JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES
OF THE GOVERNMENT OF THE PHILIPPINES

THE STUDY
ON
INDUSTRIAL HAZARDOUS WASTE MANAGEMENT
IN
THE REPUBLIC OF THE PHILIPPINES
(PHASE 2)

FINAL REPORT

October 2002

EX CORPORATION
KOKUSAI KOGYO Co.,Ltd.

Preface

In response to a request from the Government of the Republic of the Philippines, the Government of Japan decided to conduct the Study on Industrial Hazardous Waste Management in the Republic of the Philippines (Phase2), and the study was implemented by the Japan International Cooperation Agency (JICA).

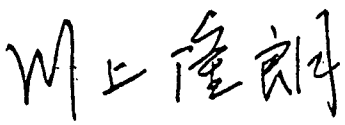
JICA sent a study team, led by Mr. Masato Ohno of EX CORPORATION and organized by EX CORPORATION and KOKUSAI KOGYO Co., Ltd., to the Republic of the Philippines 4 times from September 2001 to September 2002.

The team held discussions with the officials concerned of the Government of the Philippines, and conducted related field surveys. After returning to Japan, the team conducted further studies and compiled the final results in this report.

I hope this report will contribute to the promotion of the plan and to the enhancement of friendly relations between our two countries.

I wish to express my sincere appreciation to the officials concerned of the Government of the Philippines for their close cooperation throughout the study.

October 2002



Takao Kawakami
President
Japan International Cooperation Agency

Executive Summary

EXECUTIVE SUMMARY

1 Background and Objectives of the Study

With the recent progress of industrialization, industrial waste generation has been increasing in the Republic of the Philippines (ROP). Due to little presence of the hazardous waste (HW) treaters dealing with waste acid, waste alkaline, waste oil, and sludge containing heavy metals, many of industries are facing difficulty in handling of HW.

The Government of the Philippines enacted the RA6969 (Toxic Substances, Hazardous and Nuclear Waste Act) in 1990. In 1992, DAO29 (Department Administration Order 29) of the Department of Environment and Natural Resources (DENR) was issued to enforce the RA6969. In addition, the environmental impact assessment (EIA) and issuance of environmental compliance certificate (ECC) system was established to control hazardous waste (HW) treatment facilities in terms of environmental concerns at the time of obtaining the building permits.

However, due to insufficient law enforcement mechanism of RA6969, the private HIW business is not yet grown enough to supply proper HIW services. Consequently, a considerable amount of HIW is assumed to be improperly handled or stored in the factories without any treatment, which may constitute a potential threat to the environment.

Responding to the promotion policy of inviting foreign capital investment by GOP, a number of industrial investments have been made in the newly industrial and free trade areas in the Philippines. However, many of these foreign factories are facing troubles in handling HW. Continuation of this situation will damage not only the environment, but also the national economy by keeping away the investment from foreign countries.

Proper hazardous waste management (HWM) becomes one of the most important issues to be solved for the environmentally as well as economically sustainable development of the national economy in ROP.

Under the situation above, GOP officially requested to the Government of Japan (GOJ) to implement the Master Plan Study on Hazardous Waste Management in the Republic of Philippines (Phase I Study).

In response to the request of GOP, GOJ has decided to conduct the above study as the technical cooperation program of the Japan International Cooperation Agency (JICA) so as to help GOP realize proper management of hazardous industrial waste.

The Master Plan Study on Hazardous Waste Management in the Philippines (Phase 1 Study) started in September 2000 and completed in July 2001. Phase 1 Study established the basic framework plan of HWM in the Philippines and formulated the Action Plan, in which it recommended that the following measures should be strongly promoted to improve HWM in the Philippines:

1. Promotion of HW treatment facilities

(1) Formulation of the HW storage plan

(2) Promoting development of the model integrated facility for HW treatment

2. **Establishment of HW management database**
3. **Capacity building of HWM administration**
4. **Establishment of the financial/economic incentives to promote proper HWM**
5. **Establishment of policy measures to promote establishment of proper HWM mechanism within HW generators**

From the recommended measures given above, ROP selected two as the priority projects, i.e. Development of the model integrated facility for HW treatment and Capacity building of HWM administration. Based on this decision, the Study on Hazardous Waste Management in the Philippines (Phase 2 Study) was conducted with the following purposes.

1. **Feasibility Study on Development of Model Integrated Facility (MIF)**
2. **Capacity Building of HWM Administration**

This Final Report compiles the achievement of the Phase 2 Study.

2 Study Period and Study Team

Phase 2 Study has been carried out from October 2001 to August 2002. The JICA Study Team and the Philippine counterparts (DENR-EMB) jointly carried out the Study, which was periodically supervised by the Steering Committee organized by the representatives of relevant government agencies and chaired by the Director of EMB.

3 Outline of F/S on MIF Project

3.1 Rationale of the Project

Since there is virtually no proper HW treatment facility, threats to human health and environment arising from improper treatment and disposal of HW continues in the Philippines. It also discourages the foreign capital investment in the Philippines. To solve these issues, proper HW treatment facility has to be established at the earliest possible.

MIF is planned as a public-private partnership project with the following major objectives:

- To minimize possible environmental risk that may arise from improper or insufficient hazardous treatment by the present generators and treaters,
- To simultaneously facilitate law enforcement on proper HWM and development of proper HW TDS facilities through active public-private partnership in implementing the model project,
- To provide private sector with the good practices of hazardous waste management through the disclosure of MIF operation.

3.2 Project Site

Based on the Master Plan formulated in Phase I Study, the MIF Project covers the HWM generated in Metro Manila and CALABARZON area. EMB selected a 10 ha of project site in the future extension area of LIMA Technology Center according to the recommendation of the Master Plan prepared in the Phase 1 study.

3.3 Projection of HW Treatment Demand

Based on the registration data of HW generators at EMB, the Study categorized the potential treatment demand into three categories as shown in Table 1 below.

Table 1: Categorization of Treatment Demand by Types of Processes

Code	HW Category	Off-Site Treatment
1. Thermal Treatment		
E	Paints/Resins/Lattices/Dyes/Adhesives/Organic Sludge	1,913
F	Organic Solvents	1,100
G	Putrescible/Organic Wastes	6,007
H	Textile	59
I	Waste Oil	4,337
J	Containers	1,597
L	Organic Compounds	631
M	Miscellaneous Wastes	11,382
	Thermal Treatment Total	**27,026**
2. Physicochemical Treatment		
A	Plating Wastes	258
B	Acid Wastes	510
C	Alkali Wastes	19,909
D	Chemical Wastes	118
	Physicochemical Treatment Total	**20,795**
3. Solidification/Landfill		
C	Alkali Wastes	19,909
D	Chemical Wastes	13,412
K	Immobilized Wastes	390
M	Miscellaneous Wastes	9,954
	Solidification/Landfill Total	**43,665**
	Total	**91,487**

Source: The Master Plan Study on Industrial Hazardous Waste Management in the Philippines (Phase I).

