Chapter 7

Financial/Economic Appraisal of the Project

7 FINANCIAL/ECONOMIC APPRAISAL OF THE PROJECT

The purpose of financial appraisal here is to evaluate financial feasibility of the project. The Study examines whether the project has enough financial profit to cover the annual operation and maintenance cost and enough financial return to cover the initial investment as well as to make additional investment for project expansion. Discounted cash flow (DCF) and profitability analysis on the Net Present Value (NPV) basis are the main tools for the above examination.

7.1 Estimation of the Project Cost

The total cost of the project mainly consists of initial investment and operation costs. Based on the project plan formulated in the former chapters, the initial investment and operation costs are estimated below.

7.1.1 Initial Investment Cost

Initial investment cost of the project mainly include:

- Land purchase,
- Civil works,
- Facility construction (including contingency)
- Construction supervision
- Other Miscellaneous expenses

Table 7.1.1 below specifies the initial investment cost by each major item.

Table 7.1.1 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	Civil works include: -Site development -Road construction
2) PCT facility	-	-	100,000	PCT facility mainly consists of: -Storage tanks -Reactor tanks -Dehydrator (filter press) -Pumping system -Effluent pit
3) Solidification facility	-	-	60,000	Solidification facility mainly consists of: -Waste pit and loading equipment -Concrete mixer and screw conveyor -Control equipment
3) Thermal treatment facility	-	-	1,200,000	Thermal treatment facility mainly consist of : -Rotary kiln / secondary combustion chamber -Bunker and feeding system -Heat recovery system -Flue gas treatment system -Wastewater treatment system -Control room
4) Landfill	-	-	148,000	Landfill facility is equipped with: -Rainwater run-off/ leachate pond -Monitoring system
5) Storage	-	-	52,000	
6) Laboratory	-	-	40,000	
7) Administration building	-	-	80,000	Administration building mainly consists of: -Main office, -Training/ function room -Workshop -Canteen
8) Utilities	-	-	80,000	Utility cost mainly includes: -Water supply -Electricity, -Telecommunication
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.
Cost of civil works is the sum of the cost of other facilities given in Table 3.13.1 of Chapter 3.
Construction cost of each facility (except landfill) is the same as Table 3.13.1.
Cost of landfill facility is the same as the total cost of landfill facility for phase 1 given in Table 3.13.2.

The total initial investment cost is estimated to be approximately 2,567 million pesos including VAT and interest during construction period.

7.1.2 Operation Cost

Operation cost of the project estimated here includes:

- Manpower cost
- Utility Cost
- Consumables (fuels, chemicals and other materials)
- Facility maintenance cost
- Waste collection/haulage fees to be paid to the contracted collectors/haulers
- Landfill cost to the contracted treater (after the closure of the landfill facility of the project)
- Other miscellaneous expenses

a. Manpower cost

According to the operation cost estimation in Chapter 4 and the organization plan of the project mentioned in Chapter 5, annual manpower cost is estimated as shown in Table 7.1.2 below

Table 7.1.2 Manpower Cost

Unit: Peso

Position	Unit cost (peso/psn./month)	Number of person	Total (peso/year)
Executive	264,000	3	9,504,000
Manager	88,000	10	10,560,000
Engineer	52,800	6	3,801,600
Technical Staff	35,200	25	10,560,000
Operator & Worker	22,000	26	6,864,000
Office Clerk	26,400	5	1,584,000
Total	**-**	**75**	**42,873,600**

b. Utility cost

As the utility cost of the project, the Study estimated the cost of electricity and water supply as shown in Table 7.1.3 below.

Table 7.1.3 Utility Cost

Unit: Peso

Position	Unit cost /y	Consumption/y	Total (peso/year)
Electricity	4 p/kwh	3,312 MWh	13,248,000
Water Supply	$11p/m^3$	$90 \times 10^3 m^3$	990,000
Total	**-**	**-**	**14,238,000**

c. Consumables

The use of consumables in the project mainly consists of the supplementary fuels for thermal treatment facility, chemical materials used for thermal and physicochemical treatment facilities, and cement for solidification treatment facility. The Study estimated the cost of these consumables as shown in Table 7.1.4.

Table 7.1.4 The Cost of Consumables

Unit: Peso

Consumables	Cost (peso/year)	Remark
Fuels	39,960,000	Supplementary fuel for operation of thermal treatment facility.
Chemical materials and agents	14,681,250	Chemical materials include: Thermal Treatment: Lime, activated carbon, caustic soda PCT: Sodium hydrochloride, aqueous sulfuric acid, slacked lime, ferrous sulfate, etc.
Cement and Sand	7,824,200	Cement is used for solidification treatment
Total	**62,465,450**	

d. Facility maintenance cost

The study estimated that the annual facility maintenance cost will be as shown in Table 7.1.5 below for each treatment and disposal facility.

Table 7.1.5 Facility Maintenance Cost

Unit: Peso

Type of Facility	Maintenance cost (peso/year)
Physicochemical treatment facility	520,000
Solidification facility	280,000
Thermal treatment facility	12,000,000
Others (Equipment and Vehicles)	800,000
Total	**13,600,000**

e. Waste collection/haulage fees

The project plans to contract our waste collection/haulage services to the private collectors/haulers. The Study estimated that the average unit cost of waste collection/haulage is to be 2,000 pesos per trip of 3 tons truck. The annual cost of waste collection/haulage is estimated to be 46,200 thousand pesos.

f. Landfill cost

After the closure of the landfill in the project site, the project plans to contract out final waste disposal to other treaters. The Study estimated that the annual cost of landfill to be paid to the contractors would be 54,600 pesos with the unit cost of 4000 pesos per ton of HW disposal.

g. Miscellaneous cost

Miscellaneous cost that is not specified in the cost items above is estimated as shown in below.

Table 7.1.6 Miscellaneous Cost

Items	Cost per Year
	Peso
Safety & Health Related	860,000-
Refractory Replacement	11,400,000-
Lab. & Computer Repairing	1,200,000-
Storage & Office Equipment	800,000-
Wastewater Discharge Fee	1,125,000-
Access Road Fee	1,800,000-
Total	17,185,000-

7.2 Estimation of the Project Income

The sources of the income in the project come from various HW treatment operations. Based on the estimated HW treatment demand and established treatment charges by types of treatment processes applied, the Study estimated the annual project income from HW treatment operations as shown in Table 7.2.1 below.

Table 7.2.1 Estimated Annual Project Income

Unit: Peso

Treatment Processes	Unit Treatment Charge (peso/ton)	Estimated Annual Treatment Amount (ton/year)	Total Income (peso/year)
Physicochemical Treatment	16,000	2,500	40,000,000
Solidification Treatment	13,000	2,500	32,500,000
Thermal Treatment	15,000	30,000	450,000,000
Landfill	5,000	3,500	17,500,000
Total	**-**	**38,500**	**540,000,000**

The project incomes that may arise from the temporary storage of HW at project site as well as from supplementary services such as consulting, etc. are not counted in this project appraisal.

7.3 Establishment of the Baseline Project Cash Flow

7.3.1 Preconditions for Establishing the Baseline Project Cash Flow

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

a. Project Period

Construction period: 3 years from 2003 to 2005

Operation period: 25 years from 2006 to 2031

b. Operation conditions of the TSD facilities

Operation days: 300 days/year for all the facilities

Operation ratio: 100%

c. Financing for initial investment of the Project

As indicated in Chapter 6, 85% of the total initial investment cost is covered by the foreign long-term loan while the remaining 15% will be prepared by local counterpart fund as the owned capital. Table 7.3.1 below shows the actual amount of the fund by each source above for initial investment.

Table 7.3.1 Financing for Initial Investment of the Project

Unit: Peso

	Financing amount (peso)	Ratio
Total initial investment	2,567,059	100%
Owned Capital	385,059	15%
Foreign Long-Term Loan	2,182,000	85%

Reamrk: -The total initial investment given above includes the value-added tax (VAT) arising from the initial investment, which will be paid by the owned capital.
-Although the interest payment of the foreign long-term loan during the construction period will also be covered by the owned capital, it is not included in the figure above.

The Study established the lending terms of the foreign long-term loan as follows in reference to the conditions of Japanese Yen Loan in its general terms.

Repayment Period: 28 years (including 10 years' grace)

Interest Rate: 2.20%/year

d. Taxes and duties arising from project implementation

Taxes and duties arising from project implementation are as follows:

Value-Added Tax: Levied to all the local procurement cost for facility construction and related services (excluding land purchase) at a rate of 10%. Although the foreign procurement cost is exempted from VAT, the project has to pay the VAT first for foreign procurement cost and receives the refund later in accordance with the

	Philippines taxation system. Therefore, the Study levied the VAT for all the cost of facility construction and related services in the project cash flow. VAT is also levied to the gross income from the operation of the TSD facilities in the project at the same rate.
Import Duties:	The project is exempted from all the import duties.
Business Tax:	Levied to the gross income from the business operation at a rate of 1%.
Corporate Income Tax:	Levied to the net profit from the business operation at a rate of 32%.
Depreciation:	All the buildings, civil works, and engineering services are subject to depreciation. Except for landfill facility, the values of all the buildings, civil works, and engineering services are depreciated for 15 years by the fixed amount. The value of landfill facility is depreciated for 5 years by the fixed amount.

e. Additional investment for extension of the landfill facility

The project plans to carry out additional investment for extension of landfill facility in 2010 before the closure of the first landfill. After the closure of the second landfill in 2017, final disposal of the HWs will be contracted out to other treaters.

f. Project income and expenditure

In the baseline case of the project, both operation income and expenditure are assumed to be fixed every year up until 2017, when the final disposal of the HWs is contracted out to other treaters.

g. Replacement of the TSD facilities

In accordance with the replacement cost estimated in Section 3.14, the project assumed that all the replacement cost would arise in the 15^{th} year of operation. The specification of replacement cost is shown in Table 7.3.2 below.

Table 7.3.2 Replacement Cost

Unit: thousand peso

Facility	Cost
Thermal Treatment	135,000
PCT	23,000
Solidification	14,000
Laboratory Equipment	11,000
Others	20,000
Total	**203,000**

Based on the preconditions established above, the Study established the baseline project cash flow as shown on next page.

