

PLANNING A CENTRALIZED HAZARDOUS WASTE TREATMENT FACILITY—AN OPERATOR’S PERSPECTIVE

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INTRODUCTION

The rapid industrial development of the Philippines and the implementation of the Toxic Substance and Hazardous and Nuclear Waste Control Act (1992) is causing an urgent need for hazardous waste treatment facilities. Estimates of hazardous waste volumes in metropolitan Manila are rising from 232,000 tons/year in 1995 to 659,000 tons/year in the year 2010. Mr. Walter Vergara of the World Bank at the 5th International Symposium on Operating European Hazardous Waste Management Facilities stated, “the issue of industrial pollution was the most urgent in the industrializing economies of Asia. Here, pollution and environmental degradation caused by industry continued to be major concerns, while compliance by industry generally leaves much to be desired.”

The availability of commercial hazardous waste treatment facilities is not only a critical environmental issue, but also an essential economic factor for nations with rapidly growing industries. Most world-class manufacturers wishing to locate in the Philippines will expect a hazardous waste management program to be in place—a program that is economical and that meets international standards, especially for ISO 14000 considerations. In addition, without the means to treat and dispose of hazardous waste, it is not possible to enforce environmental legislation.

The management of hazardous wastes in the Philippines is regulated under Republic Act (RA) 6969 “Toxic Substance and Hazardous and Nuclear Waste Control Act,” DAO 29 Title II (Toxic Chemical Substances) and Title II (Hazardous and Nuclear Wastes).

These regulations establish an order of preference for management of hazardous waste: (1) minimization, (2) recycling, (3) treatment, and (4) landfilling. One other important factor that is not directly discussed in the regulations but is implied by necessity is education. Most industries in the Philippines are small manufacturing plants that are not aware of the environmental hazards associated with the chemicals they use or the toxicity of the wastes they generate. The following observations describe the current situation in the Philippines:

- Most firms do not have a hazardous waste management plan.

- Most firms do not have proper hazardous waste segregation, storage, or accumulation areas.
- Most of the hazardous wastes are commingled with the solid wastes.
- Most waste accumulation areas exhibit contamination of the underlying soils.

The development of centralized hazardous waste treatment facilities will both assist the economic growth of industries and provide the proper treatment and disposal of waste.

In addition, operators of hazardous waste treatment facilities can and should provide assistance to the waste generators in educating their work force and thus minimizing environmental impacts and reducing treatment and disposal costs.

GOALS

The planning process for developing a successful operation must evaluate not only technical issues but also commercial and financial aspects. There are two basic goals of developing a centralized hazardous waste treatment facility:

1. Environmentally sound disposal system.
2. Profitability.

These two goals, although simplistic and fundamental, raise many complex and interrelated issues. The technical aspects of providing an environmentally sound treatment/disposal system are probably more straightforward than the commercial issues since they are dictated by regulations; however, they impact profitability directly. The single most important factor affecting a hazardous waste treatment facility is enforcement of the regulations, particularly those governing the generators of the waste. Enforcement will cause a revenue stream to be generated and also dictate the operational and disposal standards for the treatment facility.

An environmentally sound disposal system, at a minimum, must meet the statutory requirements for both disposal and operation. In some cases, when more stringent international regulations are applied, additional treatment could be required.

Profitability is the driving force for any commercial entity. It is the sole reason for expenditure of capital by the investor; without it, the venture will fail. The degree of profit is a function of operational efficiency and the competitiveness of the product.

SERVICES PROVIDED BY TREATMENT FACILITY

Before going into details, it is appropriate to briefly describe what is envisioned as a centralized hazardous waste treatment facility and the function it would provide. In an industrialized country, hazardous waste treatment vendors offer their clients services that go beyond just

treatment and disposal. These services include not only collection, treatment, and disposal, but also technical assistance.

Treatment and disposal are the primary functions of such a facility and are technical in nature and driven by regulations. Collection, i.e., transport of the waste, has a regulatory element, but is more a function of quantity of waste, location, economy, and, in some cases, convenience.

Technical assistance is a service, sometimes free and sometimes at a cost, that provides the generator with advice on how to comply with the regulations and potentially reduce disposal costs.

PLANNING PROCESS

The planning process for a centralized hazardous waste treatment facility has three key elements:

- Commercial
- Technical
- Financial

These three elements are regulatory driven and are factors in profitability. Each element affects the others. For example, the technical issue, degree of treatment, affects the commercial aspect of affordability to the generator and the financial element of capital cost to construct the facility.