Regarding the potential demand for thermal treatment of approximately 27 thousand tons per year given in the table above, its actual demand is estimated to be larger since about 2 thousand tons of HW currently incinerated on site will give rise to residues requiring off-site treatment. Moreover, the amount of medical HW may be underestimated in the above estimation due to limited available generation data from hospitals and other medical facilities. Taking all of these into account, the Study established the potential demand of thermal treatment to be 30 thousand tons per year.

As to physicochemical treatment (PCT), a considerable number of generators may establish their own PCT facility to treat their HW on site. Local treaters are also currently employing this type of process. Therefore, the Study estimated that 75% of the above off-site treatment amount would be absorbed by generators' on-site treatment while a half of the remaining 25% will be handled by the existing local treaters. Accordingly, the potential demand of PCT at the model facility is established to be 2.5 thousand tons per year, about one-eighth of the above off-site treatment amount.

The 43 thousand tons of off-site treatment amount subject to solidification and landfill are considered to represent the amount that is stored on-or off-site for at least 4 to 5 years. Based on this, the Study assumed that the actual potential demand of solidification and landfill would be about 10 thousand tons per year (rounding out the result of dividing 43 thousand tons by 4 years). Although the landfill in the model facility is designed to accept residues generated from each treatment facility in MIF, the Study assumed to accept 60% of the above potential demand 6,000 tons) at the landfill in consideration of the limited availability of proper landfill and storage for HW in the Study area. In this case, 2,500 thousand tons (approximately 40%) of the above 6 thousand tons may be required for solidification to meet the acceptance criteria at the landfill while the remaining 3,500 tons (approximately 60%) can be directly disposed at the landfill.

Thus, the estimated potential demand of HW treatment in the model facility is estimated as shown in Table 2 below.

Table 2: Estimated Potential Demand of HW Treatment

Treatment System	Potential Treatment Demand (tons/year)
PCT Facility	2,500
Thermal Treatment Facility	30,000
Solidification/Controlled Landfill	15,000

Remark: The potential demand of solidification/landfill includes the amount of direct disposal as well as those coming from other treatment processes in MIF (9,000 tons/year).

3.4 Basic Design of MIF

(1) Design Capacity of MIF

Based on the above potential HW treatment demand, design treatment capacity of HW is established for each treatment process as shown in Table 3.

Table 3: Design Treatment Capacity of MIF

HW Treatment Facility	Design Capacity	Remark
PCT	10 tons/8hrs./day	
Solidification	20 tons/8hrs./day	PCT residues, fly ashes from thermal treatment and sludge are the main HWs to be treated.
Thermal Treatment	100 tons/24hrs./day	300 days' operation per year
Controlled Landfill	15,500 tons/year	Slag generated from thermal treatment process will be mainly disposed of.

The design thermal treatment capacity of 100 tons per day is determined in consideration of the projected treatment demand made in Chapter 2 as well as the scale economy of the facility. Treatment capacity of thermal treatment depends on the size of inlet as well as the capacity of kiln. The kiln applied in the thermal treatment facility is designed to treat HWs with the drum containers of 200-litter capacity. In fact, there is almost no difference in cost of this type of kiln if its treatment capacity ranges from 60 to 100 tons per day. Therefore, the Study selected the design treatment capacity of 100 tons per day. If it exceeds 100 tons per day, the cost will be totally different and its operation risk may increase. Through 300 days of operation, the thermal treatment facility can treat 30 thousand tons of HW annually, which can accept additional 3,000 tons of HW annually to the potential thermal treatment of 27,000 tons per year, which is estimated in Chapter 2.

The thermal treatment facility also accepts treated residual liquid of 4 tons per day from PCT facility for thermal decomposition by the secondary combustion chamber.

To meet the estimated potential PCT demand of 2,500 tons per year, its design treatment capacity is set at 10 tons per 8 hours operation daily. Although the annual operational day is set at 250 days, it can be increased if the demand is more than the amount estimated above. The daily operation hours can also be extended in response to possible increase of demand. By applying such flexible operation of PCT facility, MIF can minimize scale of PCT facility as well as its operation related risks.

As to Solidification facility, its design treatment capacity depends on the amount of ashes from thermal treatment facility, sludge from PCT, and direct acceptance of HW. Although the amount of ashes is determined by the ash content of each HW accepted, the Study made a rough estimation based on the actual records of similar facilities in Japan that 10% of HW input to thermal treatment would generate as ashes. Therefore, 10 tons of ashes are accepted daily by solidification facility. Concerning PCT sludge, the Study assumed that about 1 ton of sludge would be required for solidification to meet acceptance criteria for disposal by landfill in MIF. Finally, as mentioned in Section 2.3, about 2500 tons of HW per year (more or less 8 tons per day for 300 days operation per year) will be subject to solidification treatment before disposal by landfill in MIF.

Take all the above into account, the Study established the design treatment capacity of solidification facility at 20 tons per 8 hours daily operation.

Landfill capacity is determined in consideration of the amount of residues generated from MIF facilities (PCT, solidification, and thermal treatment) as well as the limitation of available areas for landfill in the project site. The Study estimated that

composition of the amount of HW disposed by landfill in MIF would be as shown in Table 4 below.

Table 4 Composition of the amount of HW disposed by landfill in MIF

Types of HW	Amount (tons/year)
Slag from thermal treatment	4,200
Sludge from PCT	600
Solidified inert waste	7,200
Inert Waste directly disposed by landfill	3,500
Total	15,500

Figure 1 shows the material flow of HW in MIF.