7.3.2 Baseline Project Cash Flow

Table 7.3.3 Basic Cash Flow

Unit 1,000 peso

Year	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Project year				1	2	3	4	5	6	7	8	9	10	11
Capital expense														
Land acquisition	153,900	0	0											
Administration building	48,000	32,000	0											
Physicochemical treatment facility	49,000	51,000	0											
Solidification Facility	30,000	30,000	0											
Thermal Treatment facility	300,000	468,000	432,000											
Storage	35,880	16,120	0											
Civil works	16,000	16,000	8,000											
Utilities	60,000	20,000	0											
Landfill facility	88,200	59,200	0					58,620						
Laboratory	24,000	16,000	0											
Physical Contingency	29,400	29,400	58,800											
Engineering	77,080	56,400	54,520											
Price Escalation	0	30,126	48,130											
VAT(construction & management)	72,876	79,426	53,875					5,862						
Preparation for business operation			23,088											
Sub-total	984,936	903,672	678,451					64,482						
Interest during the construction		16,680	34,813											
Total	984,936	920,351	713,264					64,482						
Income from TSD facility operation				540,000	540,000	540,000	540,000	540,000	540,000	540,000	540,000	540,000	540,000	540,000
VAT				54,000	54,000	54,000	54,000	54,000	54,000	54,000	54,000	54,000	54,000	54,000
Business tax				5,400	5,400	5,400	5,400	5,400	5,400	5,400	5,400	5,400	5,400	5,400
Operating expenses														
Manpower cost				42,874	42,874	42,874	42,874	42,874	42,874	42,874	42,874	42,874	42,874	39,048
Utility and consumables				76,703	76,703	76,703	76,703	76,703	76,703	76,703	76,703	76,703	76,703	76,703
Maintenance cost				13,600	13,600	13,600	13,600	13,600	13,600	13,600	13,600	13,600	13,600	13,600
Collection/haulage consignment				46,200	46,200	46,200	46,200	46,200	46,200	46,200	46,200	46,200	46,200	46,200
Miscellaneous Expenses				17,185	17,185	17,185	17,185	17,185	17,185	17,185	17,185	17,185	17,185	17,185
Final disposal consignment				0	0	0	0	0	0	0	0	0	0	54,600
Interest payment for overseas long-term loan				48,004	48,004	48,004	48,004	48,004	48,004	48,004	48,004	45,337	42,670	40,003
Interest payment for private longterm loan				0	0	0	0	0	0	0	0	0	0	0
Interest payment for short-term loan				0	0	0	0	0	0	0	0	0	0	0
Depreciation				160,107	160,107	160,107	160,107	160,107	142,231	142,231	142,231	142,231	142,231	130,307
Total operating expenses				404,672	404,672	404,672	404,672	404,672	386,796	386,796	386,796	384,129	381,462	417,846
Profit before tax				75,928	75,928	75,928	75,928	75,928	93,804	93,804	93,804	96,471	99,138	62,754
Corporate income tax				24,297	24,297	24,297	24,297	24,297	30,017	30,017	30,017	30,871	31,724	20,081
Profit after tax				51,631	51,631	51,631	51,631	51,631	63,787	63,787	63,787	65,600	67,414	42,672
Repayment for overseas long-term loan				0	0	0	0	0	0	0	121,222	121,222	121,222	121,222
Repayment for private long-term loan				0	0	0	0	0	0	0	0	0	0	0
Repayment for private short-term loan				0	0	0	0	0	0	0	0	0	0	0
Balance at the fiscal year end				211,738	211,738	211,738	211,738	147,256	206,017	206,017	84,795	86,608	88,422	51,957
Balance brought forward				211,738	423,475	635,213	846,950	994,206	1,200,223	1,406,240	1,491,035	1,577,643	1,666,065	1,718,022
Fund raising														
Owned capital	226,776	96,105	113,670											
Subsidy	0	0	0											
Overseas long-term loan	758,160	824,246	599,594											
Private long-term loan	0	0	0											
Private short-term loan		0	0											
Loan balance at the fiscal year end														
Overseas long-term loan	758,160	1,582,406	2,182,000	2,182,000	2,182,000	2,182,000	2,182,000	2,182,000	2,182,000	2,182,000	2,060,778	1,939,556	1,818,333	1,697,111
Private long-term loan	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Private short-term loan	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Year	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Total	Year
Project year	12	13	14	15	16	17	18	19	20	21	22	23	24	25		Project year
Capital expense																**Capital expense**
Land acquisition															153,900	Land acquisition
Administration building															80,000	Administration building
Physicochemical treatment facility				23,000											123,000	Physicochemical treatment facility
Solidification Facility				14,000											74,000	Solidification Facility
Thermal Treatment facility				135,000											1,335,000	Thermal Treatment facility
Storage															52,000	Storage
Civil works															40,000	Civil works
Utilities				20,000											100,000	Utilities
Landfill facility															206,020	Landfill facility
Laboratory				11,000											51,000	Laboratory
Physical Contingency															117,600	Physical Contingency
Engineering															188,000	Engineering
Price Escalation															78,256	Price Escalation
VAT(construction & management)				20,300											232,339	VAT(construction & management)
Preparation for business operation															23,088	Preparation for business operation
Sub-total				223,300											2,854,840	**Sub-total**
Interest during the construction															51,493	Interest during the construction
Total				223,300											2,906,333	**Total**
Income from TSD facility operation	540,000	540,000	540,000	540,000	540,000	540,000	540,000	540,000	540,000	540,000	540,000	540,000	540,000	540,000	13,500,000	Income from TSD facility operation
VAT	54,000	54,000	54,000	54,000	54,000	54,000	54,000	54,000	54,000	54,000	54,000	54,000	54,000	54,000	1,350,000	VAT
Business tax	5,400	5,400	5,400	5,400	5,400	5,400	5,400	5,400	5,400	5,400	5,400	5,400	5,400	5,400	135,000	Business tax
Operating expenses																**Operating expenses**
Manpower cost	39,048	39,048	39,048	39,048	39,048	39,048	39,048	39,048	39,048	39,048	39,048	39,048	39,048	39,048	1,014,462	Manpower cost
Utility and consumables	76,703	76,703	76,703	76,703	76,703	76,703	76,703	76,703	76,703	76,703	76,703	76,703	76,703	76,703	1,917,575	Utility and consumables
Maintenance cost	13,600	13,600	13,600	13,600	13,600	13,600	13,600	13,600	13,600	13,600	13,600	13,600	13,600	13,600	340,000	Maintenance cost
Collection/haulage consignment	46,200	46,200	46,200	46,200	46,200	46,200	46,200	46,200	46,200	46,200	46,200	46,200	46,200	46,200	1,155,000	Collection/haulage consignment
Miscellaneous Expenses	17,185	17,185	17,185	17,185	17,185	17,185	17,185	17,185	17,185	17,185	17,185	17,185	17,185	17,185	429,625	Miscellaneous Expenses
Final disposal consignment	54,600	54,600	54,600	54,600	54,600	54,600	54,600	54,600	54,600	54,600	54,600	54,600	54,600	54,600	819,000	Final disposal consignment
Interest payment for overseas long-term loan	37,336	34,670	32,003	29,336	26,669	24,002	21,335	18,668	16,001	13,334	10,668	8,001	5,334	2,667	792,066	Interest payment for overseas long-term loan
Interest payment for private longterm loan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Interest payment for private longterm loan
Interest payment for short-term loan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Interest payment for short-term loan
Depreciation	130,307	130,307	130,307	130,307	13,333	13,333	13,333	13,333	13,333	13,333	13,333	13,333	13,333	13,333	2,299,533	Depreciation
Total operating expenses	415,179	412,513	409,846	407,179	287,539	284,872	282,205	279,538	276,871	274,204	271,537	268,870	266,203	263,537	8,767,281	**Total operating expenses**
Profit before tax	65,421	68,087	70,754	73,421	193,061	195,728	198,395	201,062	203,729	206,396	209,063	211,730	214,397	217,063	3,247,719	Profit before tax
Corporate income tax	20,935	21,788	22,640	23,495	61,780	62,633	63,486	64,340	65,193	66,047	66,900	67,753	68,607	69,460	1,039,270	Corporate income tax
Profit after tax	44,486	46,299	48,113	49,926	131,282	133,095	134,909	136,722	138,536	140,349	142,163	143,976	145,790	147,603	2,208,449	**Profit after tax**
Repayment for overseas long-term loan	121,222	121,222	121,222	121,222	121,222	121,222	121,222	121,222	121,222	121,222	121,222	121,222	121,222	121,222	2,182,000	Repayment for overseas long-term loan
Repayment for private long-term loan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Repayment for private long-term loan
Repayment for private short-term loan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Repayment for private short-term loan
Balance at the fiscal year end	53,770	55,584	57,397	-164,089	23,593	25,406	27,220	29,033	30,847	32,660	34,474	36,287	38,101	39,914	2,038,220	Balance at the fiscal year end
Balance brought forward	1,771,793	1,827,377	1,884,774	1,720,685	1,744,278	1,769,684	1,796,904	1,825,937	1,856,784	1,889,444	1,923,918	1,960,205	1,998,306	2,038,220	38,179,120	Balance brought forward
Fund raising																**Fund raising**
Owned capital															436,551	Owned capital
Subsidy															0	Subsidy
Overseas long-term loan															2,182,000	Overseas long-term loan
Private long-term loan															0	Private long-term loan
Private short-term loan															0	Private short-term loan
Loan balance at the fiscal year end																**Loan balance at the fiscal year end**
Overseas long-term loan	1,575,889	1,454,667	1,333,444	1,212,222	1,091,000	969,778	848,556	727,333	606,111	484,889	363,667	242,444	121,222	0		Overseas long-term loan
Private long-term loan	0	0	0	0	0	0	0	0	0	0	0	0	0	0		Private long-term loan
Private short-term loan	0	0	0	0	0	0	0	0	0	0	0	0	0	0		Private short-term loan

Complete repayment of overseas long-term loan becomes possible this year

Collection of all the investment capital becomes possible this year.

7.4 Financial Appraisal of the Project

7.4.1 Estimation of the Financial Internal Rate of Return (FIRR)

FIRR is the most important indicator for evaluating the financial viability of project by the so-called Net Present Value (NPV) method. To estimate FIRR, the annual net cash flow (NCF) is needed to be calculated based on the estimation of the actual revenue and expenses arising in the project. In the case of the current project, the actual revenue and expenses includes the following items respectively.

Revenue: -Gross income obtained from TSD facilities operation (the sum of HW treatment fees)

Expenses: -Initial investment (including land purchase, facility construction, engineering services, contingency, and VAT.)
-Operation expenses (including manpower, utility, consumables, and maintenance, and collection/landfill consignment fees)
-Replacement cost (landfill facility construction cost in the year 2010 and other facilities in the year 2020

Table 7.4.1 on next page shows the annual net cash flow of the project on the basis of the above preconditions.

Table 7.4.1 Net Cash Flow of the Project (Unit:1000 Peso)

Year	Revenue	Construction Cost	Operational Expenses	Replacement Cost	Total Financial Cost	Net Cash Balance
2003	0	912,060			912,060	-912,060
2004	0	824,246			824,246	-824,246
2005	0	601,490	23,086		624,576	-624,576
2006	540,000	0	196,562		196,562	343,438
2007	540,000	0	196,562		196,562	343,438
2008	540,000	0	196,562		196,562	343,438
2009	540,000	0	196,562		196,562	343,438
2010	540,000	0	196,562	64,482	261,044	278,956
2011	540,000	0	196,562		196,562	343,438
2012	540,000	0	196,562		196,562	343,438
2013	540,000	0	196,562		196,562	343,438
2014	540,000	0	196,562		196,562	343,438
2015	540,000	0	196,562		196,562	343,438
2016	540,000	0	247,336		247,336	292,664
2017	540,000	0	247,336		247,336	292,664
2018	540,000	0	247,336		247,336	292,664
2019	540,000	0	247,336		247,336	292,664
2020	540,000	0	247,336	223,300	470,636	69,364
2021	540,000	0	247,336		247,336	292,664
2022	540,000	0	247,336		247,336	292,664
2023	540,000	0	247,336		247,336	292,664
2024	540,000	0	247,336		247,336	292,664
2025	540,000	0	247,336		247,336	292,664
2026	540,000	0	247,336		247,336	292,664
2027	540,000	0	247,336		247,336	292,664
2028	540,000	0	247,336		247,336	292,664
2029	540,000	0	247,336		247,336	292,664
2030	540,000	-153,900	247,336	-74,433	19,003	520,997
Total	**13,500,000**	**2,183,896**	**5,698,748**	**213,349**	**8,095,993**	**5,404,007**

NPV	-450, 119
FIRR	11. 15%

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.

7.4.2 Sensitivity Analysis

In order to assess the sensitivity of the project because of the fluctuation of income and expenditure, especially about its financial risks, the Study estimated the fluctuation of FIRR in the case of 10% decrease in income and 10% increase in operation expenses, as well as the case of simultaneous occurrence of the both cases. Table 7.4.2 below shows the results of FIRR estimation for each of these cases.

Table 7.4.2 Sensitivity of the project against the fluctuation of project income and expenses

	No change in project income	10% decrease in income
No change in project expenses	FIRR: 11.15%	FIRR: 8.94%
10% increase in operation expenses	FIRR: 10.30%	FIRR: 7.99%

Decrease in project income has a larger negative impact on the financial viability of the project than increase in operation expenses. In case 10% decrease in income occurs with 10% increase in operation expenses, FIRR of the project will go down to about 7.99%, which means that the project becomes financially risky even with the finance of long-term low interest loan. Securing the stable amount of HW for treatment by the TSD facilities will be the key of financially sustaining the project.

7.5 Economic Appraisal of the Project

7.5.1 Estimation of Economic Internal Rate of Return (EIRR)

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.

(1) Conversion of the Financial Cost to Economic Cost

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 in accordance with the following formula:

SCF = (I+E)/(I+Ic+E-Et+Ss)

Where,

I: Import

E: Export

Ic: Import Tariff

Et: Export Taxes

Ss: Net Subsidies

Table 7.5.1 shows the result of SCF based on the last 5 years' trade and financial statistics from 1993 to 1997.

Table 7.5.1 Estimation of SCF

Unit: million pesos

Year	Import Amount	Export Amount	Import Tariff	Export Taxes	Net Subsidies	SCF (%)
1993	479,529	304,071	81,971	0	0	90.53%
1994	567,979	354,209	81,610	0	0	91.87%
1995	684,432	446,735	97,601	0	0	92.06%
1996	851,887	538,625	104,566	0	0	93.01%
1997	1,065,329	736,774	94,800	0	0	95.00%
G/T	3,649,156	2,380,414	460,548	0	0	92.90%

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%. However, the figures given table above need to be further elaborated based on a set of information to be provided by the Philippines.

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.

The allocation of foreign and local cost of the project is shown below for major cost items.

a. Allocation of Foreign and Local Cost in the initial investment

Total Cost				2003	2004	2005
I Land Purchase Cost						
	Foreign	0	0%	0	0	0
	Local	153,900	100%	153,900	0	0
	Total	153,900	100%	153,900	0	0
II Construction Cost						
A. Plant	Foreign	1,064,000	69%	320,000	408,000	336,000
	Local	468,000	31%	166,880	205,120	96,000
	Total	1,532,000	100%	486,880	613,120	432,000
B. Landfill	Foreign	26,000	10%	15,600	10,400	0
	Local	242,000	90%	149,200	84,800	8,000
	Total	268,000	100%	164,800	95,200	8,000
Subtotal	Foreign	1,090,000	58%	335,600	418,400	336,000
	Escalation 5%	55,360	3%	0	20,920	34,440
	Local	710,000	38%	316,080	289,920	104,000
	Escalation 2%	10,000	1%	0	5,798	4,202
	Total	1,865,360	100%	651,680	735,038	478,642
C. Import Duty (5%)		0		0	0	0
D. (A+B+C)		1,865,360		651,680	735,038	478,642
E. VAT(10%)		186,536		65,168	73,504	47,864
F. Total (A+B+C+E)	Foreign	1,145,360	56%	335,600	439,320	370,440
	Local	720,000	35%	316,080	295,718	108,202
	Local Tax	186,536	9%	65,168	73,504	47,864
	Total	2,051,896	100%	716,848	808,542	526,506
G. Physical Contingency						
	Foreign	25,200	21%	0	0	25,200
	Escalation 5%	2,583		0	0	2,583
	Local	92,400	76%	29,400	29,400	33,600
	Escalation 2%	1,945		0	588	1,357
	Total	122,128	100%	29,400	29,988	62,740
Total Construction Cost						
	Foreign	1,173,143	54%	335,600	439,320	398,223
	Local	814,345	37%	345,480	325,706	143,159
	Local Tax	186,536	9%	65,168	73,504	47,864
	Total	2,174,024	100%	746,248	838,530	589,246
III Consulting Services						
Engineering	Foreign	188,000	100%	77,080	56,400	54,520
	Escalation 5%	8,408		0	2,820	5,588
VAT	Local	19,640	100%	7,708	5,922	6,010
Total Consulting Services	Foreign	196,408		77,080	59,220	60,108
	Local Tax	19,640		7,708	5,922	6,010
	Total	216,048		84,788	65,142	66,118
Preparation for Business Operation	Local	23,086	100%	0	0	23,086
Total Foreign		1,369,551	53%	412,680	498,540	458,331
Total Local		1,197,507	47%	572,256	405,132	220,119
Grand Total		2,567,059		984,936	903,672	678,451

b. Allocation of Foreign and Local Cost in O & M

Unit: Peso

Cost Item	Foreign Cost	Local Cost	Remark
Manpower	0(0%)	42,873,600(100%)	Local Procurement
Utilities	0(0%)	14,238,000(100%)	Local Procurement
Consumables	7,340,625(12%)	55,124,825(88%)	50% from foreign procurement for chemical materials and agents. Remainder are local procurement.
Facility Maintenance and Repair	12,800,000(94%)	800,000(6%)	Maintenance and repair of thermal treatment facility, equipment and vehicles are foreign procurement.
Consignment of HW Collection and Haulage	0(0%)	46,200,000(100%)	Local Procurement
Consignment of Final Disposal	0(0%)	54,600,000(100%)	Local Procurement
Miscellaneous Cost	12,600,000(73%)	4,585,000(27%)	Replacement of refractory, laboratory equipment and computers are foreign procurement.
Total	32,740,625(13%)	218,421,425(87%)	

c. Allocation of Foreign and Local Cost in Plant Replacement

Unit: Peso

Plant/Facility	Foreign Cost	Local Cost	Total
Thermal Treatment	80,000,000	55,000,000	135,000,000
PCT	3,000,000	20,000,000	23,000,000
Solidification	10,000,000	4,000,000	14,000,000
Lab. Equipment	8,000,000	3,000,000	11,000,000
Others	0	20,000,000	20,000,000
合計	101,000,000	102,000,000	203,000,000

(2) Estimation of the Benefit

a. Identification of Project Benefits

The benefits brought about by the model project are identified as follows:

(A) Saving in medical cost arising from the increase of disease caused by HW-induced pollution in the case of non-existence of the project,

(B) Avoided economic losses arising from decrease of foreign direct investment due to insufficient HWM system in the Philippines in the case of non-existence of the project including decrease in foreign capital inflow, industrial or export value, new employment opportunities, etc.)

