniture to strong slope, in borders of slopes and the deep ravines.

About the climatological view, the town of Jijel is characterized by a humid climate with the moderate and humid winters and the hot and dry summers. The yearly total of rain passes the 1200 mms. The rainy period spreads of the mid - October to the mid - April.

The hottest month is the month of August and the coldest month is December. The yearly middle temperature adjoins 18°C.

The dominant winds are from direction Northwest and then Northeast. The winds South is rare and breath in summer (July - August).

Occupation of soils: The potential site is implanted at the place of an range of olive trees. The access to the site makes itself by the path byway CV3 (road vicinal number 3) that connected in path departmental CW 150.

Access to the potential site: spreading on a surface of 12 has, the potential site is accessible by the path local CV number 3 that takes departure of the path of wilaya CW N°150.

The CV number 3 is a path going against El Djerf (Mechta of the township of Jijel) and Ben Saber and Djebra (mechtas of the township of Kaous).

The CV number 3 presents a bad state and ask for a réaménagement. Concerning information of the traffic transports circulating about CV number 3 is not available (not of vehicle numbering).

State of supplying drinking water: the supplying water goes for all the districts of towns even the illicit constructions. The drinking water is brought back from four reservoirs situated near the military barrack, on the heights of the old city. The total capacity of these four reservoirs is 8.000 m3. These reservoirs are feeded by the waters of the Mencha and Djen Djens river. Two other reservoirs being to 100 ms of altitude in the South part, with a total capacity of 4.000 m3. To quoted of these two reservoirs, be two other reservoirs (capacity of 3.000m3). The supplying drinking water distribution of conducts' diameter varies 100 to 450 mms. The distributed water especially remained insufficient in period of summer where rivers are too dry.

Network of purification: the network of purification crosses all the districts of the town, as it is the case for the network of supplying drinkingwater to town.

It exists an old, unit network, in the old city. The second network is separatif, crossbar the new city (Ayouf city, Ouled Aissa). The receiving environment of the purification waters is the El Kantra river for the old network and the Maatasse oued for the new network purification. Dismissals are directly toward the sea. A station of purification is foreseen in the west part (Rabta) (the survey being finished but lack financing for facilities).

The network of supplying drinking water and purification is limited to the agglomeration chief place of Jijel. The secondary agglomeration and the scattered zone are not nourished by the network of supplying drinking water and don't arrange network of purification.

Network of electricity: the city of Jijel is nourished in electricity by the Middle Tension (MT) lines and high tension (HT) coming from the powerhouse of Ziama Manssoria and Irraguène and by two other lines coming from Mila and Skikda.

Natural gas network: the network is nourished by a station of distribution situated to three kilometer to the East of the town that is to its tours nourished by the main station of Skikda.

Only the agglomeration chief place of Jijel is nourished in gas of city, the other (secondary agglomerations, zone scattered) nourish themselves by gas Butane.

Demographic data:

The population of the town of Jijel is distributed in an agglomeration chief place, three (03) secondary agglomerations and a scattered zone.

DESIGNATION	Agglomeration Chief place (ACL)	Secondary agglomeration (HAVE) AS	Scattered zone (ZE)	TOTAL
Jijel RGPH 1987	62.793	(Bouinar) 732	6.240	69.765
Jijel RGPH 1998	106.003	(Bouinar, Harratene, 3 rd KM) 6.337	2.859	115.196

RGPH: general recensement of the population and the inhabitat

The rate of urbanization (urban population: ACL + HAVE by the total population) is 97,52%.
The rate of growth of the population of the town retained for Jijel is 3,43% short-term (2003),
2,95% medium-term (2008) and 2,45% long-term (2018).