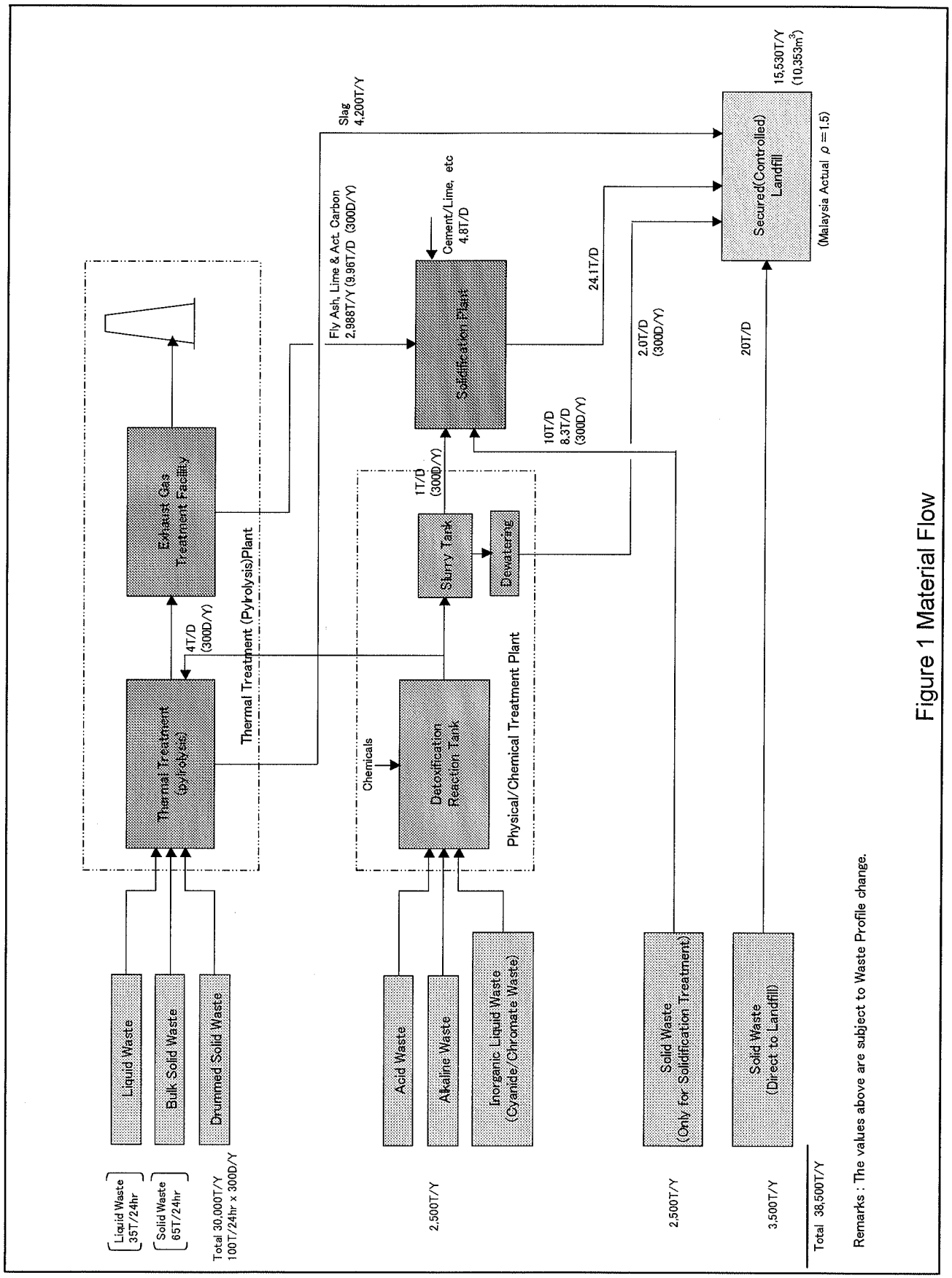


Figure 1 Material Flow

(2) Other Equipment and Materials

All the necessary equipment and materials for operation of MIF including HW hauling vehicles, heavy equipment for various treatment and landfill operations, waste analysis instruments, etc. are also provided in MIF.

(3) Estimation of MIF Construction Cost

The construction cost of MIF is estimate as shown in Table 5 below.

Table 5: Construction Cost of MIF (unit: peso)

Facility	Total
PCT (plant only)	52,000,000-
Solidification (plant only)	28,000,000-
Thermal Treatment (plant only)	800,000,000-
Civil Works (excluding landfill works)	440,000,000-
Electrical & Control	132,000,000-
Landfill (Phase I only)	148,000,000-
Laboratory Equipment	40,000,000-
Administration Office (excluding civil works)	60,000,000-
Others (Storage, Utilities, etc.)	100,000,000-
Physical Contingency*	117,600,000-
Total	1,917,600,000-

* Physical Contingency includes Civil Works and 20% of landfill cost.

Replacement cost of MIF during 20 years of project period is estimated to be about 2 million pesos.

(8) Facility Layout

The overall facility layout is shown in Figure 2 on next page

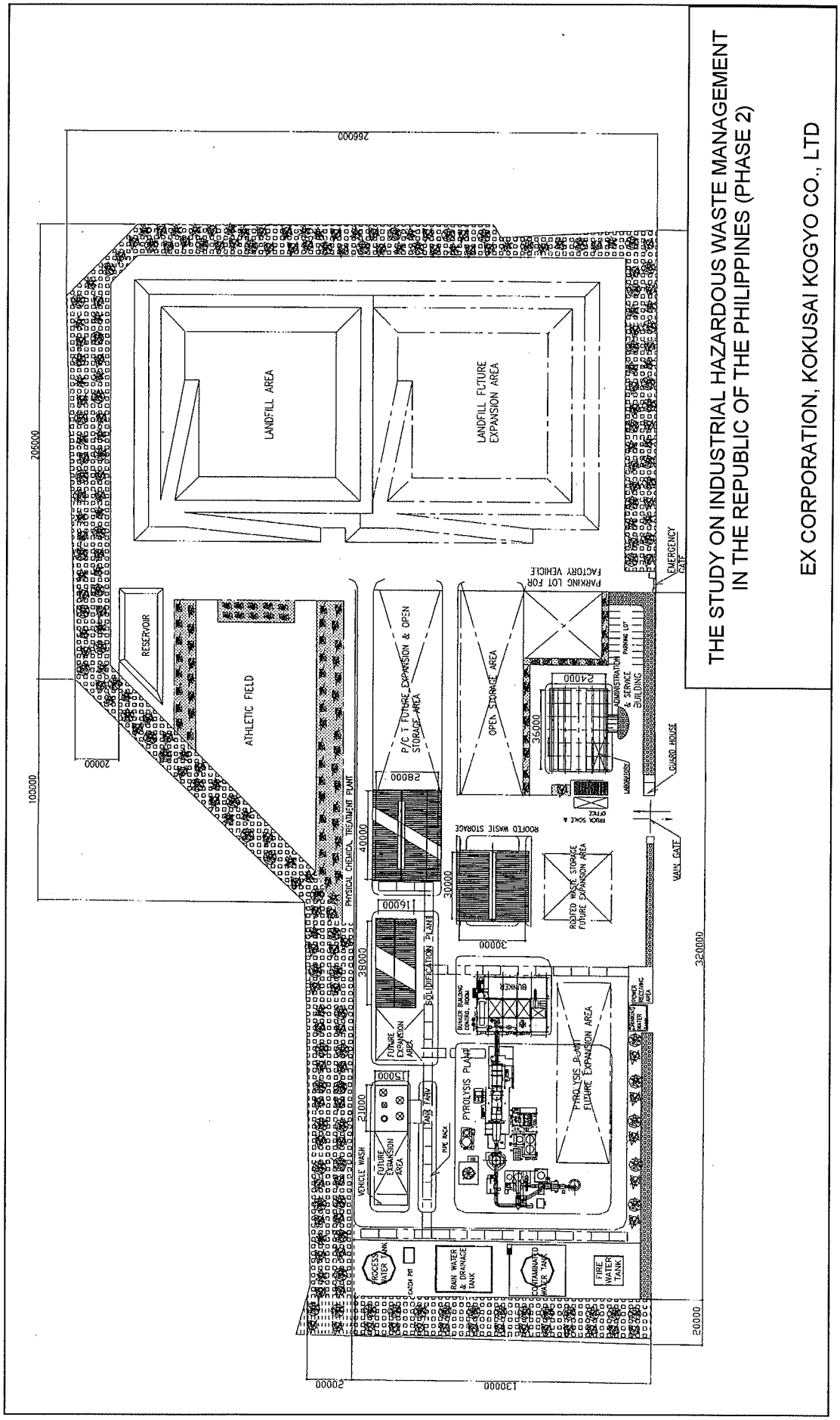


Figure 2 Layout Plan of the Industrial Hazardous Waste Treatment Facility

3.5 MIF Operation Plan

MIF operation plan consists of the following items

(1) Waste Acceptance procedure

(2) Waste Collection and Transportation

(3) HW Data Management in MIF

(4) Safety and Environmental Management and Education

(5) Maintenance of Treatment Facilities

(6) Operation of Facility

(7) Consumable Parts and Materials

The cost of MIF operation is estimated in accordance with the above operation plan.