(C) Opportunity cost arising in the case of non-existence of the project including construction and operation cost of additional HW storage facilities and restoration cost of soil (land) polluted by improper disposal of HW.

As to the benefit (A), it is very difficult to quantify because of the following uncertainties:

- Unclear epidemiologic cause-effect relationship between HW-induced pollution and specific diseases,
- Uncertainty regarding the projected impacts of HW-induced pollution in terms of the number of population affected as well as the intensity of impacts,

Likewise, the benefit (B) above is also difficult to quantify due to the uncertainty about the degree and extent of negative impacts of no available HW treatment facilities upon the foreign direct investment.

Therefore, the Study quantified the benefit (C), the opportunity cost arising in the case of non-existence of the project.

b. Methods of Benefit Quantification

The opportunity cost arising in the case of non-existence of the project is divided into the following two categories:

- Construction and operation cost of additional HW storage facilities, and
- Restoration cost of the soil (land) polluted by improper disposal of HW.

Each of the above opportunity cost is estimated below respectively.

ba. Assumptions regarding the measures to handle the HWs that will be treated by the model facility if the project does not exist

If the model HW treatment facility is not realized, its annual treatment amount of 38,500 tons has to be handled by other facilities or methods, from which opportunity cost will arise. The Study assumed here that the above 38,500 tons of HWs would be handled in the same way as they are now. The current conditions of HW treatment are summarized in Table 7.5.2 below, based on the available data of HW generators registered at EMB.

Table 7.5.2 Current Conditions of HW Treatment

	Amount (tons/year)	**Ratio (%)**
Generation	**278,393**	**100%**
Recycled	69,555	25.0%
Treated on site	68,501	24.6%
Treated off site	11,055	4.0%
Potential Treatment Demand	**129,282 (100%)**	**46.4%**
Stored	37,905 (29.3%)	13.6%
Disposed	51,963 (40.2%)	18.7%
Not clarified	39,414 (30.5%)	14.1%

From the amount given in Table 7.5.2 above, the amount stored, disposed, and not clarified, of which the total is about 130 thousand tons, are the potential demand for proper treatment. The model facility is proposed to annually treat 38,500 tons of them per year. Therefore, if the project is not realized, the above amount will be stored, disposed, or missing with their destination not clarified as far as the current treatment practices does not change.

To estimate the opportunity cost arising in the case of non-existence of the project, the Study assumed that the above 38,500 tons of HWs would be stored, disposed, and missing in the same ratio as shown in Table 7.5.2 (percentage given in parenthesis).

Table 7.5.3 Assumptions regarding the treatment of HW in the case of Non-Existence of the Project

	Amount (tons/year)	%
Stored	11,280	29.3%
Disposed	15,477	40.2%
Not clarified	11,743	30.5%
Total	**38,500**	**100%**

bb. Estimation of Opportunity Costs

Based on the assumptions made above, the Study estimated that the following incremental costs would arise in the case of non-existence of the project.

Table 7.5.4 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

i) Cost of HW Storage

To continue storage of HW on-or off-site, additional facilities have to be built. In this case, the cost of constructing and operating additional HW storage will be the opportunity cost. Based on the result of cost survey in the Philippines as well as in Japan, the Study estimated unit construction and operation costs of HW storage facility as follows.

Table 7.5.5 Estimation of Unit Construction and Operation Cost of Storage Facility

Item	Cost	Remark
Land	1,500pesos/m^2	Land price in Lima Land
Storage Building Construction	43,000pesos/m^2	
Operation of HW Storage	2,150pesos/m^2/year	5% of the construction cost

According to the assumptions given in Table 7.5.3, 11,280 tons of HW will be annually stored in the case of non-existence of the project. Based on the examples in Japan, the Study established the average specific gravity of HW to be 1 ton per cubic meter while the allowable height of piling up HWs was set up at 2 meter based on the HW storage guidelines available in Japan.

Taking into account the preconditions above, the total area required for storing the above 11,280 tons of HW is estimated to be 5,640 square meters if the building is one story. In this case, the total cost required for storage of the above amount of HW is estimated as shown in Table 7.5.6 below.

Table 7.5.6 The Total Cost Required for Storage of HW

Cost Item	Unit Cost	Quantity	Total Cost (thousand pesos)
Land	1,500pesos/m^2	6,000m^2	9,000
HW Storage Construction	43,000pesos/m^2	5,600m^2	240,800
Operation of HW Storage	2,150pesos/m^2/year	5,600m^2	12,040
		Total Cost Required	**261,840**

As shown in the table above, the total cost of 261,840 thousand pesos will be required to properly store the 11,280 tons of HW every year in the case of non-existence of the model project.

ii) Cost of HW Disposal

About a half amount of HW disposed of are on-site disposal while the remaining half is disposal by the treaters. Since there is no landfill facility that is able to properly control HW in the Philippines, direct disposal of HW will cause serious pollution of soil (land) unless it is detoxified by proper intermediate treatment. Although the Study could not identify how much HW disposed of are direct disposal, at least a half amount are directly disposed of in the improper way. Once soil pollution is discovered at the place of HW disposal, the soil must be restored to avoid possible danger to human health and environment. Since HWs include various hazardous and toxic substances, restoration must be strictly carried out to eliminate or minimize their negative impacts. Therefore, the Study estimated this soil restoration cost as an opportunity cost arising in the case of non-existence of the project.

Since there is no available data on the cost of soil restoration in the Philippines, the Study took the examples in Japan. Table 7.5.7 below shows the examples of soil pollution and restoration in Japan.

Table 7.5.7 Examples of Soil Pollution and Restoration in Japan

Pollutants	Amount of Soil Polluted (m^3)	Restoration Cost (thousand pesos)	Unit Cost (pesos/m^3)
Zinc (Zn)	20,000	4,300	215
Cadmium (Cd), Lead (Pb), Mercury (Hg), etc.	200	4,300	21,500
Oil, etc.	100	12,900	129,000
Fluorine (F), Phenol, Oil, etc.	600	17,200	28,667
Trichloroethylene, etc.	12,000	18,490	1,541

Pollutants	Amount of Soil Polluted (m^3)	Restoration Cost (thousand pesos)	Unit Cost (pesos/m^3)
Trichloroethylene	2,700	51,600	19,111
Cyanide, Trichloroethylene	1,850	58,480	31,611
Lead, Mercury	3,500	111,800	31,943
Cyanide, Lead, Arsenic, etc.	11,000	150,500	13,682
Lead, Mercury, Zinc	5,000	167,700	33,540
		Average	**31,081**

The cost of soil restoration varies with the characteristics of soil contamination such as the types of pollutants, depth of soil layer polluted, geological conditions of soil (land), and so forth. Therefore, it is difficult to accurately estimate the cost of soil restoration. The Study adopted the weighted average unit cost of soil restoration given in Table 7.5.7 above as the default figure to estimate the opportunity cost arising from direct disposal of HWs.

Assuming that a half amount of HW disposal is conducted in a improper way and causes soil pollutions, the cost of soil restoration is given as the result of multiplying the unit cost of soil restoration by the amount of HW improperly disposed of. Thus, the soil restoration cost arising in the case of non-existence of the project is estimated to be as follows:

31,081 (pesos per m^3 of soil polluted) * 15,477 (tons per year of HW disposal)/2

= 240,520 (thousand pesos per year)

iii) Opportunity Cost of the HWs not clarified about their treatment and disposal

Assuming that the HWs that are missing or not clarified about their treatment or disposal are handled improperly, they will also cause serious pollution. Therefore, similar with the case ii) above, the cost of soil restoration is estimated as the opportunity cost arising in the case of non-existence of the Project. In this case, the cost is estimated as follows:

31,081 (pesos per m^3 of soil polluted) * 11,743 (tons per year of HW missing)

= 364,984 (thousand pesos per year)

iv) Total Opportunity Cost

To sum up the cost estimated in i), ii), and iii) above, the total opportunity cost arising in the case of non-existence of the Project is as follows.

Table 7.5.8 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**

(3) Estimation of EIRR

Based on the estimation of economic cost and benefit of the project given above, its economic internal rate of return was estimated as shown in Table 7.5.9 on next page.

Table 7.5.9 Calculation of EIRR of the Project (Unit: thousand pesos)

Year	Benefit	Replacement Cost		Personnel Expenditure (Local Cost)	Construction Cost		Utility and consumables		Misc. Maintenance Cost (Foreign)	Misc. Maintenance Cost (Local)	Total Cost	Cash Balance
		(Foreign)	(Local)		(Foreign)	(Local)	(Foreign)	(Local)				
2003	0	0	0	0	450,647	507,574	0	0	0	0	958,221	-958,221
2004	0	0	0	0	544,406	353,391	0	0	0	0	897,798	-897,798
2005	0	0	0	0	500,497	208,828	0	0	0	0	709,326	-709,326
2006	867,254	0	0	36,245	0	0	8,016	58,639	27,737	43,609	174,246	693,008
2007	867,254	0	0	36,245	0	0	8,016	58,639	27,737	43,609	174,246	693,008
2008	867,254	0	0	36,245	0	0	8,016	58,639	27,737	43,609	174,246	693,008
2009	867,254	0	0	36,245	0	0	8,016	58,639	27,737	43,609	174,246	693,008
2010	867,254	0	54,512	36,245	0	0	8,016	58,639	27,737	43,609	228,758	638,496
2011	867,254	0	0	36,245	0	0	8,016	58,639	27,737	43,609	174,246	693,008
2012	867,254	0	0	36,245	0	0	8,016	58,639	27,737	43,609	174,246	693,008
2013	867,254	0	0	36,245	0	0	8,016	58,639	27,737	43,609	174,246	693,008
2014	867,254	0	0	36,245	0	0	8,016	58,639	27,737	43,609	174,246	693,008
2015	867,254	0	0	36,245	0	0	8,016	58,639	27,737	43,609	174,246	693,008
2016	867,254	0	0	33,011	0	0	8,016	58,639	27,737	44,884	172,288	694,966
2017	867,254	0	0	33,011	0	0	8,016	58,639	27,737	44,884	172,288	694,966
2018	867,254	0	0	33,011	0	0	8,016	58,639	27,737	44,884	172,288	694,966
2019	867,254	0	0	33,011	0	0	8,016	58,639	27,737	44,884	172,288	694,966
2020	867,254	121,321	94,853	33,011	0	0	8,016	58,639	27,737	44,884	388,460	478,794
2021	867,254	0	0	33,011	0	0	8,016	58,639	27,737	44,884	172,288	694,966
2022	867,254	0	0	33,011	0	0	8,016	58,639	27,737	44,884	172,288	694,966
2023	867,254	0	0	33,011	0	0	8,016	58,639	27,737	44,884	172,288	694,966
2024	867,254	0	0	33,011	0	0	8,016	58,639	27,737	44,884	172,288	694,966
2025	867,254	0	0	33,011	0	0	8,016	58,639	27,737	44,884	172,288	694,966
2026	867,254	0	0	33,011	0	0	8,016	58,639	27,737	44,884	172,288	694,966
2027	867,254	0	0	33,011	0	0	8,016	58,639	27,737	44,884	172,288	694,966
2028	867,254	0	0	33,011	0	0	8,016	58,639	27,737	44,884	172,288	694,966
2029	867,254	0	0	33,011	0	0	8,016	58,639	27,737	44,884	172,288	694,966
2030	867,254	-40,440	-31,618	33,011	0	0	8,016	58,639	27,737	44,884	100,228	767,026
Total	21,681,360	80,881	117,748	857,616	1,495,550	1,069,793	200,399	1,465,966	693,420	1,109,352	7,090,724	14,590,636
										NPV	935,003	
										EIRR	21.22%	

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

7.5.2 Sensitivity Analysis

Same as the case of the financial appraisal above, the Study estimated the fluctuation of EIRR in the case of 10% decrease in income and 10% increase in operation expenses, as well as the case of simultaneous occurrence of the both cases. Table 7.5.10 below shows the results of EIRR estimation for each of these cases.

Table 7.5.10 Sensitivity of the project against the fluctuation of project benefit and cost

	No change in project income	10% decrease in income
No change in project benefit	EIRR: 21.23%	EIRR: 18.89%
10% increase in operation expenses	EIRR: 20.77%	EIRR: 18.40%

Same as the case of FIRR, decrease in project income has a larger negative impact on the economic viability of the project than increase in operation expenses. However, EIRR of the project is lower than 20% in the case of 10% decrease in income, which indicates the importance of keeping the planned treatment amount in the model facility.

Chapter 8

Implementation Plan

8 IMPLEMENTATION PLAN

8.1 Time Schedule for Implementation

Assuming that it will take 4 years to build MIF and prepare for its operation, the Study established the following year-by-year schedule.