COMMERCIAL ISSUES

The commercial aspect is driven by one main issue, that is, a revenue stream or the quantity of waste treated by the facility. Waste is the raw material of a hazardous waste treatment facility. The revenue stream generated by the waste treated allows the operator to pay for operations, pay back capital, and make a profit. Revenue stream alone does not ensure a profitable business; profitability depends on efficiency of operations. Several key issues affect the revenue stream:

- Client base (waste generators).
- Affordability of treatment/disposal of hazardous waste.
- Regulatory enforcement.

Client Base

The client base for a disposal facility includes many large and small businesses that generate different quantities and types of waste. Long-term contracts with large manufacturing businesses provide the operator with a predictable revenue stream and treatment process requirements.

A waste generation feasibility study is necessary to determine the potential quantity and type of waste. The study should identify such items as:

- Number of industries generating hazardous waste.
- Quantity of waste generated by each industry.
- Type of waste generated by each industry (i.e., plating sludges, polychlorinated biphenyls [PCBs], and spent chemicals).
- Rate of industrial growth.
- Location of generators.
- Ability of industries to properly store and package waste.
- Ability of industry to pay.

The information developed from this type of study provides a business with the knowledge needed to determine the magnitude of capital required to finance the project.

Affordability of Treatment and Disposal of Hazardous Waste

Affordability of treatment and disposal of hazardous waste is the second element that affects the revenue stream. The cost of treatment and disposal of hazardous waste should be considered just another operating cost to industries. Like all operating costs, by itself it should not significantly increase product costs. In developing countries, like the Philippines, it will. Much of the development in the Philippines has occurred without the availability of proper hazardous waste treatment facilities, so most waste is either commingled and disposed of as regular waste or stored on-site awaiting disposal. Thus, the cost of proper disposal has not yet become part of the operating costs of industries.

In industrialized countries, where there is sufficient hazardous waste treatment capacity, the cost of treatment is very competitive, which lowers the cost to the generator. Until the hazardous waste treatment industry matures in the Philippines, industries will perceive the cost of treating waste as an undue burden. This is an important realization that must be recognized by the owners/operators of a centralized hazardous waste treatment facility because it will impact financial performance. This realization also offers the generator and treatment facility operator the opportunity to work together to develop a program that would reduce the generator disposal cost and provide the treatment facility operator with a long-term client base.

Controlling the Quality and Type of Waste Requiring Treatment—The overall cost for treatment/disposal of hazardous waste for any industry can be dramatically impacted by its knowledge of the regulations and operational procedures. This is the only area of the hazardous waste treatment process in which the generators can control their costs. It is also the area in which they can make the most significant reduction in overall costs. The generator can use operating procedures to control the quantity and type of waste that requires treatment by a hazardous treatment facility. These operating procedures must focus on waste minimization, recycling, and waste storage. Each of these items affects the overall cost of hazardous disposal

and should be controlled by the waste generator. It's good business, in addition to being environmentally responsible. To achieve these reductions, both management and operators of industries must be educated about regulations and operational procedures.

Assistance to Industries in Achieving Waste Minimization—This is an area in which the operators of a hazardous waste treatment facility can assist industries. The operators can assist by recommending waste recycling options and by providing standard designs for hazardous waste storage facilities, which will reduce disposal costs and could even reduce production costs. The operators can also assist industries in developing waste minimization programs, including using the pharmacy approach. Using the pharmacy approach in dispensing hazardous chemicals needed for production is a simple process that accounts for and controls the amount of chemicals used for a particular task. The pharmacy approach also limits the generation of hazardous waste. Why use a drum of solvent when only a few gallons are needed?

Hazardous waste treatment operators can also assist industries in developing a hazardous waste management plan specific to their facilities. This plan provides the framework for industries to control hazardous waste. The plan provides for procedures in the event of an accidental spill of chemical waste.

This approach of helping industries manage and reduce their hazardous disposal costs seems to counter good business operations of a centralized hazardous waste treatment facility. In reality, it actually provides the operator an opportunity to better understand its clients' needs and thus the potential for long-term contracts, which are essential to a predictable revenue stream.

Regulatory Enforcement: The Most Important Element

The third element affecting a revenue stream for a hazardous waste treatment facility is enforcement of the disposal regulations applicable to the generators of the waste. This is by far the most important of the three elements of a revenue stream. Although the laws and regulations were developed to protect the environment, they are the foundation of hazardous waste treatment industries. Without enforcement on the activities of the waste generators, there will be little or no raw material for a hazardous waste treatment facility. For a developing country, it is a dramatic and costly change in doing business and will affect the success or failure of a commercial hazardous waste treatment operation. This is the reality in the Philippines, and it is a major consideration/concern when investors are deciding to commit capital to such a facility.