3.6 PROJECT IMPLEMENTING ORGANIZATION AND BUSINESS OPERATION PLAN

(1) Project Implementing Organization

Although DENR/EMB is proposed to be the proponent of the project, it is difficult for DENR/EMB to be the applicant of ECC of the project as it is the ECC issuing body as well. Therefore, Natural Resources Development Corporation (NRDC), a public corporation under the control of DENR is responsible for conducting the EIA and applying for ECC.

However, since NRDC has no experience in building such facilities as proposed in the project, organizational supports from DENR/EMB and other relevant government agencies are required for proper management of facility construction.

As to operation and management of MIF, NRDC also needs supports from those who have enough experience and know-how in HW treatment facilities. In this regard, the Study proposed to consign it to private O & M contractors by tendering. Taking into account that the experience and know-how in O & M of HW treatment facilities are very limited in domestic private treaters, the Study recommended inviting foreign experienced contractors in the tendering.

(2) Use of Private O & M Contractor

Private sector participation in the operation and management of MIF has the following options.

Option A: Facility lease contract with private O & M contractor

Option B: Commissioning O & M to private contractor

Option C: Joint Venture with private contractor for O & M

In principle, HW treatment should be carried out under the initiative of private sector including HW generators. Since public sector will take most of the risks in the case of Option B, it is not the appropriate method of private sector participation.

Comparing Option A and C, Option C is more limited in the methods of fund raising for the project although the advantages and risks are mostly similar between these options. Thus, the Study suggested to take Option A for private sector participation in O & M of MIF.

(3) Operation and Management Body

To ensure smooth implementation of the facility construction, a project taskforce will be established within the NRDC. The collection and transportation will be contracted out to other companies.

(4) Sales and Marketing

To obtain sufficient client, the O & M contractor must have clear business policies and built reliable relationship with clients as well as neighboring communities.

As to user charges, the following treatment prices are established in consideration of financially viable operation of MIF as well as the willingness-to-pay of the potential users (HW generators).

Table 6 Established user charge

	Unit cost/ton (peso)
Thermal	15,000
PCT	16,000
Solidification	13,000
Landfill	5,000

3.7 Financing Options

The Study estimated that the initial investment cost of the project would be 2,570 million pesos. The Study examined various fund raising options including those from domestic as well as foreign financial sources. Its result is as follows:

1) Domestic Sources

Capital infusion by the project implementing body and National Budget appropriation are the currently possible domestic financing sources in the Philippines.

According to the surveys done by the Study Team, the possible financing amount from domestic sources is estimated to be approximately 600 million pesos at the maximum. It covers about 25% of the total initial investment cost of the Project.

2) Foreign Sources

If the Project is implemented by a public body (DENR or NRDC), there is a possibility to utilize Japanese Yen loan.

In the case of utilizing the fund from multilateral aid agencies (IFC or ADB), the project implementing body can be private or public-private joint venture. The financing amount will be more limited than Japanese Yen Loan. Therefore, the remaining fund to be raised from other sources will be much bigger.

The model HW treatment project recommended in this Study is estimated not to be financially feasible enough to be implemented as a private sector business in the Philippines. That is why public body is recommended to be the implementing body of the Project. All of these indicate that it is difficult to utilize IFC/ADB finances since both of them requires that the Project has to be carried out by private sector.

Accordingly, use of long-term low interest loan from bilateral aid agencies (including the use of Japanese Yen loan) is considered to be the most appropriate financing option for the Project.

3.8 FINANCIAL/ECONOMIC APPRAISAL OF THE PROJECT

(1) Estimation of the Project Cost

The total cost of the project mainly consists of initial investment and operation costs. The initial investment is estimated to be about 2,360 million pesos as shown in Table 7 below.

Table 7 Initial Investment Cost

Unit: thousand Pesos

Item	Unit Price	Amount	Price	Remark
1. Land Purchase	1,539p/m^2	100,1000m^2	**153,900**	
2. Facility Construction			**1,800,000**	
1) Civil works	-	-	40,000	
2) PCT facility	-	-	100,000	
3) Solidification facility	-	-	60,000	
3) Thermal treatment facility	-	-	1,200,000	
4) Landfill	-	-	148,000	
5) Storage	-	-	52,000	
6) Laboratory	-	-	40,000	
7) Administration building	-	-	80,000	
8) Utilities	-	-	80,000	
3. Physical Contingency	-	-	**117,600**	20% of the total cost of civil works.
4. Engineering Services	-	-	**188,000**	1% of the total facility construction cost including contingency.
5. Price Escalation	-	-	**78,296**	5% for foreign currency portion and 2% for local currency portion.
6. Preparation for Business Operation	-	-	**23,086**	
Initial Investment Total			**2,360,882**	

Remark: The above initial investment cost excludes value-added tax and loan interest during construction period.

(2) Establishment of the Baseline Project Cash Flow

The Study established the cash flow of the project in accordance with the following preconditions.

1) Project Period
   Construction period: 3 years from 2003 to 2005
   Operation period: 25 years from 2006 to 2031

2) Operation conditions of the TSD facilities
Operation days: 300 days/year for all the facilities
Operation ratio: 100%

Additional investment cost for extension of landfill and replacement cost of facilities are also considered. Income and expenses of the project are in accordance with the estimation done in the Study.

(3) Financial Appraisal of the Project

The result of FIRR estimation based on the net cash flow given above is 11.15%, which is not financially viable if Japanese yen loan of low interest is not available for the project. Applying the discount rate of 15% considering the domestic commercial bank rate in the Philippines, the NPV of the project becomes approximately -450 million pesos, which indicates that the current project is not financially viable with the finance from the local banks or other lending institutes.

(4) Economic Appraisal of the Project

Estimation of EIRR of the project is made basically in the same manner of estimating FIRR although the financial cost and benefit used in obtaining FIRR are required to be converted to economic cost and benefit.