1st Year

- Completion of the Environmental Impact Assessment (EIA)
- Acquisition of the Environmental Compliance Certificate (4 months after submission of the Environmental Impact Statement)
- Preparation of the Project Proposal
- ICC Approval (3 months after submission of the project proposal)
- Approval of budget appropriation to the project
- Official request of foreign 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

Figure 8.1.1 shows the detailed time schedule of project implementation.

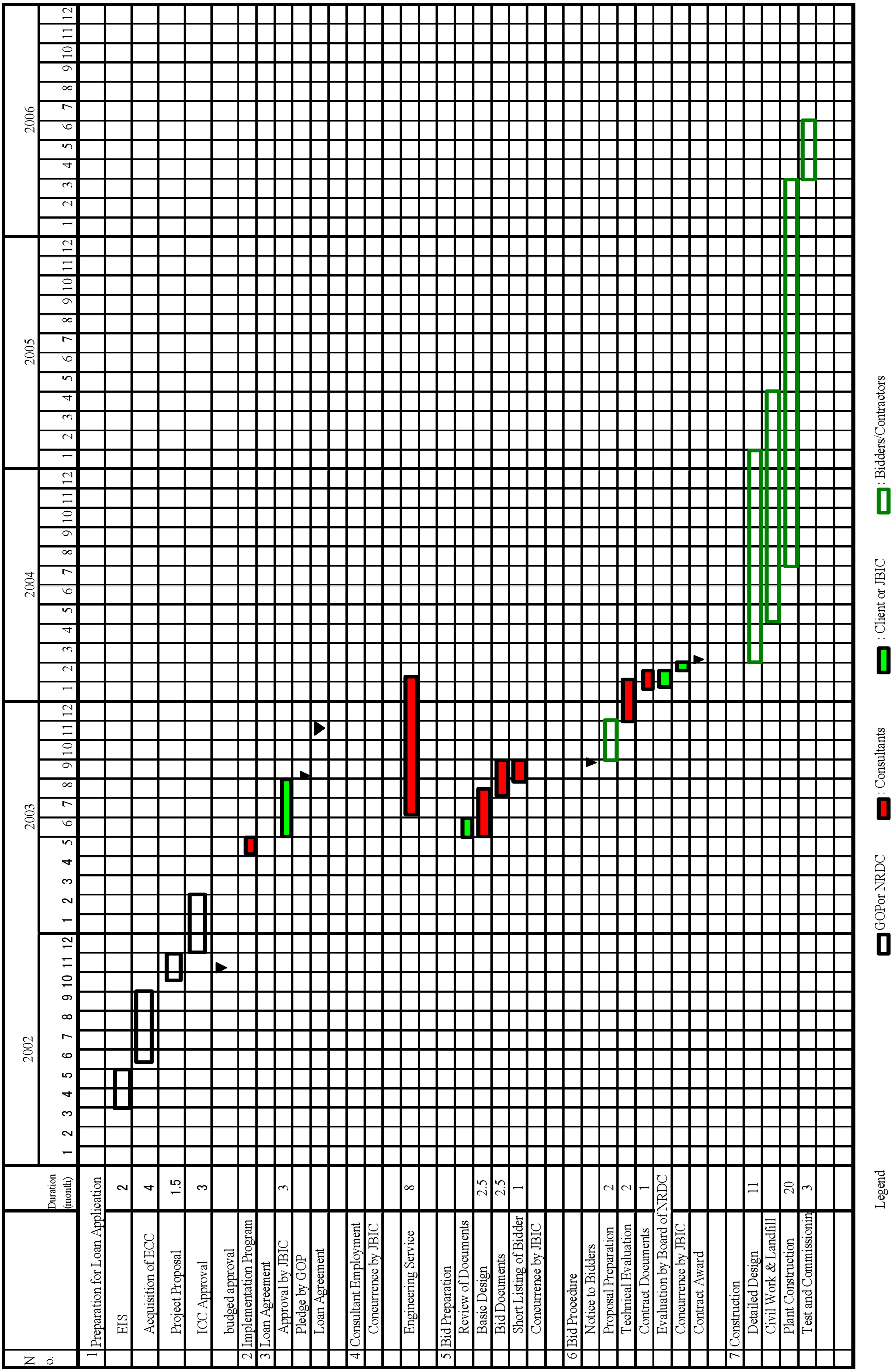


Figure 8.1.1 Project Implementation Schedule

8.2 Procurement Method

8.2.1 Procurement of Contractors

a. Options of Contracts with the Contractors

The building works required in the project are mainly divided into two categories, i.e. facility construction (PCT, solidification, and pyrolysis treatment facilities) and civil works for the controlled landfill facility. Two methods of contracts are basically considered, i.e. separate and package contracts. In the case of separate contracts, facility construction works and civil works are separately contracted out to different contractors. On the other hand, the package contract combines facility construction and civil works into one set of building works to contract out. Moreover, there is another issue to be considered about whether detailed designs of facilities are to be included in the construction works or not included and separately contracted out.

Taking into account the necessity of simultaneous implementation of facility site development and civil works for landfill, it is considered more preferable to apply package contract method. However, facility contractors or plant suppliers are generally very limited in their capacity of design and civil works of landfill facility. Therefore, the project will separately contract out the detail design of landfill facility to a consultant while detail design of the other facilities are included in the contract of facility construction works.

b. Procedure for Procurement of Contractors

The International Competitive Bidding (ICB) will be held to select contractors of facility construction works. The procedure for selecting Procurement of contractors will be made by opening the international competitive bidding (ICB). The basic procedure for selection of contractors by ICB is shown in the flow diagram below.

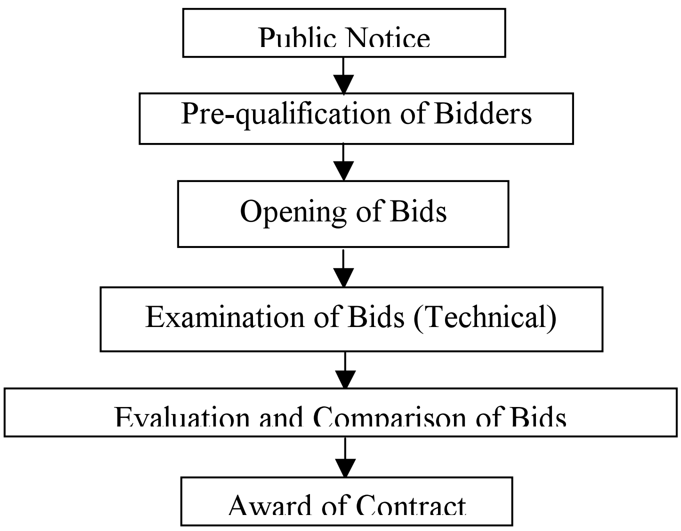


Figure 8.2.1 Basic Procedure for Procurement of Contractors

It will take 3 to 4 months to complete the above procedure for selecting the contractors.

c. Public Announcement of Bidding

Public announcement of pre-qualification for bidding of the facility construction works will be made in the major newspapers in the Philippines.

d. Pre-qualification (P/Q) of Bidders

Based on the documents submitted by the bidders in response to the public announcement above, their technical and financial capacities are pre-qualified. The items of pre-qualification may include experience, qualified human resources, stock of construction machinery and equipment, financial performance, etc. Particularly on the technical aspects, the experience in the international bidding market of the construction of pyrolysis treatment and landfill facilities is of great importance. Possession of the technologies required for the pyrolysis treatment facility in the project is one of the most important keys for the applicants to be qualified to participate in the bidding.

e. Appraisal of Technical and Cost Proposals

The qualified bidders in the P/Q process above are requested to submit technical and cost proposals of the facility construction works. The qualified consultant to be hired by the project implementation body will first evaluate the submitted technical proposals in terms of their compliance with the technical specification required for the facilities. The evaluation committee will be organized in the project implementation body (i.e. NRDC) to make final decision on selection of the contractors.

8.2.2 Procurement of Consultants

a. Consulting Services Required

The consulting services required for implementing the project will include:

- Project preparation activities
  - Preparation of bidding documents with technical specification of facilities
  - Basic and detail design of site preparation, road, and landfill facility)
  - Listing of eligible contractors/suppliers
  - Evaluation of technical/cost proposals by the bidders
- Project implementation activities
  - Construction supervision
  - Technical and advisory services related to project implementation
  - Advisory services regarding social and environmental considerations
  - Preparation of contract documents
  - Other related services

b. Procurement of the Consultant

The consultant will be selected in accordance with the following steps:

Step 1: Preparation of TOR and cost estimation
Step 2: Short-listing of the consultants (3 to 5 candidates)
Step 3: Request for submitting proposals
Step 4: Evaluation of the proposals
Step 5: Contract negotiation

The above process has to be completed before the public announcement of the bidding for facility construction works. It will take at least 2 months to finish this process. The experience in the field of hazardous waste management and detailed knowledge in this field are the key eligibilities for the consultant.

c. Estimated man-months of the consulting services

Taking into account the required consulting services given above, the necessary man-months are estimated as shown in Table 8.2.1 below.

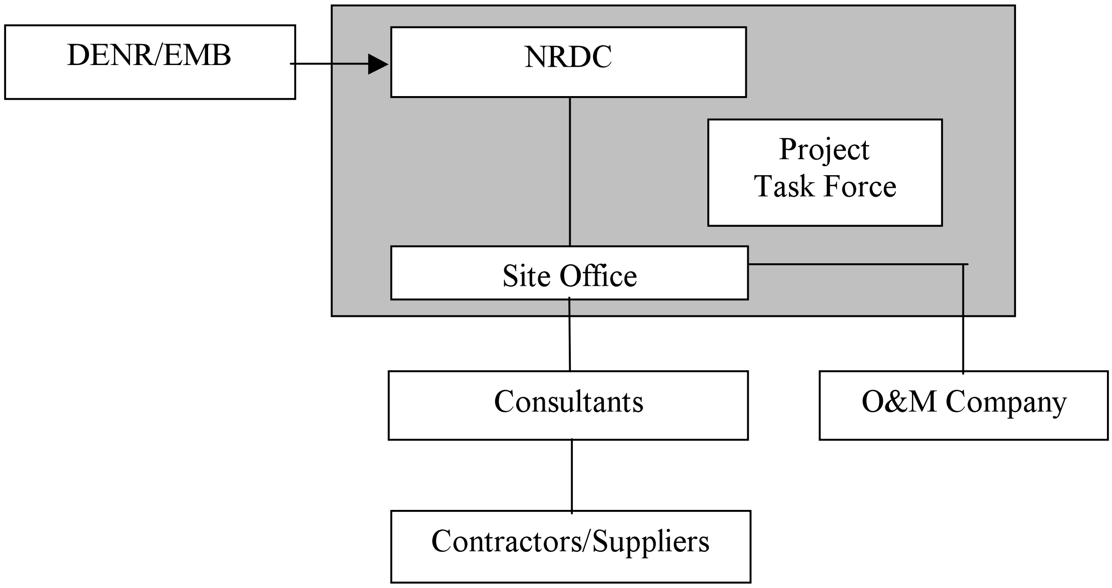
Table 8.2.1 Estimated Man-Months of Consulting Services

	Engineering Services		Supervision		Total
	No.	M/M	No.	M/M	M/M
A1 Foreign Experts					
Project Manager	1	3.0	1	28.0	31.0
Plant Mechanical Eng.	1	3.0	1	18.0	21.0
Plant Electrical Eng.	1	1.5	1	18.0	19.5
Environmental Eng	1	3.0	1	5.0	8.0
Building Eng.	1	1.5	1	16.0	17.5
Documentation Staff	1	3.0	1	20.0	23.0
Total	**6**	**15.0**	**6**	**105.0**	**120.0**
A2 Local Experts					
Plant Mechanical Eng.	1	3.0	1	22.0	25.0
Plant Electrical Eng.	1	3.0	1	22.0	25.0
Civil Eng	1	3.0	1	16.0	19.0
Building Structural Eng.	1	3.0	1	14.0	17.0
Building Electrical Eng	1	3.0	1	14.0	17.0
Cost Estimate Spec.	1	3.0	1	20.0	23.0
Total	**6**	**18.0**	**6**	**108.0**	**126.0**

8.3 Implementing Body of the Project

8.3.1 Construction Stage

NRDC will act as the project implementation body and hold the primary responsibility for construction of all the facilities in the project. However, because NRDC has only limited experience in carrying out this type of project, a special project taskforce needs to be established within NRDC to exclusively working for the project. A site office will also be established at the project site for regular construction supervision.



a. Project Taskforce
Detail of the project taskforce is shown in Chapter 5. The taskforce has to be organized by the experts having enough experience in this type of project. If there is no proper human resources in NRDC, recruitment of the experts need to be considered.

b. Site Office
A site office is established at the project site for regular supervision of building works. A representative from the project taskforce above and another from the hired consultant will be assigned to work at the site office. The local office of the O/M company will be set up within this office for preparation of facility operation.

c. Consultant
The hired consultant will conduct construction supervision at the site office as well as support the activities of project taskforce.

8.3.2 Operation Stage

Operation of the facilities will be made under the organizational structure given in the figure below.