The table below indicates the distribution of households and their sizes by scattering in the town of Jijel (source RGPH 1998):

Scattering	Population	Households	TMM *
ACL	106.003	16.216	6,54
AS	6.337	923	6,86
ZE	2.859	376	7,60
Total	115.196	17.518	6,58

TMM *: Size Average of Households

The table below gives us the evolution of the population and the quantity generated by inhabitants to different horizons:

Year	Population Total	waste Kg/hab/j	waste T/j
1999	119 147	0,60	71,5
2000	123 234	0,60	73,9
2001	127 461	0,62	78,4
2002	131 833	0,63	83,1
2003	136 355	0,65	88,1
2004	140 377	0,66	93,0
2005	144 518	0,68	98,1
2006	148 782	0,70	103,5
2007	153 171	0,71	109,2
2008	157 689	0,73	115,3
2009	161 553	0,75	121,1
2010	165 511	0,77	127,1
2011	169 566	0,79	133,5
2012	173 720	0,81	140,2
2013	177 976	0,83	147,2
2014	182 336	0,85	154,6
2015	186 804	0,87	162,3
2016	191 380	0,89	170,5
2017	196 069	0,91	179,0
2018	200 873	0,94	188,0

In Algeria, practices of consumption are identical for the majority Algerian cities. The rate of growth of the waste production is valued to 2% to 3% by year (Robert GILLET 1985 and survey of Algiers 1995).

The rate growth used for Jijel evolution waste is 2,5 %.

Faunistique inventory

On the ecological plan, the zone of survey presents a particular faunistique diversity. Although the middle underwent of numerous particular modifications these last years, an important fauna subsisted.

According to information collected by the inspection of the environment of Jijel the printout of species exists in the region is the next one:

Nevertheless the degree of rarity is of rare to rarissime.

1. **Birds:** A total of 131 species are present. Among these certain species are protected (presidential decree number 83-509 of august 1983, and departmental order of 17 january 1995), it is about of:

Common name	Scientific name
Bruant ortolan	<i>Emberiza hortulana</i>
Chardonneret	<i>Carduelis carduelis</i>
Coucou gris	<i>Cuculus canorus</i>
Cinle plongeur	<i>Cinclus cinclus</i>
Gros bec	<i>Coccothraustes</i>
Guépier d'Europe	<i>Merops apiaster</i>
Huppe fasciée	<i>Upupa éops</i>
Loriot d'Europe	<i>Oriolus oriolus</i>
Martinet à croupion blanc	<i>Appus affinis</i>
Pic épeiche	<i>Dendrocopos</i>
Sitelle Kabyle	<i>Sitta ledanti</i>
Torcol	<i>Jynx torquilla</i>
Aigle botté	<i>Hieraetus pennatus</i>
Aigle royal	<i>Aquila chrysaetos</i>
Busard cendré	<i>Circus pygargus</i>
Chouette chevêche	<i>Athene noctua</i>
Epervier d'Europe	<i>Accipiter nisus</i>
Hibou grand duc	<i>Bubo bubo</i>
Milan royal	<i>Milvus milvus</i>
Vautour fauve	<i>Gyps fulvus</i>
Cigogne blanche	<i>Ciconia ciconia</i>
Héron pourpé	<i>Adrea purpurea</i>

2. Mammels: A total of fifteen species are present of which eleven protected by the Algerian regulation:

Common name	Scientific name
Singe magots	<i>Macaca sylvanus</i>
Loutre	<i>Lutra lutra</i>
Porc épic	<i>Hystrix cristata</i>
Hérisson	<i>Erinaceus europaeus</i>
Belette	<i>Mustella numidica</i>
Mangouste	<i>Herpestes ichneumon</i>
Genette	<i>Gennetta genetta</i>
Lérot	<i>Eliomys quercinus</i>
Renard	<i>Vulpes vulpes</i>
Hyène rayée	<i>Hyaena hyaena</i>