All the cost factors in the project are divided into two categories: domestic procurement (local cost) and procurement from abroad (foreign cost). In the case of foreign cost, foreign exchange premium needs to be considered to adjust various market distortion factors including trade distortions, unsustainable current account balance, value added and other indirect taxes. According to the information provided by NEDA, the safe and suitable exchange premium to be used for converting the foreign cost of the project to economic cost is 20%. Therefore, the Study multiplied all the foreign cost by 1.2 to obtain its economic cost.

Meanwhile, the local cost also has to be adjusted by eliminating such market distortion factors, which are in this case value-added tax. Value-added tax is estimated as 9% of the market prices of commodities or services purchased domestically.

The Standard Conversion Factor (SCF), to be applied to adjust market prices of local cost to shadow prices, is estimated.

Accordingly, the financial cost of local currency procurement is converted to economic cost as the result of multiplying the financial cost subtracted of 9% of VAT by the above 5 years SCF of 92.90%.

Based on the allocation of foreign and local cost of the project done by the project cost-planning member of the JICA Study Team, the total financial cost was converted into economic cost for each item.

As to the socio-economic benefit of the project, the Study estimated that the following incremental opportunity costs would arise in the case of non-existence of the project.

Table 8 Incremental Costs Arising in the Case of Non-Existence of the Project By Types of HW Handling Realized

HW Handling Realized	Incremental Cost Arising
Stored	Cost of constructing and operating additional storage facilities
Disposed improperly	Restoration of soil (land) polluted by improper HW disposal
Not clarified (missing)	Restoration of soil (land) polluted by improper HW disposal

The total incremental cost arising in the case of non-existence of the project is estimated as shown in Table 9 below.

Table 9 The Total Opportunity Cost in the Case of Non-Existence of the Project

Type of Opportunity Cost	Cost (Pesos/year)
HW Storage Cost	261,840
Restoration Cost of the Soil Polluted by the HWs disposed	240,520
Restoration Cost of the Soil Polluted by non-clarified handling of HWs	364,894
Total	**867,254**

Based on the above, EIRR of the project is estimated to be 21.23%, which is higher than FIRR and estimated to be feasible enough as the national project of economic development.

3.9 IMPLEMENTATION PLAN

Assuming that it would take 4 years from the completion of feasibility study to start operation of MIF, the Study estimated the schedule of these 4years as follows:

1st Year

- Completion of the Environmental Impact Assessment (EIA)
- Acquisition of the Environmental Compliance Certificate (4 months after submission of the Environmental Impact Statement)
- Elaboration of the Project Proposal
- ICC Approval (3 months after submission of the project proposal)
- Parliamentary approval of budget appropriation to the project in the fiscal year 2003/04
- Official request of long-term loan

2nd Year

- Formulation of Implementation Plan and Program
- Procurement of consultants
- Basic design
- Preparation of bidding document
- Opening of the bidding

3rd Year

- Procurement of contractors (selection of contractors)
- Starting of facility construction

4th Year

- Completion of facility construction
- Trial run of facilities
- Acquisition of facility operation permits
- Starting of full-scale facility operation

3.10 ENVIRONMENTAL CONSIDERATION

The result of EIA Study showed that possible environmental impact arising from the project would be minimized through implementation of proper environmental protection measures by the project while many socio-economic benefits were estimated to arise from the project. Although some negative environmental impacts were estimated to arise during the construction period, they are only temporary ones and can be properly dealt with by the project.

The EIA study has confirmed that the site for location of the hazardous waste treatment plant project was suitable for minimised impacts on the physical and living environment as well as public health. Main potential impacts of the project are relevant to occupational health and industrial hazards and accidents. These are, however, similar to those of a classic industrial plant and can be minimized through proper safety measures in MIF.

Since the environmental benefit of the project for public health and natural ecosystems of the whole CALABARZON area is not questionable in terms of MIF's objective of minimizing the impact of HW upon human health and environment through proper treatment, it is concluded that the possible small side effects of the project are quite reasonable and acceptable.

4 OUTLINE OF ACHIEVEMENT OF SUPPORTING ACTIVITIES TO STRENGTHEN CAPACITY OF HWM ADMINISTRATION

4.1 Updating of HW Registration

In relation to update of HW registration data, the Study carried out the following activities:

- Introduction of HW Management Databese
- Revision of various registration forms
- Update of registered data and information

4.2 HW Management Database

To control and manage HW registration data at national as well as local levels, the following computers and equipment are introduced to build nationwide HW management database network.

- Main Server (1 package for EMB)
- Computers (3 for EMB and 1 for each of NCR, Region III, IV, VII, and XI)

4.3 Preparation of Technical Requirements

Based on RA6969 and DAO 92-29, the JICA Study Team has examined the following technical requirements that are necessary for actual implementation of hazardous waste management administration.

- Definition of inert hazardous waste residues
- Classification of hazardous waste
- Requirements for authorized waste transporters
- Criteria for issuing Transport Permit
- Labelling requirements
- Classification of TSD facilities
- Technical requirement for TSD facility

4.4 Compliance Monitoring Manual

This manual was prepared for helping staffs of DENR regional offices and the EMB central office that are in charge of compliance monitoring related to RA6969 and DAO 92-29.

4.5 Seminars and Workshops on Hazardous Waste Management

The following seminars and workshops are held for DENR Regional Office Staff and EMB Central Office Staff.

Seminar/Workshop	Number of seminars/workshops
Operation of HWM Database System	8
HWM Administration	6
Seminars on RA6969	2

5 RECOMMENDATIONS

In relation to the issues to be addressed for further enhancement of HWM in the Philippines, The JICA Study Team made the following recommendations.

(1) Recommendations on Development of HW Treatment Facilities

- Establishment of temporary storage facility for HW and examination of measures for further development of proper HW treatment facilities.

(2) Recommendations on Laws and Regulations

- Publication of the Procedural Manual for Implementing DA92-29 at the erliest possible.
- Preparation of the National Guidelines for HW analysis.
- Preparation and dissemination of the technical handbook on HWM.

(3) Recommendations on HWM administration

- Transfer of Responsibility for implementing RA6969 and DAO 92-29 from the Secretary of DENR to the Director of EMB to improve law and policy formulation and enforcement efficiency.
- Proper allocation roles between the central and local offices of DENR(EMB) in enforcing RA6969/DAO92-29 for efficient HWM administration.
- Strengthening organizational capacity of HWM Section in the central EMB.
- Proper budget appropriation for enhancement of HWM administration at central and local offices of DENR/EMB.

(4) Recommendations on the use of HW management database

- Official appointment of the persons responsible for operation and maintenance of HW management database.
- Installation of an exclusive telephone line for the use of HW management database at local offices of DENR/EMB
- Capacity building of central and local DENR/EMB staff on HW registration and evaluation of application forms and documents relating to HWM.
- Development and dissemination of database-assisted policy making and planning skills and technologies (projection of HW generation, HWM planning by making use of GIS, integration of HW data with other environmental and pollution data for formulation of a comprehensive environmental management planning, etc.).
- Formulation of the local plans on enhancement of HW registration and inspection under the initiative of local DENR/EMB.