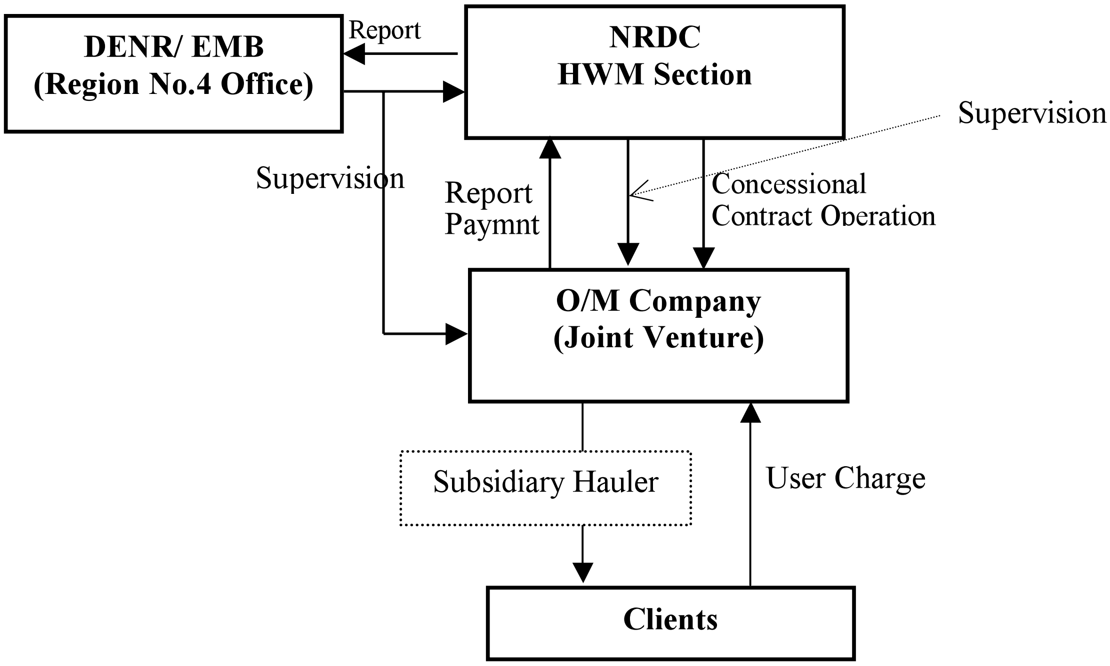


Figure 8.3.1 The Structure of the TSD Facility Operation

The Project Taskforce will be reorganized as the Section of Hazardous Waste Management of NRDC in charge of supervising and auditing the O/M Company at the time of starting the operation of the facilities.

O/M company will start business operation as an authorized TSD operator under the control of NRDC. It will be responsible for operation and management of TSD facilities. Hazardous waste collection and haulage services will be provided through the subsidiaries of O/M Company. Details on the roles and responsibilities of the O/M Company are given in Chapter 5.

For proper operation of the facilities, the O/M Company may be required to make a technical cooperation or advisory contract with the foreign O/M companies having enough experience and technical capacity. Based on such contract, the O/M company will request dispatch of the experts to the foreign companies so as to transfer technical skills and know-how of facility operation through on-the-job training.

The plan of dispatching experts is estimated as given in the table below.

Table 8.3.1 The Plan of Dispatching Experts

	No.	M/M	Dispatch Period
Business Operation Manager	1	4	From 1 year before starting operation to 1 year after starting operation
Pyrolysis treatment facility operator	1	12	From the time of testing run to 1 year after starting operation
PCT facility operator	1	6	From the time of testing run to 1 year after starting operation
HW analysis expert	1	3	From the time of testing run to 1 year after starting operation
Total	4	23	

Regarding the maintenance of the facilities, a section of facility maintenance has to be established within the O/M Company. Experienced maintenance experts will be hired from foreign O/M companies so as to provide training and technical transfer to the local staff members of the O/M Company. In addition, general maintenance contracts will be made with the facility contractors or plant suppliers.

Chapter 9

Environmental Consideration

9 ENVIRONMENTAL CONSIDERATION

9.1 Environmental Impact Statement System (EIS)

9.1.1 Background

The EIA study has been subcontracted to the local consultant Woodfields Consultants, based on the scope of work established by the JICA study team in coordination with EMB and the local consultant. The EIA report is provided in appendix as a separate report. This report is the technical study of EIA to be submitted by the project proponent to the DENR in the process of getting ECC approval. The EIA study has been executed in conformity with the technical requirements of DENR.

9.1.2 Outline of EIS System

The Philippines Environmental Impact Statement (EIS) System Decree (PD 1586) requires the project proponent to obtain the Environmental Compliance Certificate (ECC) of the project from DENR before its construction and operation. The proponent is required to submit an EIS of the project for approval of EMB.

The EIS report consists of the technical study for evaluation of impacts (EIA) and the documents of social acceptability statement (public hearing report and process documentation report). The Procedural Manual for DAO 96-37 provides details about the EIS system procedure. The schematic presentation of the EIS system is shown in Figure 9.1.1.

9.1.3 Scoping

Scoping is the first procedural step before conducting the EIA study. First level scoping is a procedure launched by the project proponent in coordination with EMB. Its purpose is to discuss and identify basic environmental issues of the project and to promote involvement of the stakeholders at the early stage.

The second level scoping meeting, which is the formal session of scoping, is held in order to finalise the scope of the EIA work within a scoping report with formal approval of EMB. Second level scoping meeting is held at least 15 days after the first scoping meeting.

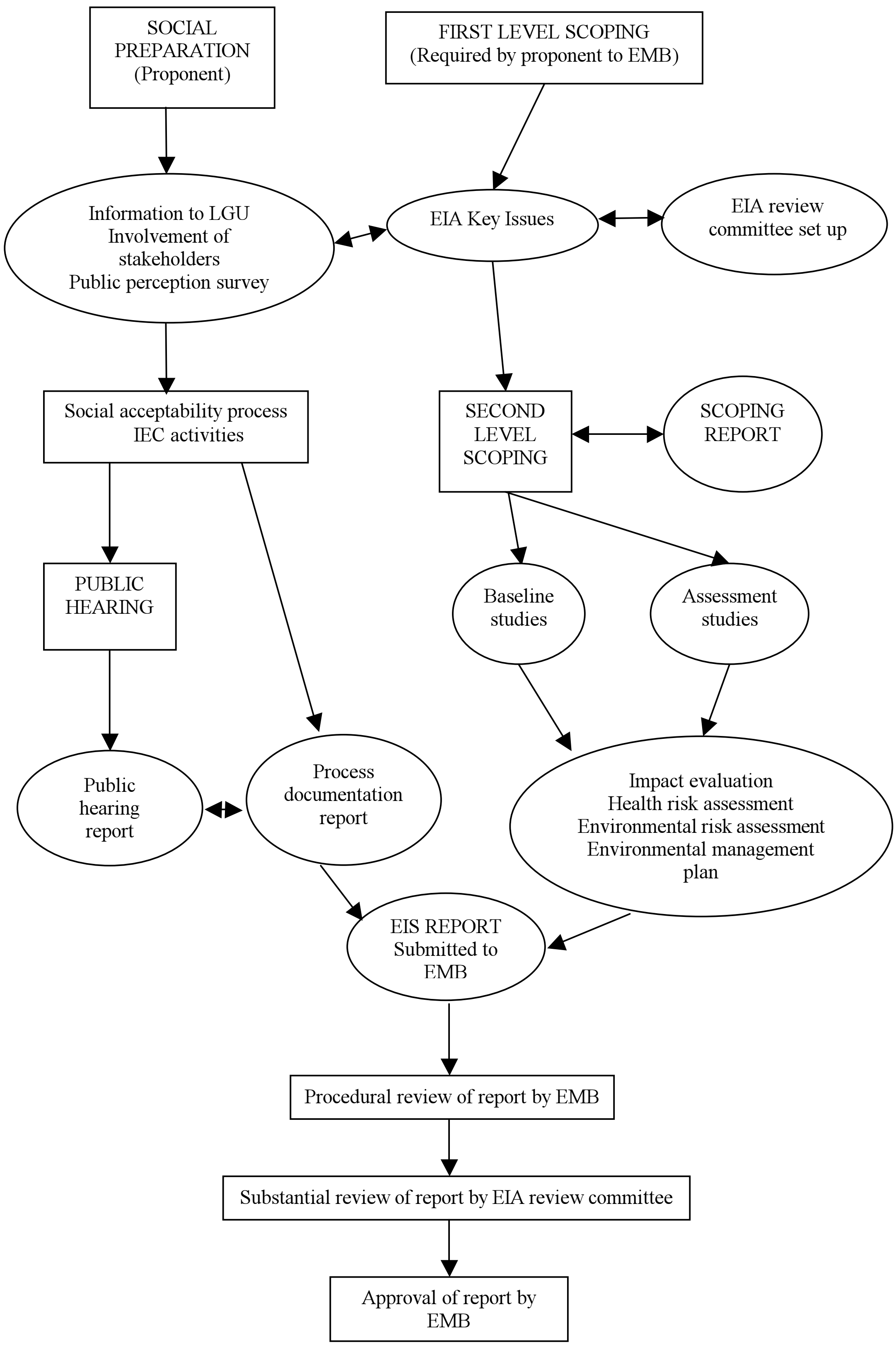


Figure 9.1.1 Main Steps of the EIA Procedure

9.1.4 EIA Review Process

Review of EIA study is done by the EIA review committee in two steps: first, as a screening of the EIA study by DENR, and second, as an assessment of the EIA documents. DENR make a final decision of granting ECC based on the recommendations given by EMB's Review Committee and Director's endorsement.

The EIA review committee is basically composed of 5 members whose review recommendations are subject to approval of the EMB director. The EIA review committee shall hold at least 3 meetings during the review process.

9.1.5 Evaluation Requirements

The Procedural Manual for DAO 96-37 requires the EIA study to conform to the general format of contents of study given in the guidelines and to include specific evaluation studies. The EIA study has been made according to the following chapters, in conformity with the required format of EIA:

- Introduction
- Project description
- Baseline environmental conditions
- Environmental and risk assessment
- Environmental management, monitoring, and institutional plans

The evaluation studies required for the EIA are:

- Environmental risk assessment study (ERA report)
- Environmental health impact assessment
- Seismic hazards risk assessment

(1) Environmental Risk Assessment

The Environmental risk assessment study is required by the EIA Division of EMB when hazardous substances are used in the industrial process of a project. There are however no official guidelines for conducting this study outside the basic requirements described in the Procedural Manual for DAO 96-37.

Its objective is to provide a qualitative ranking of risk of major industrial hazards and accidents and to recommend prevention and management measures. It clearly pertains to the assessment of injury risks caused by short-term acute exposure from industrial hazards. There is no requirement of quantitative risk assessment study. The assessment provides a guaranty that identified hazards have been considered in the design of the project.

The risk assessment process does not terminate when a project or activity is started or implemented but extends to the operational phase and the phase after closure. The risk assessment document must be continuously updated and revised.

The study is expected to systematically examine the safety of the project by addressing the following issues:

- Identification of hazardous materials present in the establishment and potential major hazards;
- Determination of where and how inadvertent releases, spills, leakage or explosions are likely to occur, if there are any;
- Assessment of the effects in case of spills, leaks or releases of toxic and hazardous materials involved in the project operations; and
- Estimation of the frequency of spills, leaks, releases and the probable ignition and/or explosion of hazardous substances used in the process.
- Presentation of prevention measures taken against occurrence of major accidents and for safety management and on-site emergency plan.

(2) Environmental Health Impact Assessment

The environmental health impact assessment is required when a project lies in an area classified by the Department of Health as a health sensitive area, or when the project is a health sensitive project. The use of hazardous and toxic waste materials in the treatment process makes the project sensitive to health. The basic objective of such study is to provide a qualitative ranking of public and occupational health risks caused by operation of the project. There is no requirement for quantitative risk assessment of health effects of the project.

The study must follow the National Framework and Guidelines for Environmental Health Impact Assessment of the Department of Health (1997). The recommended contents of such study are:

- Baseline health information (health and sanitation conditions);
- Identification of health hazards, human receptors, health consequences;
- Assessment of risks to workers and communities; and
- Control and mitigating measures to reduce risks.

9.2 Outline of Environmental Conditions

9.2.1 Baseline Data and Field Surveys

Present environmental conditions in and around the project site have been evaluated according to the baseline data. Table 9.2.1 is a checklist of the availability of data according to basic items under review for the understanding of present environmental conditions.

Primary baseline data pertaining to the project site area and the primary impact area are provided from field investigations launched by the JICA Study Team. These field investigations have focused on the physical environment only. The secondary baseline data have been collected from existing data sources for the project site and its surrounding areas.

The following field surveys have been conducted within the scope of work of the EIA study:

- Surface water sampling;
- Well water sampling;
- Meteorological parameters measurement;
- Air sampling;
- Noise measurement;
- Traffic counting;
- Observation of biogeographic and socio-economic conditions of project site borders.

Soil samples taken during the geotechnical study have been used as an additional source of primary data. The main data sources for the collection of secondary baseline data have been:

- PAGASA, climatological station of Ambulong, Batangas (meteorological data)
- BSWM (geology)
- NAMRIA (maps)

Table 9.2.1 Checklist of Baseline Data Collected and Analyzed for the Study

Baseline Data	Primary data	Secondary data	Limited data	No data
MORPHOLOGY, GEOLOGY				
Morphology, geological features	x	x		
Slopes, erosion conditions	x	x		
Soil physical properties	x			
Natural disaster occurrence		x		
Seismic and volcanic activity		x		
CLIMATE, METEOROLOGICAL PARAMETERS				
Climatic general conditions		x		
Precipitation, peaks and averages		x		
Wind velocity	x	x		
Atmospheric stability (turbulence)	x			
Humidity	x	x		
Temperatures	x	x		
SURFACE WATER				
Watershed areas and hydrographical system		x		
Creeks flood patterns			x	
Water uses around the site		x		
Surface water quality	x			
Existing surface water pollution sources		x	x	
Records of complaints of local community to local authorities				x
GROUNDWATER				
Hydrogeology of subsurface groundwater (project site)				x
Hydrogeology of shallow aquifers		x	x	
Hydrogeology of deep aquifers		x	x	
Groundwater table elevation		x		
Confinement / recharging conditions				x
Impermeability conditions of soil (geological survey)	x			
Groundwater uses and wells		x		
Groundwater demand projections		x		
Groundwater quality data	x	x		

Table 9.2.1 Checklist of Baseline Data Collected and Analysed for the Study (Continued)

Baseline Data	Primary data	Secondary data	Limited data	No data
AIR				
Ambient air quality	x			
Air pollutants emitting establishments in the area		x		
NOISE AND VIBRATION				
Ambient noise levels	x			
Ambient vibration levels	x			
Records of noise and vibrations data along main road				x
Records of complaints of local community to local authorities				x
BIOLOGICAL ENVIRONMENT				
Biogeographic description of project site and wildlife	x			
Check of natural areas of value around the project site		x		
LAND USE				
Land use and population data		x		
Water and air pollution sources in the area (see above)			x	
Forecasted trends of land use / environmental pressures		x		
Land use of project site: historical records				x
Landscape, places of interest		x		
Human settlements and housing areas close to the project site	x			
LIVING ENVIRONMENT, HEALTH, WELFARE				
Women and sensitive groups				x
Occupation, employment		x	x	
Livelihood, use of local resources			x	
Public health		x		
Welfare, quality of life				x
Traffic conditions, traffic counting data	x			
Records of major traffic accidents on main road		x		

9.2.2 Sampling

Sampling and measurements of the physical environment parameters have been the point of focus of the field surveys. Sampling has been done according to 3 sessions:

- November and December 2001 sessions
- March 2002 session set up later in order to complete the data available for the study

The vibration survey has been delayed and performed in February 2002.