2. Fishes : Inventories of fishes species presents are given below in the table:

Common name	Scientific name
Red mullet	<i>Merlangus</i>
Merlans	<i>Mullus barbatus</i>
Pageots	<i>Pagellus crytirus</i>
Dorade	<i>Chrysophyrinus</i>
Soles	<i>Solea solea</i>
Sépias	<i>Sépia officianalis</i>
Crevette rouge	<i>Artisteus antennatus</i>
Crevette blanche	<i>Parapenaeus longirostris</i>
Langouste	<i>Palunirus vulgaris</i>
Langoustine	<i>Nephrops norvigieus</i>
Allache	<i>Sardinella aurita</i>
Enchois	<i>Engraulis encrasicolus</i>
Sardine	<i>Sardina pilcharus</i>
Saurel	<i>Trachurus trachurus</i>
Bogue	<i>Boops boops</i>
Maquereau	<i>Scomber scomber</i>
Bonites	<i>Sarda sarda</i>
Thons	<i>Thynnus thynnus</i>
Espadon	<i>Xiphias geaduis</i>
Raies	<i>Reja sep</i>
Chien de mer	<i>Mustellus mustellus</i>

Inventory faunistique and floristique at the level of the potential site:

The potential site is invaded by species pushing naturally, we finds some of the wild olive tree, of the dwarf palm. we also finds the brushwood composed of lentisque and of the calicotome.

The animal species observed by the service of forests are: the boar, the hare, the rabbit, the partridge, reptiles, the mongoose, the jackal, the fox and the bird of prey protégé kestrel.

If the site will be exploited in controlled landfill, it doesn't constitute a negative impact in place for fauna, they will move elsewhere. However if the site is exploited in an uncontrolled way, it will constitute a middle of animals savage attraction, dangerous illness vectors.

The potential site, exploited in controlled landfill, doesn't constitute a risk of fires for population foresters (forest of Mazritane, forest of Kissir oued and domanical forest of Jijel).

Appendix H | Sample Rate Tables

Appendix H

Exhibit 1 | Residential, Multi-Family, Commercial, and Roll Off Rate Structure

User Rate (US\$/month)		User Rate (US\$/month)	
Single family residential		Commercial	
20 gal., 1x/week	11.68	1 yr. bin	
32 gal., 1x/week	14.47	1x/week	64.42
64 gal., 1x/week	23.86	2x/week	128.86
96 gal., 1x/week	32.79	2 yr. bin	
Multi-family residential		1x/week	128.86
1 yd. bin		2x/week	257.71
1x/week	117.80	3 yr. bin	
2x/week	182.23	1x/week	193.28
2 yd. bin		2x/week	386.57
1x/week	182.23	4 yr. bin	
2x/week	311.08	1x/week	257.71
3 yd. bin		2x/week	515.43
1x/week	246.66	Roll off	
2x/week	439.94	22 yd. box + wt	296.57
4 yd. bin			
1x/week	311.08		
2x/week	568.80		

Exhibit 2 | Residential and Commercial Rate Structure

	Number of Pick-ups / Week		
	One	Two	Three
Residential Rates (US\$/month)			
One 32-gal. can	16.75		
Two 32-gal. cans	33.50		
Three 32-gal. cans	50.25		
Four 32-gal. cans	67.00		
One 40-gal can	20.87		
Two 40-gal cans	41.75		
One 45-gal. can	22.05		
Two 45-gal. cans	44.10		
Commercial Rates (US\$/month)			
One 1-yd. bin	98.40	165.80	233.20
One 2-yd. bin	164.60	291.60	418.60
One 3-yd. bin	230.80	417.40	604.00