CONTENTS

List of Tables

List of Figures

Exchange Rate:1PHP ≒2.7yen

Abbreviations

A	ADB	Asian Development Bank
	APCD	Air Pollution Control Device
	ASME	American Standard of Mechanical Engineers
B	BOI	Board of Investments
	BOO	Build-operate-own Scheme
	BOT	Build-operate-transfer Scheme
C	CAA	Clean Air Act
	CALABARZON	CAvite, LAguna, BAtangas, Rizal, QueZON
	CBR	California Bearing Ratio
	CDO	Ceased and Desist Order
	CENRO	City Environment and Natural Resource Officer
	CIF	Cost, Insurance and freight
D	DAO	Department Administrative Order
	DBM	Department of Budget and Management
	DBP	Development Bank of the Philippines
	DENR	Department of Environment and Natural Resources
	DOE	Department of Energy
	DOF	Department of Finance
	DOH	Department of Health
E	ECC	Environment Compliance Certificate
	EIA	Environmental Impact Assessment
	EIRR	Economic Internal Rate of Return
	EIS	Environmental Impact Statement (System)
	EISCP	Environmental Infrastructure Support Credit Program
	EMB	Environmental Management Bureau
	EMB-EQD	EMB Environmental Quality Division
	EMB-HWMS	EMB Hazardous Waste Management Section
	ERA	Environmental Risk Assessment
	ESP	Electrostatics Participator
F	FIRR	Financial Internal Rate of Return
	FRP	Fiber Reinforced Plastic
G	GIS	Geographic Information System
	GOJ	the Government of Japan
	GOP	the Government of the Philippines
H	HDPE	High Density Polyethylene
	HWM	Hazardous Waste Management
	HWMS-EQD	Hazardous Waste Management Section - Environmental Quality Division
I	IATAC	Inter-Agency Technical Advisory Council
	ICB	International Competitive Bidding
	IDF	Induced Draft Fan
	IEC	Information, Education & Communication
	IFC	International Finance Corporation
	IRR	Implementing Rules and Regulations
J	JBIC	Japan Bank for International Cooperation
	JICA	Japan International Cooperation Agency
	JIS	Japan Industrial Standard

L	LAN	Local Area Network
	LGU	Local Government Unit
	LLDA	Laguna Lake Development Authority
M	MIF	Model Integrated Hazardous Waste Treatment Facility
	MIS	Management Information System
	MMDA	Metropolitan Manila Development Authority
N	NCR	National Capital Region
	NEDA	National Economic and Development Authority
	NPV	Net Present Value
	NRDC	Natural Resources Development Corporation
O	ODA	Official Development Assistance
	ORP	Oxidation Reduction Potential
	OSHA	Occupational Safety & Health Administration
P	P/O	Permit to Operate
	PCO	Pollution Control Officer
	PCDD	Polychlorinated Dibenzo-p-dioxin
	PCT	Physico-Chemical Treatment
	PD	Presidential Decree
	PENRO	Provincial Environment and Natural Resource Officer
	PEZA	Philippines Economic Zone Authority
	PPP	Public-private partnership
	PSME	Philippine Society of Mechanical Engineers Code
R	RA	Republic Act
	ROP	the Republic of the Philippines
S	SCC	Secondary Combustion Chamber
	SCF	Standard Conversion Factor
	SS	Suspended Solids
T	TEQ	Toxicity Equivalent Quantity
	TOC	Total of Organically bound Carbon
	TSD	Treatment, Storage, and Disposal
U	UPS	Uninterruptible Power Supply
V	VAT	Value Added Tax

Introduction

INTRODUCTION

1 Background of the Study

Industrial waste generation has been increasing with the recent progress of industrialization in Metro Manila and the peripheral regions in the Republic of the Philippines (hereinafter referred as ROP). The Government of the Philippines (hereinafter referred as GOP) enacted RA6969 (Toxic Substances, Hazardous and Nuclear Waste Act) in 1990 and issued DAO92-29 to enforce the RA6969. GOP established the environmental impact assessment (EIA) and issuance of environmental compliance certificate (ECC) system to control proper HW management.

However, the proper HW management system is not yet well established in ROP because law enforcement mechanism of RA6969 and monitoring and inspection system are not established sufficiently by administrative bodies, and because the private business is not yet grown enough to supply proper HW treatment services. Consequently, a huge amount of HW, especially waste oil, waste acid, waste alkali and sludge containing heavy metals, is stored in factories without any treatment. It is a pressing issue for GOP to implement effective measures for the proper management of HW.

Insufficient HW management may not only constitute a potential threat to the environment but also damage the economic development by keeping away the investment from foreign export companies that regard ISO acquisition as important.

Under the situation above, GOP officially requested to the Government of Japan (GOJ) to carry out the master plan study and feasible study on hazardous industrial waste management. In response to the request, GOJ provided technical assistance to the Master Plan Study (Industrial Hazardous Waste Management Study - Phase 1).

The Master Plan Study (Industrial Hazardous Waste Management Study - Phase 1) was completed in June 2001; the final report was submitted to ROP. Since GOP has identified a prospective implementing body of the model HW treatment project that has been proposed in the master plan and ways to secure the project funds, the Feasibility Study on the model HW treatment facility project (Industrial Hazardous Waste Management Study - Phase 2) has been carried out.

2 Objectives of the Study

The Industrial Hazardous Waste Management Study - Phase 2 has the following two main objectives:

(1) Conducting a feasibility study on the Model Integrated Facility (MIF) Project, which was proposed as the priority project in the Master Plan (Phase 1) and

(2) Strengthening the capacity of HWM administration through the following activities:

(a) Development of nation wide HW database network and transfer of database operating technology through workshops and seminars for the central/local DENR/EMB officers,

(b) Assisting DENR/EMB in preparing the Procedural Manual for implementing DAO92-29 concerning the enforcement of RA6969, Toxic Substances, Hazardous and Nuclear Waste Act, and

(c) Strengthening the capacity of DENR/EMB in HWM administration through the above activities and dissemination of regulatory mechanism on HWM to HW generators and TSD operators through workshops and seminars.

3 Scope of the Study

(1) The Study Area

The Study covers Metro Manila and *CALABARZON area.

*CALABARZON: **CA**vite, **LA**guna, **BA**tangas, **R**izal, Que**ZON**

(2) Components of the Study

The Study has two major components i.e. Feasibility Study on MIF Project and Strengthening the capacity of DENR/EMB in HWM administration. Specific study items and activities are shown below respectively.