Location and number of sampling points are shown in Table 9.2.2. Sampling and measurement items as well as methods of analysis are described in Table 9.2.3.

The location and the number of sampling points together with the period of sampling are reported in the table below. Data of the geo-technical survey performed for the purpose of study of foundation soils have been used in the EIA baseline data report.

Table 9.2.2 Location and Number of Samples and Sampling Points

Field surveys	Period of sampling (sampling sessions)	Number of samples or measure-ments per session	Total number of samples or measure-ments	A Project site	B Close area	C Larger area	Total Num-ber of points
Creek surface water	26.11.01 19.12.01 4.03.02	2	6	0	2	0	2
Shallow wells (80m and 30m)	26.11.01 20.12.01 4.03.02	1	3	0	1	1	2
Deep wells (more than 150m)	4.03.02	1	2	0	2	0	2
Soil (drilled for Geo-technical study)	November - December 2001	6	6	1	0	0	1
Meteorology	26 -31.01.02	8	8	0	1	0	1
Air	23 - 25.11.01 17 - 19.11. 01 24.0102	X	x	0	6	0	6
Noise	23 - 25.11.01 17 - 19.11. 01 24.0102	X	x	0	6	0	6
Vibrations	7 - 8.02.02	1	1	0	1	0	1
Traffic counting	26.11.01	1	1	0	1	0	1
Observation survey (biogeography)	23.11.01	X	x	1	1	x	2
TOTAL	x	20	27	2	22	1	24

A. Sampling points within boundaries of the project site
B. Sampling points in vicinity and on borders of the project site
C. Sampling points outside immediate area boundaries or outside Lima Technology Center boundaries

- Municipality of Malvar (socio-economic profile)
- NWRB (hydrology)
- LWUA (water resources)
- EIA study Lima Land Inc. and others

Table 9.2.3 Items for Sampling and Measurement of the Physical Environment

Sampling items	Method of Analysis (or measurement)
1. Surface Water Quality	
Dissolved oxygen (DO), mg/L	Portable DO meter
Biochemical oxygen demand (BOD), mg/L	Azide modification (Dilution Technique)
Dissolved oxygen (DO), mg/L	Portable DO meter
Biochemical oxygen demand (BOD), mg/L	Azide modification (Dilution Technique)
Total suspended solids, mg/L	Gravimetry

Table 9.2.3 Items for Sampling and Measurement of the Physical Environment (Continued)

Sampling items	Method of Analysis (or measurement)
Nitrogen (mg/L)	Kjeldahl and Titrimetry
Ammonia (mg/L)	Kjeldahl and Titrimetry
Phosphate (mg/L)	Colorimetry (SnCl2)
Chlorine (mg/L)	O. Tolidine
Phenols, mg/L	Direct photometry
Total coliform, MPN/100mL	Multiple tube fermentation technique
Copper, mg/L	Atomic absorption spectrophotometer
Hexavalent chromium, mg/L	Diphenyl carbazide
Arsenic, mg/L	Atomic absorption spectrophotometer
Cadmium, mg/L	Atomic absorption spectrophotometer
Cyanide, mg/L	Colorimetry
Lead, mg/L	Atomic absorption spectrophotometer
PCB, mg/L	Gas chromatography
Total mercury, mg/L	Flow injection mercury systems
2. Groundwater quality	
PH	Portable pH meter
Conductivity	Portable Conductivity meter
Arsenic, mg/L	Atomic absorption spectrophotometer
Cadmium, mg/L	Atomic absorption spectrophotometer
Chromium, mg/L	Diphenyl carbazide
Cyanide, mg/L	Colorimetry
Lead, mg/L	Atomic absorption spectrophotometer
Total mercury, mg/L	Flow injection mercury systems
PCB, mg/L	Gas chromatography
Trichloroethylene and tetrachloroethylene	Gas chromatography
3. Air quality	
SO_2	Pararosaniline Method
NO_2	Griess-Saltzman Method
CO	NDIR
SPM	Gravimetry
HCl	Volhard titration iodine
Lead	AAS
4. Meteorological conditions	
Wind direction	Wind vane
Wind velocity	Rotating cup anemograph
Cloudiness	Observation
Radiation balance	Net radiometer
Temperature	Automatic weather station instrument
Humidity	Automatic weather station instrument
Rainfall	Automatic tipping bucket raingauge
5. Noise and vibrations	
Noise	Sound level meter
Vibrations	FBA type sensor
6. Traffic conditions	
Counting of vehicles	Manual counting

9.2.3 Physical and Biological Environment

(1) Location of Project Site

The project site lies in an extension zone of the industrial park of Lima Technology Centre, which has received ECC in 1997. It belongs to the Barangay San Fernando, in Malvar municipality, while closest barangays around the project site are Bagong Pook, Luta del Norte, and Luta del Sur. The total population of the surrounding area (4 barangays) amounts to 7,817 persons in 1995 and 8212 persons in 1998. Distance between the project site border and Bagong Pook border, which is the closest inhabited area located on NE of the site, is at least 500m.

(2) Topography, Morphology and Soil

The project site elevation is from 260m in north to 277m in south, with slopes up to 10% excepted along the creek which is hemmed in by steep banks. There is no erosion under present conditions of vegetal cover. The southern part of the project site is a hill.

The project site belongs to a geological area classified as accumulation of tuffaceous materials from Taal volcanic activity of quaternary period. Geological layers are clay, sand, and tuffaceous materials accumulated on more than 200m depth. The JICA geotechnical survey done on the project site has shown that subsurface layers are mainly dense silt and sand layers, in most cases with mixed materials (sandy silt, silty sand, presence of gravels). Permeability tests made on 5 samples of silt and silty sand taken from subsurface soil up to 2m depth have shown high compaction and low permeability characteristics. The 5 stratigraphic profiles established by the geotechnical study have however shown the presence of sand mixed with gravel layers, at about 4 to 11m deep in the hill, and more importantly at 2 to 4m underground in the flat area in the north part. Half the 20m profile of drilling boreholes in North has shown the presence of sand with gravel.

Sampling and analysis of top soil up to 2m depth (mainly silty sand layer 2m thick) has shown waterproof property in 3 samples (K=0) and very low permeability in 2 samples (K up to 7.33E-06 cm/s).

(3) Meteorological Conditions

The project site is exposed to the southwest monsoon effects and tropical cyclones during the rainy season which extends from June to November. Yearly average predominant winds are from NE (about 39% frequency on 10 years average) and SW (15%), with a speed ranging between 1 and 4m/sec. Average annual rainfall is 1952mm (30 years records) with a peak in June (358mm). Annual average ambient temperature is 27.6°C, with the highest monthly average maximum temperature in April (34.5°C) and the lowest in February (21.7°C).

(4) Natural Disaster Occurrence

The site is classified as a quiet area, according to the classification of frequency distribution of seismic epicentre, and is free from geological faults. Exposure to volcanic hazards (Taal volcanoe) is moderate. Exposure to seismic hazard as ground shaking is moderate.

(5) Water Use

Deep groundwater is the main water resource for domestic and industrial consumption in the Malvar area, since about 98% is supplied through Level III water supply systems of MLWD (Metro Lipa Water District) and LWUA (Local Water Utilities Administration). It is considered that there is no shallow well supply.

This area is classified by the National Water Resources Board as a difficult area, which means scarcity of water resources. Over pumping of groundwater has been reported in places like Barangay Poblacion and Barangay Bulihan. Total water supply from deep wells of the Lima Technology Centre for operation of the project will be around $300m^3$/day. Water consumption for operation of the thermal treatment plant will be between $30m^3$ and $60m^3$ / day.

There are no quantitative data on water use, but a statistical study (Water sources survey, 1998, Lima Land Inc.) has shown that well water supply in Malvar municipality around the project site was for 60% in number supported by shallow wells of less than 50m deep. However, the same study has shown that in the area around the project site (Bagong Pook, Luta del Norte, Luta del Sur, San Fernando), shallow wells represent less than $0.5m^3$ of wells supply, which confirm the very low use of shallow well water by the population or business sector. If we consider 8,212 persons as the total population and 150L/day consumption of water, the potential water demand is then $1{,}232m^3$/day, to which shallow wells could contribute up to 3.8% rate in best case (shallow wells supply amounts $48m^3$).

(6) Surface Water Bodies

The project site belongs to the upstream part of the watershed area of San Juan river, which drains surface water to the Laguna Lake in North. Laguna Lake as well as its whole water basin has been classified as an ecologically sensitive area under the jurisdiction of Laguna Lake Development Authority (LLDA), in view of water resources protection. Laguna Lake lies at about 35km from the project site.

Surface water body on the project site is limited to a small natural water course (creek) lying along the eastern border of the project site and with natural intermittent flow. This water course is used for drainage of the wastewater discharged upstream from the wastewater treatment plant of Lima Technology Centre. The course of the creek will not be modified by the project plant.

(7) Surface Water Quality

Creek water is the wastewater discharged by the wastewater treatment plant of Lima Technology Centre after treatment. The treatment plant must conform to the wastewater discharge quality standards of DENR. The wastewater treatment plant is designed for the biological treatment and chlorination of domestic wastewater. As to industrial wastewater, Lima Technology Center only accepts it as far as it is treated on site to the level of their acceptance criteria for wastewater.

(8) Groundwater

Deep aquifers are used as groundwater sources for the Malvar area. The groundwater that supplies deep wells of Lima Technology Centre (6 wells) have been drilled at a depth between 100m and 250m below ground level.

According to a recent study of hydrogeology (MLWD, 2001), the groundwater table is established at about 220m elevation in the project site area, which indicates its presence at about 40m below ground level. Shallow wells of the Malvar municipality are certainly supplied from this groundwater. The flow of this groundwater is oriented toward north-north-west.

The geotechnical study made by the JICA study team has shown the presence of water at an elevation being around 260m in south and 245m in north of the project site, mostly at depth between 15 and 20m. The origin of this water has however not been investigated, but there could be isolated and heterogeneous shallow water levels in the layers of sand mixed with gravel.

(9) Groundwater Quality

Groundwater quality data have been provided from the following sources:

- Results of analysis of 2 sessions sampling in 1 shallow well located near the project site at about 1km north. This well is the only one which could be identified near the project site in the downstream flow of groundwater. Its depth is estimated by the owner to be around 80m. Pumping is operated by a motor engine.
- Results of analysis of 1 session sampling in 1 shallow well located in the project site close to the Lima Land offices, at about 2km south the project site. This well is however located in the upstream flow of shallow groundwater.
- Results of analysis of 1 session sampling in 2 deep wells located in the Lima Technology Centre
- Published results of water quality tests for 6 deep wells of Lima Technology Centre (Watcon, 2001)

The 2 samples taken during the first and second sampling sessions of 26 Nov. and 20 Dec. 2001 from the shallow well located north the project site have been analysed for a total of 12 quality parameters: 5 physical parameters, 6 heavy metals parameters, and PCBs.

The sample taken during the third sampling session of 4 March 2002 from the shallow well located south the project site has been analysed for the same list of parameters including trichloroethylene and tetrachloroethylene.

The main results of analysis of water samples of the shallow and deep wells have been compared with the National standards for drinking water and the Class AA surface water quality standard under DENR DAO 34. The physico-chemical quality of water has been found to be acceptable. Pb concentration was found to be high in the 1st and 2nd sessions of sampling of shallow well water located in north of the project site.

The deep groundwater quality tests have provided results according to 10 physical parameters and 8 chemical parameters. No trace of pollution could be identified from these tests results.

(10) Soil Quality

Sampling of soil has been done in November and December 2001 in order to determine the physical conditions of the soil for civil works. These soil samples are dried soils extracted without using boring wash water. They have been stored in wood boxes. A set of 6 soil samples taken from boreholes n°3 to 5 has been used for analysis of 5 heavy metals and PCBs in March 2002. Boreholes n°3 to 5 are located in the hill zone of the project site. Each of these 3 boreholes has provided 2 samples. Samples characteristics are summarised in Table 9.2.4. It shows that all the samples have been taken outside the sand and gravel strata which have best potential for storing groundwater as shown by the results of the geo-technical study. Soil structure of all samples taken from deeper layers is described as silt.

The results of analysis did not provide any indication of abnormal concentration of heavy metals or PCBs in soil. It is however recommended that an investigation of groundwater in subsurface layers of the project site should be performed.

Table 9.2.4 Description of the sampling points and soil samples

	Borehole n°3	Borehole n°4	Borehole n°5
Location	Down hill	Slope of hill	Top of hill
Surface elevation	265.70	272.5	277.2
Water table elevation	247.70	264.50	260.20
Depth of water table	18	8	17
Depth of upper sample	4	7	5
Depth of lower sample	15	13	17
Soil type upper sample	Sandy silt	Silty sand + gravel	Sandy gravel
Soil type lower sample	Silt	Sandy silt	Silt

(11) Air Quality

The air quality survey has been made in 6 sampling points during 2 sampling sessions on 23 to 25 November 2001, and on 18 to 19 December 2001. The analysis of the 12 air samples in and around the site have shown the low level of background pollution for the selected 6 parameters (Table 9.2.3). Concentrations for CO and HCl are very low to undetectable. Dust concentration was higher in November samples but well below the DENR ambient quality standards.