Exhibit 3 | Breakdown of Residential and Commercial Rates and Franchise Fees

	City #1	City #2	City #3	City #4	City #5	City #6
Residential Service (US\$/month)						
Flat Rate	13.00	N/A	N/A	N/A	N/A	N/A
32/35 gal. can		7.77	12.65	19.00	19.44	11.79
60/64 gal. can		9.12	25.30	38.00	32.66	22.54
90/96 gal. can		16.89	37.95	57.00	45.89	33.29
Bulky waste (flat rate)	0.30	0.71	N/A	Sep. charge	Incl. in special pick-up rate	0.51
Special pick-up (flat rate)	N/A	N/A	N/A	N/A	8.20	N/A
Recycling (flat rate)	2.40	4.43	Incl. in rate	2.71	2.70	3.18
Yard waste (flat rate)	N/A	5.59	Incl. in rate	N/A	5.59	5.59
Commercial Service (US\$/month)						
96 gal. Toter/cart	43.45	23.31	37.95	65.99	59.85	34.14
2-yd. bin, 1/wk	167.50	68.74	114.85	217.75	215.79	93.58
2-yd. bin, 2/wk	310.08	134.86	241.15	398.30	393.66	187.10
3-yd. bin, 1/wk	235.22	95.15	172.25	298.02	306.07	140.34
3-yd. bin, 2/wk	433.81	187.68	356.00	554.35	557.40	280.68
4-yd. bin, 1/wk	302.74	121.55	229.70	375.90	390.48	187.10
Recycling	N/A	Sep. charge	Incl. in rate	Incl. in rate	Incl. in rate	N/A
Franchise Fees						
% of gross revenues	8%	10%	9.8%	2.5%	5%	9%

Exhibit 4 | Commercial User Rates for Specified Refuse

Can Rates

Pick Ups / Week	32 Gallon Can	45 Gallon Can	55 Gallon Can
1	19.58	27.54	33.66
2	39.17	55.03	67.32
3	58.75	82.62	100.98
4	78.34	110.16	134.65
5	97.92	137.70	168.31
6	120.52	169.49	207.15
7	146.14	205.50	251.17

Toter Can Rates – light regular garbage (up to 45 lbs / can)

Pick Ups / Week	1 Can	2 Cans	3 Cans	4 Cans	5 Cans	6 Cans
1	30.98	57.22	83.62	110.33	136.27	162.67
2	58.75	111.40	164.06	216.69	270.25	322.46
3	86.68	165.72	244.62	323.67	403.48	481.61
4	114.45	219.75	329.62	430.48	535.77	641.23
5	142.37	274.07	405.62	537.30	669.01	800.69
6	177.18	342.13	507.10	672.04	837.02	1001.97
7	211.97	410.34	608.57	806.79	1005.04	1203.25

Toter Can Rates – restaurant or wet regular garbage (up to 90 lbs / can)

Pick Ups / Week	1 Can	2 Cans	3 Cans	4 Cans	5 Cans	6 Cans
1	40.12	74.31	108.50	142.53	176.87	211.04
2	76.30	144.67	213.03	281.24	349.62	417.82
3	112.47	214.87	317.40	419.95	522.35	624.89
4	148.63	285.37	421.93	558.52	695.25	831.82
5	184.80	355.56	526.32	697.23	867.84	1038.75
6	226.61	439.80	651.76	863.73	1075.52	1287.49
7	271.02	524.04	777.05	1030.21	1283.22	1536.23

32 Gallon Toter Can Rates – organic garbage (no weight limit)

Pick Ups / Week	1 Can	2 Cans	3 Cans	4 Cans	5 Cans	6 Cans
1	14.69	29.37	44.06	58.75	73.44	88.12
2	29.37	58.75	88.12	117.51	146.87	176.24
3	44.06	88.12	132.18	178.24	220.30	264.36
4	58.76	117.51	176.27	235.03	293.78	352.54
5	73.44	146.89	220.33	282.77	367.22	440.66
6	90.39	180.77	271.16	361.55	451.93	542.32
7	109.60	219.19	328.79	438.38	547.98	657.58

Container Rates – wood

Pick Ups / Week	1 Yard	1.5 Yards	2 Yards	2.5 Yards	3 Yards	4 Yards
1	18.24	27.35	36.47	45.59	54.71	72.95
2	36.47	54.71	72.95	91.18	109.42	145.89
3	54.71	72.95	109.42	136.77	164.13	218.84
4	72.95	109.42	145.89	182.36	218.84	291.78
5	91.18	136.77	182.36	227.96	273.55	364.73
6	109.42	164.13	218.84	273.55	328.26	437.67