Initially, a smaller disposal facility with fewer treatment processes can serve the large multinational firms who already subscribe to international waste management practices. The facility should be designed to be easily expanded to accommodate larger volumes and different types of waste. Without enforcement, there is a smaller voluntary client base and affordability of treatment is an issue. Thus, the other two elements of the commercial aspect of the hazardous waste business are less important than regulatory enforcement issues.

Enforcement is a major factor to investors considering committing capital to such a facility in a developing country. One approach that may minimize the impact of enforcement issues is to develop a facility that offers both solid and hazardous waste disposal services. Because the

demand for solid waste disposal is much greater than the demand for hazardous waste disposal, providing solid waste disposal offers a significant revenue stream that could keep the facility profitable and allow a controlled growth into the hazardous waste market. Again, enforcement is the driving force with solid waste disposal, but solid waste disposal is further along in the process of going from no controls to regulatory controls. In December 1998, the Department of Environment and Natural Resources (DENR) issued Administrative Order 98-49, which presents the technical guidelines for municipal solid waste disposal.

TECHNICAL ISSUES

The second key element of the planning process is to identify and address the technical issues that are required for a successful hazardous waste treatment facility. We considered five technical issues:

1. Permitting
2. Site Selection
3. Collection
4. Treatment
5. Operations

Permitting

The Toxic Substance and Hazardous and Nuclear Waste Act mandates that a hazardous waste treatment and disposal facility be permitted by DENR. The permitting process requires preparing an Environmental Impact Statement (EIS), which, in turn, necessitates an Environmental Impact Assessment (EIA). The EIA is a requirement to obtain an Environmental Compliance Certificate (ECC), which is needed for the project to proceed. This process, which is expected to be complex and to be the major emphasis during the planning process, deals with many of the issues required to select a site for the facilities, and is expected to take at least a year to complete.

An EIA, as defined by DENR Administrative Order No. 37, is “the process of predicting the likely environmental consequences of implementing projects or undertaking and designing appropriate preventive, mitigating and enhancement measures.” Using this process requires identifying issues such as:

- Geological Considerations
- Water Resources
- Socioeconomics
- Management Plan
- Facilities Design
- Financial Responsibility
- Public Participation
- Baseline Environmental Conditions

The EIA process is costly and time consuming; however, when completed properly, it provides answers to critical environmental issues.

From a business point of view, the venture cannot be considered viable until the permit is issued.

Site Selection

Selecting a site for a hazardous waste treatment facility requires consideration of many factors. These factors can be categorized in three general issues that must be evaluated in detail:

- Regulatory
- Sociopolitical
- Geographic

The first two issues, regulatory and sociopolitical, are primary and controlling in that they provide a screening mechanism to identify potential locations. Then geographic considerations are incorporated into the planning process. Both of the primary issues are “equal,” that is, both must result in a positive evaluation or a particular site is eliminated from consideration. The regulations to be considered fall under two distinct areas:

- National environmental laws and regulations.
- Local government requirements.

The national regulations are the requirements of Republic Act 6969 and Administrative Order No. 29. These regulations require considerations that will protect the environment and public health and safety and require preparing an EIS/EIA, as described in the previous section on permitting.

The sociopolitical issue is a critical one that is hard to predict and has significant consequences in relation to developing a hazardous waste treatment facility. In many countries it is common for local communities to oppose such a facility. The perception of a catastrophic failure that would put the environment and the health of the surrounding communities at risk is the primary reason for the opposition. This single issue alone, if not handled properly, could preclude siting a facility in the desired location even though the location is a preferred site from an environmental point of view.

This issue of geographic location deals with such factors as location of waste generators, transportation routes, availability of road networks, availability of land, and availability of work force.

Collection

One of the services to be offered to industries is collection, manifesting, and transport of waste materials to the hazardous waste treatment facilities. Since transport of hazardous waste is

regulated under RA 6969, and many of the industries generate relatively small quantities of hazardous waste, it is generally less expensive to use the services of a professional organization.

For long-term customers, a schedule of pickups would be developed to minimize storage of waste at their sites. Other customers would be able to schedule pickup of waste as needed.

The facility will initially operate box vans with a hydraulic lift gate. The primary collection vehicle will also have a spill/emergency response kit. All waste received by the facility will arrive in small or bulk containers.