(12) Noise and Vibrations

Noise measurement has been done in the same sampling points and during the same sessions as for air sampling. Vibration measurement has been done on 7-8 February

2002 (24 hours records of ground vibration) in 5 close points located in the centre of Lima Technology Centre area.

The results have shown that background median noise level was very low, almost between 40 and 55 dB(A) at the exception of the point of entrance to the Lima Technology centre, where noise level ranged between 59 and 75 dB(A).

(13) Biogeography and Wildlife

Natural habitats in and around the project site are agro-ecosystems composed of cultivation fields and fruit trees, specially the coconut trees. There is no aquatic habitat in or close to the project site. Since operation of the Lima Technology Centre has received ECC for industrial development and cutting of tree species, the presence of valuable fruit trees in the project site cannot be considered in this study as a valuable natural patrimony.

The bio-geographical observation and interview survey of November 2001 have shown that very few fauna and flora species could be found in this area.

9.2.4 Living Environment and Public Health

(1) Socio-economic Data Sources

The project site is isolated from the living areas of local communities, which makes the social issue a secondary one in the evaluation of impacts of the project on the environment. Only few items have been considered. Secondary data have been collected from the following sources:

- Municipality of Malvar, Comprehensive land use plan of the municipality of Malvar (2000-2005) for socio-economic data;
- Community based monitoring board, December 2000;
- Municipal health officer, for health data.

(2) Population

Population of Malvar municipality has reached about 27,000 inhabitants in 1995 with a growth rate of 2.7% in the same year. Population growth of the 90ties is mainly attributed to in-migration of people. Population of the immediate surroundings of the project site (Bagong Pook, Luta del Norte, Luta del Sur, San Fernando) was around 7,817 persons in 1995. The population of Bagong Pook was 1,108 persons in 1995 and 1,267 persons in 2000.

Population density of Malvar municipality was around 645 persons/km^2 in 1995, which is under the average of Batangas province (749). Population density of Bagong Pook is still lower, with 432 persons/km^2 in 1995. Population structure shows the importance of the young population in Malvar (36% under 14 years old).

(3) Land use

About 55% of land use was dedicated to agriculture in Malvar municipality in 1995, followed by industry and industrial estate development (21%). Agricultural use of land in the municipality of Malvar has been on the decline during the last decade, shifting from 4,300ha in 1990 to 1,880ha in 1997. During the same period, vegetables and fruit trees crop areas have increased. Coconut tree crops still remain the main agricultural use of land.

(4) Occupation and Employment

Employment in the municipality of Malvar is generated from agriculture and various services activities. Agriculture remains important with 30% of the total active population in 1995. This sector includes traditional agriculture and about 30 units of livestock and poultry industrial farming. Unemployment rate was only 3% of active population in 1995, which can be partly explained by the proximity of Manila. Most families raise a backyard livestock and poultry. The rate of unemployment in Bagong Pook is insignificant.

(5) Sanitation

In Bagong Pook, 100% of houses are supplied with safe drinking water, and more than 98% have toilet. Domestic wastewater is collected in 6 barangays of the municipality of Malvar but there is no municipal wastewater treatment unit. Individual septic tanks and direct discharge of wastewater to natural water bodies is the most current practice. Municipal waste is collected in 6 barangays. The waste disposal site is located in the San Pioquinto barangay. Domestic waste is mostly dumped along creeks and rivers or in other places.

(6) Public Health

Basic facilities like a health centre and a day care centre are available in Bagong Pook. The main causes of morbidity reported in Malvar between 1993 and 1995 were acute respiratory infections, nutritional vitamin deficiency and anemia, and skin diseases, gastrointestinal disorders and heart diseases. Heart diseases and cancers are leading causes of mortality.

(7) Women

The place of women in the local community and their role in the household economy could not be clarified from secondary data and in the absence of specific social investigation.

(8) Education

There are no data regarding the education level of people around the project site. Literacy level of the population is however established at 93% in 1995. Most of the barangays like Bagong Pook have an elementary school.

(9) Landscape and Amenities

Tourism land use occupied almost 0.1% of total land use in Malvar in 1995. There is no tourism place near the project site. Although no investigation was made in this field, it is assumed that the area around the Lima Technology Centre does not provide scenery amenities that could be based on landscape resources. As regards to the urban environment, the municipality of Malvar is carrying out a policy for greenery and beautification of urban environment. The ECC rules of Lima Land Corporation provide development conditions like the planting of trees for beautification of the site and preservation of species.

(10) Results of Baseline Data Study

The results of the baseline data have been summarised in Table 9.2.5. These results are established for the main items of the EIA evaluation by ranking sensitivity level and exposure potential based on the collected data. The qualitative ranking is made taking into account the minimising and maximising factors of sensitivity or exposure, when possible. The purpose of the table is to highlight main issues raised by the baseline data report.

Table 9.2.5 Summary of Results of Baseline Primary and Secondary Data Study

	A	B	OBSERVATIONS minimising factors	OBSERVATIONS Maximising factors	C
PHYSICAL ENVIRONMENT					
Slopes, morphology	+	0	x	x	+
Erosion	+	0	Vegetation cover	Change in land use	+
Soil	+	+	Impermeability coefficient	Sand and gravel strata	+
Typhoon	+	+	x	x	+
Flood	0	0	x	x	0
Seismicity	+	+	Area with low frequency of seismic epicentres	x	+
Volcanism	+	0	Area moderately exposed to volcanic disaster	x	+
Creeks flood patterns	+	0	Artificially sustained flow from wastewater discharge	Land use change increasing flow	+
Water resources / water demand	+	+	Water supply from Lima Technology Centre	Increasing demand / scarcity in the area	+
Surface water quality	+	+	Wastewater flow from treatment plant of LTC	Drainage toward Laguna de Bay	+
Shallow groundwater quality	+	0	Waterproof soil layers	Location in groundwater difficult area	+
Deep groundwater quality	0	++	Depth and waterproof soil layers	Location in groundwater difficult area	+
Ambient air quality	+	+	Background air ambient quality within standards	x	+
Ambient noise and vibrations	0	0	No source of noise and vibrations.	Housing area along the national road	0
Natural habitats	0	0	x	x	0
Wildlife	0	0	x	x	0
LIVING ENVIRONMENT					
Land use, local development	+	+	Project site located in industrial park	Project will be unique centralised unit for HW treatment	+
Human settlements and housing	0	0	No housing area at close distance	Bagong Pook located downwind the flue gas stack	0
Women	0	0	x	x	0
Occupation, employment	+	+	Low level of unemployment	x	+
Livelihood, local resources	0	0	x	x	0
Landscape, amenities	0	0	No tourism area near the site	x	0
Traffic conditions	0	0	Low traffic on national road due to opening of highway	x	0
HEALTH AND WELFARE					
Public health and sanitation	+	0	No use of surface water / shallow groundwater	Limited collection of domestic waste	+
Welfare, quality of life	0	0	x	x	0

Ranking level of significance: 0: low; ++: high; +: medium A. Sensitivity level; B. Exposure potential; C. Potential for impact
Sensitivity level: sensitivity of site items to project, or sensitivity of project site to site items, according to the case; Exposure potential: exposure of project in case of sensitivity of project site to site items; of concerned population or other receptor in case of sensitivity of site items to project) to change in any of the site items
Maximising factors mean factors that contribute to maximize sensitivity of exposure, then potential for impact. Similar view for minimising factor.

9.3 Description of Project and Pollution Control Design

9.3.1 Pollution Control Integrated Project

Since the project handles toxic and hazardous materials, its implementation must integrate basic requirements for environmental protection and various equipment for pollution control and prevention. These measures and corresponding equipment and facilities are integrated components of the project plant. The thermal treatment plant process has been selected as the best available technology achievable under reasonable conditions for the control of air pollution.

The project as part of the master plan for the management of hazardous waste provides the full integration of pollution control and protection of the environment according to the following measures:

- Master plan for the registration of 6,500 generators of hazardous waste by 2010 and data base;
- Compliance with Environmental Protection Requirements;
- Pollution Prevention and Control Equipment.

9.3.2 Compliance with Basic Environmental Protection Requirements

(1) Location of site

The selection of the project site has been made during the Phase 1 study through screening of environmental constraints factors. As no criteria is available for appropriate location of industrial waste landfill, the screening checklist of DENR for municipal waste landfills has been used in the EIA. The reference used for this checklist was the landfill site and design evaluation checklist of the Ecological Solid Waste Management Act of 2000 (DAO 200-34-IRR of RA9003). Requirements of the checklist represent the minimal requirements for suitability of location. The project site fulfils all the requirements.

(2) Air Quality

Air pollutants emission from the thermal treatment plant and PCT plant must comply with the air emission criteria of RA 8749, Philippine Clean Air Act of 1999. As regards to the ambient air quality, the EIA study has included the air pollutants dispersion modelling study in order to estimate the impact of the project according to the worst case scenario. The purpose is to show that ambient air quality will be conform to the Philippine Clean Air Act of 1999 around the project treatment plant during its operation (see Table 9.3.1).

As to dioxins and furans, a strict emission standard of 1 nanogram per cubic meter in TEQ (toxicity equivalence quantity) is set in the Philippine Clean Air Act. Therefore, MIF is also required to comply with this emission standard.

(3) Surface Water Quality

The discharge of wastewater from the project plant will be subject to acceptance criteria for discharge in the wastewater treatment plant of Lima Technology Centre. It is assumed that the wastewater treatment plant will in turn satisfy the DENR and LLDA wastewater quality discharge requirements in natural water courses (DAO 90-35, Revised Effluent Regulations of 1990, Revising and Amending the Effluent Regulation of 1982, Revised Water Usage and Classification, Water Quality Criteria Amending Section Nos. 68 and 69, Chapter III of the NPCC Rules and Regulations).

(4) Groundwater Quality

There are no criteria specifically dealing with groundwater and soil quality requirements. The national standards for drinking water or the standards set for Class AA river water quality should be used as reference for groundwater quality.

Prevention of groundwater contamination can be managed through several regulatory rules or guidelines, but the JICA study Team has recommended in Phase I study to apply quantitative waste acceptance criteria at the special waste landfill like the one planned at the project site. Technological requirements for Class III landfills are also recommended.

9.3.3 Pollution Prevention and Control Equipment

The planned equipment for pollution prevention and control is described together with main facilities of the project plant in Table 9.3.1. It describes the equipment and measures taken at the hazardous waste treatment plant project to control the potential sources of pollution. Main pollution sources are the input waste materials (waste received at the plant for treatment) and the output waste materials (waste generated by the treatment processes). Other possible sources of pollution or nuisances are chemical products used for PCT operation, and fuel used for thermal treatment operation.

Regarding dioxins and furans, the Study introduces the best available technology for their emission control. The thermal treatment facility is designed to minimize their emission by complete combustion of pyrolysis gas in the secondary combustion chamber (SCC) and quenching of fugitive gas at the cooling tower. Quenched flue gas is absorbed by lime and activated carbon and collected by bag filter. Meanwhile, hydrogen chloride is treated by gas scrubber if it exceeds the emission standard. Thus, the thermal treatment facility in MIF will meet the air emission standards in the Philippines.

9.3.4 Transportation of Hazardous Waste

The total amount of hazardous waste that will be transported to the plant is estimated at about 38,500 tons per year, of which 13,000 tons are liquid wastes. Total daily average will amount to 132 tons, namely liquid waste 45tons per day, equivalent to 15 trips/day, and solid waste, 87tons per day equivalent to 10 trips/day. It is then estimated that a daily total of 25 trips will be necessary for transportation of hazardous waste. Accordingly, the traffic generated by transportation of waste will be very low.

Transportation will be operated through the highway and the planned interchange in front of the Lima Technology Centre. A new access road will be constructed between the interchange and the project plant. Then, no nuisance related to increased traffic of trucks is likely to occur in the vicinity of the project area.

Table 9.3.1 Project Components and Planned Equipment for the Prevention and Control of Pollution

Plant components	Characterisation	Pollution prevention measures	Pollution control equipment	Objectives	Output waste materials	Final treatment
Chemicals storage tanks	8 tanks	Secondary containment (spill retention facilities) double walled tank and liner; Indoor room Fire alarm, fire walls, fire doors; Inspection	Air ventilation Water sprinklers	Prevention of accidents and on-site injuries	x	x
Hazardous waste storage tanks	5 storage tanks for: - alkali waste - acid waste - chromium waste - cyanide waste - heavy metals waste	Secondary containment (spill retention facilities) double walled tank and liner; Fire alarm, fire walls, fire doors; Inspection	Air ventilation Water sprinklers	Prevention of accidents and on-site injuries		x
Waste handling area	Concrete floor	Water cooling, Safe working practices	Water sprinklers	Prevention of accidents and on-site injuries	x	x
System of prevention and fighting of fires	Network	Positioning of chemical fire extinguishers Training of personnel to emergency conditions	Emergency showers Eye washing fountain Network of water supply for fire fighting and health care service	Safety of workers Prevention of accidents and on-site injuries	Waste water in case of major fire fighting operation	Surface water dilution
Thermal treatment: Slagging rotary kiln secondary combustion chamber	30,000t/year High BTU liquids recovered from waste materials will feed burners	Control of temperature Negative pressure in furnace by induced draft fan Heat energy recovery	Startup and shutdown procedures in case of bad operation	Prevention of fugitive emissions	Slag Fly ashes	Landfill Solidification
		Secondary combustion chamber	x	Destruction of dioxin and residual hazardous substances	Fly ashes Flue gas emissions (almost water vapor and CO2)	Solidification Atmospheric dispersion

Table 9.3.1 Project Components and Planned Equipment for the Prevention and Control of Pollution (Continued)

Plant components	Characterisation	Pollution prevention measures	Pollution control equipment	Objectives	Output waste materials	Final treatment
		Control of quantity and quality of waste materials input	x	Acceptable ratio of hazardous substances in combustion	Fly ashes Flue gas	Solidification Wet scrubber treatment
		x	Wet scrubber Demister	HCl emission, Hg, SOx	Sludge Scrubber waste water	Solidification Water recycling Waste water treatment at central plant
		x	Quenching Tower Bag filter	Dioxins and Furans	Filters Flue gas emissions	Thermal treatment Atmospheric dispersion
		x	Flue gas stack 50m height	Discharge of gases	Flue gases complying norms (almost water vapor and CO_2)	Atmospheric dispersion
Physico-chemical treatment reactor tanks	2500 t/year, 10t/day 5 reactor tanks for: - alkali waste - acid waste - chromate waste - cyanide waste - various	Impermeable concrete floor	Filter press and filtration pit with pH adjustment	Separation of output waste materials	Waste water Sludge Non recyclable drums	Waste water treatment at central plant Water recycling Landfilling Solidification Thermal treatment
			Fume gas absorption filter	Prevention of offensive odors and toxic gases	Gas absorption filters Air emissions	Thermal treatment Air dispersion
Solidification	Concrete mixer 5800t/year				Inert waste Sludge	Landfilling
Waste water treatment	Treated by the central wastewater treatment plant in LIMA Tech. Centre	Installation of wastewater discharge pit	Wastewater quality check before discharge	Complying with standards of central waste water treatment plant	Waste water	Discharge to the sewer system
Landfill facility	Dry-tomb type landfill 112,300 t capacity, 15,000 t/year 52t/day	Landfilling of inert waste	Double liner Surface water drainage Leachate reservoir Monitoring		Leachate	Wastewater treatment. Used as cooling water for thermal plant.
					Drainage water	Discharge in creek
Transportation of waste	Liquid waste 45t/day; 15 trips/day Solid waste 87t/day; 10 trips	Specific access road Traffic control Equipment	X	Prevention of accidents / spillage during transportation	x	X

9.4 Evaluation of Potential Impacts

9.4.1 Method of Evaluation and Assessment Studies

(1) Checklist Approach

The qualitative evaluation of potential impacts induced by the construction and operation phases of the project has been made according to the DENR guidelines. These guidelines require a checklist approach according to criteria like nature of impacts, their importance, their geographical extent, the probability of occurrence, and the predicted duration.