(a) Feasibility Study on MIF Project

1. Justification of the Model Industrial HW Treatment Project
2. Preconditions of the Project
3. Basic Design of the Model Facility
4. Facility Operation Plan
5. Business Operation Plan
6. Financial Plan
7. Financial/Economic Appraisal of the Project
8. Implementation Plan
9. Environmental Impact Assessment

(b) Strengthening the capacity of DENR/EMB in HWM administration

1. Development of nation wide database network for registration of HW generators and TSD operators.
2. Workshops and seminars on operation of the database for transfer of technologies to the central and local DENR/EMB officers
3. Workshops and seminars for dissemination of HW registration system to HW generators and TSD operators
4. Assisting DENR/EMB in preparing the Procedural Manual for implementing DAO92-29 of RA6969
5. Workshops and seminars for dissemination of the Procedural Manual to the central and local DENR/EMB officers, HW generators, and TSD operators

4 Study Period and Study Team

The following members of the JICA Study Team and the Philippine counterparts (DENR-EMB) jointly carried out the Study, which started in September 2001 and completed in October 2002.

JICA Study Team
1. Mr. Masato Ohno: Team Leader
2. Mr. Mitsuhiro Yamamoto: Enhancement of Administration Capacity
3. Mr. Tadao Tanaka: Treatment Facility Design
4. Mr. Junji Anai: Treatment Facility Design/ HW Generator Registration
5. Dr. Marlito Cardenas: Industrial HW Management Administration/ Legal System
6. Mr. Fujio Igari: Site Survey/ Cost Estimate
7. Mr. Jude M. De Vera: Fund Raising
8. Dr. Christian Rouvier: Environmental Impact Assessment
9. Ms. Kaoru Oka: Hazardous Waste Management
10. Mr. Satoshi Sugimoto: Economic/Financial Analysis
11. Ms. Misako Takagi: Model HW Treatment Project Management
12. Mr. Kunito Ishibashi: Computer System Design (1)
13. Mr. Daisaku Kiyota: Computer System Design (2)

Philippine Counterpart (DENR-EMB)
1. Mr. Julian D. Amador: Director
2. Ms. Angelita T. Brabante: OIC-Environmental Quality Division
3. Ms. Erlinda A. Gonzales: Chief, Hazardous Waste Management Section
4. Mr. Jose Salvador T. Passe, Jr.: Supervising Environmental Management Specialist
5. Mr. Solon C. Rativo: Senior Environmental Management Specialist
6. Ms. Ninette P. Ramirez: Senior Environmental Management Specialist
7. Ms. Leah Aurea U. Texon: Science Research Specialist II
8. Ms. Elizabeth L. Carino: Science Research Specialist II
9. Ms. Resancleire P. Villanueva: Science Research Specialist I
10. Ms. Aimee S. Martinez: Environmental Management Specialist I

The Steering Committee comprised of the following members has been established under DENR/EMB for coordinating with relevant agencies and receiving helpful comments:

Eng'r. Ernesto Y. Mangune:	Natural Resource Development Corporation (NRDC)
Ms. Tonilyn P. Lim:	Philippine Economic Zone Authority (PEZA)-ESD

Mr. Ramon Dones:	Department of Energy (DOE)-EPMD
Ms. Helen Agacer:	Metro Manila Development Authority (MMDA)
Ms. Raquel B. Echague:	Board of Investments (DTI)
Ms. Teresita Santiago:	National Economic Development Authority (NEDA)

5 Report Organization

The F/R has 2 (two) volumes i.e. Volume 1: Feasibility Study on MIF Project (from Chapter 1 to Chapter 9) and Volume 2: Report on the achievement of supporting activities to strengthen capacity of HWM administration in the Philippines (from Chapter 10 to Chapter 14). Chapter 15 finally makes some recommendations regarding the issues to be addressed for further enhancing proper HWM in the Philippines.

Volume 1 describes in detail on the basic plan of MIF Project. Chapter 1 clarifies the rationale of the project in terms of its relevance to the National Strategy on HWM, the project objectives, and its expected benefits. Chapter 2 identifies topographic, geological, and physical conditions of the project site with the estimated demand for industrial HW treatment. Chapters 3 and 4 discuss in detail the basic design of the facilities to be built under MIF Project and the operation plan of the facilities with the estimate of their construction and operation costs. In Chapter 5, the basic policies of HW treatment business operation and organizational arrangement for construction and operation of MIF are recommended.

Chapter 6 examines the financing options for the project and makes several recommendations on fund raising and financing measures to be applied. Based on the detailed project plan formulated in the above chapters, financial and economic appraisal of the project is conducted in Chapter 7 by making use of key financial indicators. Although Chapter 6 and 7 recommended the use of Japanese Yen Loan and conducted the analysis of project cash flow based on its use for financing the project, it is the recommendation by the Study Team and does not represent any of Japanese Government. There is no discussion on this recommendation with GOJ. Chapter 8 provides the expected implementation plan of the project, focusing on the time schedule of preparation and construction stages of the project from the year 2002 to 2006. Finally in Chapter 9, the results of EIA Study are presented with the recommended environmental management plan of the project.

In Volume II, the achievement of supporting activities to strengthen HWM in the Philippines is described by the following orders:

Chapter 10: Updating of HW registration

Chapter 11: HW Management Database System

Chapter 12: Development of Technical Requirements for Hazardous Waste Management (Procedural Manual)

Chapter 13: Compliance Monitoring Manual

Chapter 14: Seminars and Workshops on Hazardous Waste Management

Finally in Chapter 15, the Study makes some recommendations regarding the issues to be addressed for further strengthening HWM in the Philippines.

VOLUME 1:
FEASIBILITY STUDY
ON MIF PROJECT

Chapter 1

Justification

1 JUSTIFICATION

1.1 Current Conditions and Issues of HWM in the Philippines

1.1.1 HW Generation and Treatment

With the recent progress of industrialization, the amount of industrial waste generation has been increasing in the Philippines. The industries generating hazardous wastes, e.g. waste acids, alkalis, oil, sludge containing heavy metals, etc. are facing serious difficulty in their proper treatment and disposal. According to the JICA Study on hazardous waste management (Phase I), approximately 280 thousand tons of hazardous wastes are generated each year by the officially registered 719 HW generators. The Study also estimated that about 100 thousand tons of the above would be stored (on-site or off-site) or missing (i.e., destination of HW cannot be identified.) every year. Besides the registered HW generators given above, there are still many non-registered factories that generate a considerable amount of HW in the Philippines. The JICA Study estimated that there were approximately 150 thousand potential HW generators, of which 1400 are large-scale factories. These estimates indicate the possibility that much larger amount of HW may be stored or improperly treated in the Philippines.

The existing TSD (Treatment, Storage and Disposal) facilities are also very limited in number as well as their capacity of HW treatment. Most of the existing TSD operators are small-sized recyclers who deal with only easily recyclable materials. Although two new HW treatment facilities recently started their operation, there is no landfill and thermal treatment facility available for HW in the Philippines.

1.1.2 Governmental Administration on HWM

The Government of the Philippines enacted RA6969 i.e., Toxic Chemicals and Hazardous and Nuclear Waste Control Act in 1990 as the basic law on hazardous waste management. Its Implementing Rules and Regulations (IRR) are spelled out in DENR Administrative Order No.29, Series of 1992 (DAO 92-29). Title III of DAO 92-29 specifically provides a general regulatory framework of HWM in the Philippines. Key regulatory and administrative tools for HWM defined by this law include:

1) Notification, registration and reporting duties of HW generators,
2) Accreditation of HW transporters and issuance of HW transport permit,
3) Issuance of TSD facility construction and operation permits and licensing of HW recyclers and treaters,
4) Monitoring of HW by utilizing the Waste Tracking System (Manifest System), and
5) Surveillance, compliance monitoring and enforcement.