In addition, the collection vehicles will be registered as required under Section 27 of RA 6969 and will contain the records as stipulated under Section 28.

Pre-Acceptance Procedures—Prior to collecting any generator wastes and prior to the facility receiving, storing, or processing any waste, pre-acceptance procedures must be completed. The purpose of pre-acceptance is to allow the hazardous waste treatment facility to ascertain the quantity and composition of the waste so the facility can determine whether it can treat/dispose of that particular waste. In a broad sense, these procedures require the following:

- All wastes must be characterized.
- Collection of waste materials must be pre-scheduled with the facility.
- All waste containers delivered to the facility are weighed or volumetrically measured upon arrival.
- All waste manifests must be verified prior to acceptance into the facility.

Upon the completion of manifest verification and fingerprint analysis of the waste, wastes that do not conform with their description in the manifest or with their pre-shipment analysis will not be accepted by the facility. These wastes will be returned to the generator unless the discrepancy can be resolved.

The following procedures will be followed and assurance testing performed prior to the waste being shipped from the generator location and accepted at the treatment, storage, and disposal facility:

1. A waste profile characterizing the waste will be completed based on generator knowledge.
2. All waste shipments will be made on a uniform manifest.
3. Prior to receipt of the material at the facility, the following tests will be performed:
 - Visual inspection to determine physical characteristics.
 - pH performed on aqueous materials.

- Reactivity and compatibility.
- Sample taken for analysis via atomic absorption.
- Treatability performed for metals removal.
- Solvents/oily materials will be sampled and gas chromatography performed for PCBs.
- Hydrometer will be used to determine specific gravity and segregation of halogenated versus non-halogenated materials.
- Solid loads will be visually inspected.
- After treatment/stabilization is complete, a toxicity characteristic leaching procedure (TCLP) will be performed to ensure appropriate treatment.

After the above parameters have been satisfied, the material will be accepted and a copy of the manifest will be sent to the generator and DENR within the prescribed time.

Treatment

Design Concept: Phased Construction Approach—The treatment facilities envisioned for this project would have limited treatment and disposal capability until a realistic assessment of the facility customer base can be determined. The initial design would be planned to allow for a phased construction in response to the hazardous waste market.

This facility is proposed to be a world-class facility, providing environmentally sound and cost-effective treatment options. Efficient operation of the facility will be accomplished through the inherent design of the facility and its attendant treatment units, the adherence to specific waste management practices within these units, the training of management and operations personnel, and scheduled inspection of the waste management units. The facility will manage waste by storing and treating in containers and tanks.

The proposed facility will be designed and managed to reclaim hazardous waste and non-hazardous waste amenable to recovery or reuse and to accumulate, bulk, blend, and repackage waste for treatment, recovery, or disposal either on-site or at approved off-site facilities. In addition, the facility may treat aqueous wastes and sludges at the aqueous waste treatment unit. The following types of wastes will be treated at this facility:

- Organic wastes will be reclaimed for reuse as solvent, treated for fuel recovery, or shipped off-site to an approved disposal facility.
- Solid inorganic wastes will be bulked, blended, and repackaged for treatment, recovery, or disposal at approved off-site facilities.

- Inorganic liquids and aqueous wastes will be accumulated, blended, and treated to produce an acceptable effluent for discharge into a publicly owned treatment works sewer. The residuals from the aqueous treatment unit and other amenable wastes will be stabilized and bulked for off-site disposal.
- Empty containers will be sent to off-site drum recovery facilities or crushed with non-recoverable containers and shipped off-site for disposal. No wastes or residuals will be disposed of at the facility.

The proposed treatment facility will include container management units, tank management units, specialized treatment units, and stabilization units. These units include:

- Waste Receiving and Unloading Unit
- Container Sampling and Processing Unit
- Containerized Waste Management Unit
- Containerized Waste Storage and Loading Unit
- Inorganic Container Management Unit
- Inorganic Tank Management Unit
- Organic Tank Management Unit
- Organic Container Management Unit
- Special Projects Management Unit
- Fuels and Solvent Recovery Unit
- Aqueous Waste Management/Treatment Unit

Facility Layout—The hazardous waste management facility will occupy a 10-hectare piece of property. The facility's physical plant will include an engineered, preconstructed steel building, built on a poured concrete base, of approximately 300 square meters. This portion of the facility will include offices, an administrative work area, laboratory, and storage area.

The storage, treatment, and waste management area of the hazardous waste management facility will initially occupy an area of approximately 600 square meters. This portion of the facility will have poured concrete slab construction with bermed areas for secondary containment. The waste management unit area will be covered by a steel roof to protect the storage areas and treatment units from inclement weather.

Operations

The operators, management, and staff are the “engine room” of the business venture. They are responsible for ensuring that profitability is achieved and that regulatory requirements are met. To ensure meeting these goals, an overall operational plan, including collection, treatment, storage, and disposal, must be developed.

The operational plan must address:

- Hazardous Waste Management Plan
- Preparation of an Operation & Maintenance Manual (O&M)

- Staffing
- Training

A Hazardous Waste Management Plan addresses health and safety, secured accumulation and storage, recordkeeping and manifesting, materials handling procedures, and most important, emergency response.

An O&M manual describes the operation in detail and establishes maintenance requirements and schedules. Process and Instrumentation Diagrams (P&IDs) developed during the design phase will be used to graphically explain the operational process and system controls. The manual will also provide detailed technical information on each piece of equipment, from chemical process equipment to forklifts. In addition, replacement schedule recordkeeping SOPs will be developed to provide the operating staff with established procedures for operation, testing, and clerical issues.

The staffing of the facility will depend primarily on the volume of waste treated but, at a minimum, would include a manager, chemist, operator(s), driver(s), and clerical personnel.

Because this facility will treat and handle complex chemicals, the management and senior operations staff who will direct operations need to have a strong background in chemistry or chemical engineering. Other operations staff who are less familiar with chemical process operations will require extensive training. This training will consist of a combination of both formal and on-the-job training. All staff, regardless of position and function, will require health and safety training. This facility will have a health and safety officer who will be responsible for overall safety of the workers and operations.

FINANCIAL ISSUES

The three financial issues that must be addressed in the planning process are capital cost, operational cost, and liability. Each of these factors diminishes the main goal of the business venture, that of profitability; therefore, each factor must be carefully managed. A cost model for the overall life of the facility must be developed to allow businessmen to predict the performance of their investments. The model would consider capital operating costs, revenue, replacement of equipment, expansion, and cost of money, as well as profit. The model will require that assumptions be made that affect all the above issues. Once an acceptable profit is established, the model will become the budget for the project. For this reason, the model and the assumptions must be realistic.

Capital Cost—The capital cost to construct the facility will depend on the size and type of treatment process initially incorporated into the system. The plan envisions a phased construction to allow for developing a revenue stream and minimizing initial capital requirements.

Operational Cost—Operational costs are influenced by the type of waste, treatment process, and ultimate disposal. Of these three factors, ultimate disposal is the largest cost and the one that is the least controllable.

Liability—Financial liability and financial responsibility are necessary cost issues that must be incorporated into the cost model. Financial responsibility is a requirement for obtaining a permit. DENR Administrative Order No. 37 (1996) requires establishing an environmental guarantee fund for all projects that pose a significant public risk or require rehabilitation or restoration. It is assumed that a hazardous waste treatment facility would fall in that category. The magnitude and the type of guarantees required are of most concern to the business venture.

Owning and operating a hazardous waste treatment facility involves the potential for significant liability to the business venture if accidents occur. The business venture must protect itself financially from the impacts of an accident through the purchase of insurance, if available, or through a reserve fund. Either way, such protection involves a sizable cost that must be included in the financial model.

CONCLUSION

Extensive planning is required to enable a business venture providing hazardous waste treatment to be profitable and environmentally sound. The planning process for such a facility is complex and is a project in itself. The process is not straightforward because many of the issues are dependent on each other. The process is also costly and time consuming.

The planning process identifies the three main issues that affect profitability—commercial, technical, and financial issues. All of these issues are regulatory driven and affect profitability. One of the most important elements of a hazardous waste treatment facility is a revenue stream, meaning sufficient hazardous waste to sustain a profitable operation. Affordability of treating hazardous waste is a major concern to the generator. The proper treatment and disposal of hazardous waste will increase the generator's product cost, and this increase should be treated as an operating cost. The cost of treatment/disposal can be minimized by the generator's operating procedures, including waste minimization and recycling.

The single most important factor affecting a hazardous waste treatment facility is enforcement of the regulations. Enforcement will cause a revenue stream to be generated and also dictate operational and disposal standards to which the treatment facility must perform.

Investment in such a facility is risky. Subsidized funding from the Government Agency or World Financial Organization would most likely be required. Plus, commitment and demonstration of enforcement would be required to attract private investors.