However, the above regulatory tools do not effectively work for proper HWM in the Philippines because of various factors. Table 1.1.1 identifies the current issues of governmental HWM administration.

Table 1.1.1 Current Issues of Governmental HWM Administration

Key Regulatory Tools	Current Issues
1. Notification, registration and reporting duties of HW generators	- Limited number of notification and registration by HW generators (Approx. 1200 generators.). - Insufficient update of registration data. - Inaccuracy in the data provided by HW generators. - Limited compliance with the reporting duties.
2. Accreditation of HW transporters and issuance of Transport Permit	- No clear licensing system of HW transporters - No enforcement of specific criteria for regulating HW transport (standards for vehicles, containers, emergency responses, etc.) - Complicated and burdensome system of transport permit issuance - Improper/unclear handling of HW by transporters.
3. TSD facility permits and licensing HW recyclers and treaters	- No criteria and standard available for regulating technological requirement for TSD facility construction and operation. - Non-existence of proper thermal treatment and landfill facilities for HW. - No clarification about the waste acceptance criteria for TSD facilities (HW treatment and landfill standard). - No clearly defined licensing system of recyclers and treaters.
4. Waste Tracking System (Manifest System)	- Not implemented. - There is no system available for tracking the destination of HW.
5. Surveillance, compliance monitoring and enforcement	- Limited capacity of compliance monitoring to inspect activities relating to HW (generators, haulers, TSD operators). - Limited and minor penalties against violation of the relevant laws and regulations and their weak enforcement.

All of the issues above hinder sound development of proper hazardous waste management facilities and services while various illegal and improper handling practices of HW are left uncontrolled. Governmental capacity of HWM needs to be strengthened in terms of legal and regulatory tools, organizations, and human resources.

1.2 Rationale of the Project (Model Integrated HW Treatment Facility)

1.2.1 Relevance of the Project in the Philippines National Strategy on HWM

The basic principle of HWM in the Philippines is called 3R and 1P, in which the priority of HWM is firstly given to **reduction (waste minimization at sources)**, secondly to **reuse**, thirdly to **recycling**, and finally to **proper treatment**.

Although the efforts of 3R above (Reduce, Reuse, and Recycle) can reduce the amount or hazard potential of HW, these will not completely eliminate HW and its possible danger to human health and environment. Moreover, the 3R of HW depend much on the individual efforts of HW generators, haulers, recyclers, and so forth. It will also take much time to raise their awareness on 3R.

Therefore, in terms of minimizing the threat of HW to human health and environment at the earliest possible, development of the proper HW treatment and disposal system should be given the first policy priority of the Philippine Government in HWM sector.

However, due to insufficient preparation of legal and regulatory tools and limited capacity of the government, investment in the development of HW treatment and disposal facilities is still very risky in terms of the uncertain demand, large capital requirement, and so forth. The Philippines is currently facing the dilemma, wherein the government cannot strictly enforce the laws and regulations on HWM without the development of proper HW treatment and disposal facilities while the private sector is not willing to participate in HW treatment and disposal facility construction and operation without any strict enforcement of laws and regulations on HWM.

Public-private partnership is the key of resolving this dilemma in HWM in the Philippines. This project on development of the Model Integrated TSD Facilities (MIF) is proposed as the epitome of public-private partnership in realizing proper HWM in the Philippines.

1.2.2 Objectives of the Project

The main objectives of the Model Integrated TSD Facility (MIF) are:

- To minimize possible environmental risk that may arise from improper or insufficient hazardous treatment by the present generators and treaters,
- To simultaneously facilitate law enforcement on proper HWM and development of proper HW TDS facilities through active public-private partnership in implementing the model project,
- To provide private sector with the good practices of hazardous waste management through the disclosure of MIF operation.

1.2.3 Basic Concept of the Model Integrated TSD Facility (MIF)

MIF is designed to properly treat the hazardous wastes that are difficult or not possible to be recycled with the presently available technologies in the Philippines. MIF will integrate the state-of-art HW treatment technologies into one place. The treatment processes to be applied in MIF include:

- Physicochemical processes (including neutralization, oxidization and deoxidization),
- Solidification (cementation),
- Thermal process (pyrolysis process)
- Controlled Landfill

MIF will detoxify HW at its maximum by utilizing the above treatment technologies. The health and environmental risks of HW will be eliminated or minimized when it is disposed at the controlled landfill. Strict waste acceptance criteria will be applied at the controlled landfill.

1.2.4 Importance of Government Intervention in Implementing the Project

Government intervention is the key element in the formation of the project implementation body. This model project applies the public-private partnership for the development of MIF in the Philippines, in which the public sector is responsible for building the facility while the private sector is responsible for its operation based on facility lease contract with the public sector.

In this formation, the public sector takes the risks of TSD facility development itself and relevant loan repayment while the private partner will cover the risk arising from TSD facility operation. Since the private sector proponents will not be able to take all the above risks in the present HWM conditions in the Philippines, the government takes the risks of initial investment so as to promote private sector participation in TSD operation business.

This project format is designed to mitigate the risks of project by equally allocating the risks to public and private sectors. Under this arrangement, the public sector has to make every possible effort in enforcing the laws and regulations on HWM so as to maximize the amount of HW to be handled by the MIF, which results in reducing the risk of TSD operation by the private partner. On the other hand, the private partner will jointly share the risks under the lease contract of the TSD facility with the government since it is obliged to pay the lease fees from the income of the TSD facility operation. Thus, the joint efforts of public and private sector in financially feasible operation of MIF will lead to the realization of the potential market for HWM business as facilitate the private sector participation in the HWM business in the Philippines.

1.2.5 Expected Benefits

The major expected benefits arising from the project include:

- Minimizing possible environmental risks that may arise from improper or insufficient hazardous treatment by the present generators and treaters,
- Facilitating law enforcement of hazardous waste management as well as accelerating establishment of overall hazardous waste management system in the Philippines,
- Realizing the potential market of HWM business in the Philippines.

Besides the benefits mentioned above, the following positive effects are also expected by the project:

- The development of a model TSD facility will send a strong signal of ~~a~~ the intention of the government to realize proper hazardous waste management,
- Anyone can learn from the model TSD facility on HW treatment technologies, facility operation and maintenance, and so forth,
- The officials of national and local government can accumulate a lot of practical experience, knowledge, and know-how of hazardous waste management from the model TSD facilities,

- The course of TSD facilities development will be further clarified through the pilot operation of the model facility (actual demand, necessary treatment technologies, necessary capacity of the facility, etc.), and
- The model TSD facility will facilitate centralized management of Waste Tracking System.