The evaluation of impacts has been made for impact sources at a level of high environmental design of the project plant.

(2) Outline of Environmental Risk Assessment

1) Evaluation Method
The methodology adopted for this study has followed guidelines and values of the Manual for the Classification and Prioritization of Risks due to Major Accidents in Process and Related Industries (IAEA-TECDOC-727), which has been developed by the Inter-Agency Programme on the Assessment and Management of Health and Environmental Risks from Energy and Other Complex Industrial Systems.

The objective of risk assessment is to estimate the frequency of the various failure cases identified and the magnitude of their impact to the surrounding area. The risk level is expressed as the product of probability of fatality from a lethal dose and frequency of occurrence of the postulated failure events.

It is worthwhile to note that this evaluation is only indicative and preliminary, based on general reference criteria for the categories of potential hazards identified for the project and on few assumptions.

2) Sources of Hazards
Based on the checklist contained in the IAEA-TECDOC-727 manual, the following materials have been assumed to be present during operation of the facilities:

- Flammable materials (fuel): Reference n°6. For the flammable materials, it is assumed that waste oils will be stored in a tank with 60-ton capacity, while the fuel will be stored in a 200-ton tank.
- Toxic materials (liquid, high toxicity): Reference n°25
- Toxic materials (gas, high toxicity): Reference n°32

3) Scope and Limits of the Evaluation
The estimation of risk considered for this particular study is a method basically applied for estimating the detrimental effects of the accidental release of hazardous materials to the public. The evaluation is based on assumptions like population density (10 persons / ha) and effect areas up to 100m radius for toxic gas.

Accordingly, the approach is clearly based on worst theoretical conditions. However, the risks estimated by the study are likewise significant for workers in-site.

4) Results

Results are only very indicative estimates based on the above mentioned guidelines and assumptions. These results are summarized in Table 9.4.1. These results should however be used with caution as preliminary indications in determining the risk acceptability of the project.

Assessment shows that the most hazardous activity during the operation phase of the project would be incidents involving toxic liquid with an estimated risk of 0.0006 fatalities per year based on worst-case scenarios (First Scenario).

On the assumptions that (a) the safety system is above average, and (b) the wind will not always be in the direction of a populated area every time an incident occur (only 50% of the time), the resulting frequencies are lower, as shown in the table (Second scenario).

Table 9.4.1 Estimates of risk assessment

	Estimated fatalities/accident	Estimated frequency of accidents / year	Computed risk of fatalities / year
First Scenario			
Case 1 (flammable/fuel)	15	3 × 10-6	4.5 × 10-5
Case 2 (liquid/toxic)	0.2	3 × 10-3	6 × 10-4
Case 3 (gas/toxic)	1.5	3 × 10-4	4.5 × 10-4
Second scenario			
Case 1 (flammable/fuel)	6.5	3 × 10-7	4.5 × 10-6
Case 2 (liquid/toxic)	3.5	3 × 10-4	6 × 10-5
Case 3 (gas/toxic)	4.5	3 × 10-5	4.5 × 10-5

First Scenario: Safety system and wind direction parameters at worst level;
Second Scenario: Safety system and wind direction parameters at more favourable level

(3) Outline of Health Risk Assessment

As stressed in Section 9.1, a quantitative assessment of health risk in not required for EIS in the Philippines. It is estimated that the quantitative assessment of health risk is not feasible due to the lack of data at all the stages of such study: Estimate and prediction of emission quantities of contaminants of concern, and background exposure levels to such contaminants through various pathways.

The qualitative health risk assessment has been then conducted using the incident potential rating technique, health consequence rating and health risk assessment matrix as provided in the Philippine National Framework and Guidelines for EHIA (DOH, 1997). The results of the environmental risk assessment for hazards evaluation and probability of fatalities due to accidents, and the results of the air contaminants dispersion study have been considered for the health risk assessment.

Accordingly, results of the health assessment are very limited and could only highlight the relative importance of the in-site occupational health and safety issue, as expected. The study could not show any significant impact for the local population.

As to dioxins and furans, since the ground level concentration of flue gas is estimated to be 10 thousandths (1/10,000) of concentration at emission point, the ambient concentration of dioxins and furans will be lower than 0.1 picogram/m^3TEQ as far as MIF meets the emission standard of 1ng/m^3TEQ. Since the above ambient standard is lower than Japanese ambient standard for dioxins and furans of 0.6pg/m^3TEQ, the possible health risk by dioxin and furan will be sufficiently minimized.

(4) Seismic Risk Assessment Study

The study made use of historical earthquake data in statistically determining the probable magnitude of ground acceleration that will be produced by earthquake events corresponding to different return periods. Finally, peak ground acceleration to be used in the design of structures for the project were recommended based on the analysis and in consideration of published literature and structural codes.

The National Structural Code of the Philippines has given guidance on the use of design peak ground acceleration value of 0.40g for most of the country (including the site). The study has recommended that this value should be considered in the structural design of buildings and facilities in the project site.

(5) Ground Level Air Pollutants Dispersion Modeling Study

1) Introduction
A Gaussian Plume Model of dispersion of air pollutants has been undertaken for the SO_2, NO_2, particles and lead parameters. These 4 air quality parameters are regulated both by emission and ambient quality standards. The objective of this ground level air pollutants dispersion modelling study is to estimate the ground level air ambient quality downwind the flue gas stack of the project plant. Predominant downwind areas are on the NE and SW borders of the project site. The primary data measured for five days at the project site and the secondary data of local meteorology have been used as input in the model. Different stability conditions are considered like the extremely unstable (Stability Class A) and moderately stable (Stability Class F).

2) Plant Related Parameters
The physical and meteorological characteristics retained for the study have been:

- Stack Height: 50 meters
- Stack Diameter: 1 meter
- Flue gas rate: 40,000 m^3/hour
- Operation of the treatment plant: 24h/day
- Flue gas temperature: 70 to 80 °C
- Wind velocity at ground level: 2m/s
- Predominant winds: SW and NE

3) Assumptions

It is assumed that pollutants concentration at flue gas emission is at its highest permissible level, which is given by the DENR emission standards for air pollutants of concern. This is considered as the worst case scenario for pollutants emission from the thermal treatment plant project. Flue gas exit velocity has been assumed to be 10m/s. The assumed air pollutants concentrations are then:

- SO_2: 50mg / m^3
- NO_2: 200mg/ m^3
- Particles: 10mg/ m^3
- Lead: 0.5mg/ m^3

4) Results

Results of the study have shown that the expected ambient air quality in close areas located downwind the flue gas stack around the thermal treatment plant after implementation of the project will be below the permissible levels. This evaluation is made for the worst conditions scenario, which is unlikely to occur in normal conditions of operation. Worst conditions are the combination of the following factors:

- Attainment of maximum allowed concentration of pollutants at emission
- High atmospheric stability (meteorological conditions)
- Areas located downwind at about 1km from the plant
- Worst conditions of background levels of air quality (from regional sources of air pollution)

The summary of the resulting dispersion concentrations of ambient air pollutants according to the combination of worst conditions is given in Table 9.4.2. The comparison with DENR air quality criteria shows that the predicted impact of the project plant on air quality will be very minimal, based on the retained air quality parameters. Results of predicted ground level concentration of greater than 2 mg/Ncm for different air pollutants have been represented with isopleths in a set of maps within the EIA report.

Table 9.4.2 Results of Study and Comparison with DENR Criteria ($\mu g/m^3$)

	SO_2	SPM	NO_2	Pb
Predicted impact of project on ambient air concentration levels in worst conditions (stable conditions)	10.6	2.1	42.5	0.11
Present background conditions of ambient air quality: maximum concentration measured on site	28.7	179	117	0
Conclusion: Predicted ambient air quality after project in worst conditions scenario	39.4	181.1	159.5	0.11
Ground level concentration for point sources[1)]	340	300	260	20
Ambient Air Quality Standard[2)]	180	230	150	1.5
Air quality index (24hours' average)	Up to 80 GOOD	Up to 80 GOOD	x	x
	81 to 180 FAIR	81 to 230 FAIR	x	x
	181 to 650 POOR	231 to 350 POOR	x	x

	SO_2	SPM	NO_2	Pb
Air quality alert levels	650 ALERT	350 ALERT	x	x
	1570 WARNING	600 WARNING	x	x
	2360 EMERGENCY	900 EMERGENCY	x	x

1) Ambient quality standard for point sources provided by Section 12. b of CAA. Sampling is required to be taken at the location of the highest concentration expected.

2) General ambient quality standard provided by Section 12. a of CAA.

9.4.2 Review of Potential Impacts

(1) Outline of Impacts of the Project

The evaluation of impacts shows that location of the project site is basically suitable from the point of view of environmental protection. Only minor negative impacts are expected and they can be mitigated through a set of measures. This statement assumes of course that the plant has taken all engineering measures needed for the achievement of environmental standards. As stated in 0, it seems however better to confirm such suitability through the conduct of an investigation on the superficial groundwater quality in the project site.

The operation of the project is planned to be made with best pollution control technologies and should then be possible without adverse impact on the environment. The plant is designed as an isolated system leaving few possibilities of pathways for environmental impacts.

Hazardous waste treatment contributes to the regional protection of health and ecosystems, with global positive result for well being and quality of life of people. At the local community level, there is possibility that people have a negative perception of the project and feel worsening of quality of life. The communication and transparency between parties involved in implementation of the project and local communities will be a key action to avoid such side negative perception.

(2) Impacts on Physical and Biological Environment

1) Land
Land clearance and levelling for development of the site will induce minor changes in the morphology. The border creek river will remain untouched. Erosion effects are improbable under good civil work practice during construction. The increased flow of water in the creek river from water use and impermeability of ground will be minimal. Soil excavated during construction works will be a potential waste needing proper management.

2) Surface Water Quality
Surface water is unlikely to be polluted by the wastewater generated by the waste treatment plant project under normal operation conditions of the wastewater treatment plant of Lima Technology Centre. Wastewater will be discharged in the sewer of Lima Technology Centre after compliance with specific quality criteria (see Chapter

3). Potential sources of degradation of surface water are construction works during the rainy season (turbidity, waste materials).

3) Groundwater Quality

In spite of limited information about the hydrogeological conditions, it is assumed that contamination of groundwater is unlikely to occur due to the set of natural and artificial barriers between the project treatment plant and the underground:

- Important depth of the deep aquifers;
- Existing waterproof soil layers;
- Retention facilities and engineering and management controls against spillage or release of hazardous substances in the treatment plant;
- Collection and treatment of leachate in the project landfill site;
- Double lining of landfill site and system of detection of leakage.

The risk of contamination of groundwater from spillage of hazardous substances between the generator and the treatment plant during transportation as a result of accident is not considered.

4) Water Resources

The hazardous waste treatment plant will not induce new water resources development. Water supply is managed by Lima Technology Centre from deep groundwater sources. The treatment plant is however located in an area classified as a "difficult area" for groundwater resources, and will have a small contribution to the trends of increased withdrawal of groundwater.

5) Air Quality

The hazardous waste thermal treatment plant has been selected as the best available technology for environmental performance at reasonable price, which means the best combination of air pollution control factors. Furthermore, the background ambient air quality of the project area for current air quality parameters is good. Thus, no adverse impact is expected on ambient air quality as measured for the air pollutants that are regulated by the Clean Air Act for emission or ambient parameters.

The emission of landfill gas is expected to be negligible since severe waste acceptance criteria will be applied to minimize the presence of organic substances.

The emission of fugitive fumes will be avoided during normal operation by maintaining negative pressures in facilities.

The emission of dust during construction works is the main impact likely to occur on ambient air quality but this should not induce off-site nuisances for the surrounding population.

6) Noise, Vibrations

High noise levels generated by the thermal treatment plant are a potential nuisance and health risk for workers. No direct or indirect off-site nuisance is likely to occur, except during the construction phase as a result of transportation of construction waste and materials. The prediction of vibrations has not been estimated but it is assumed that it could affect only the in-site area of the project plant.

7) Worsening of Traffic Conditions
Worsening of traffic conditions is not expected because the project plant will induce negligible traffic and an access road will be constructed. The transportation of construction waste and materials during the construction phase will contribute to off-site traffic nuisances along the national road. The density of traffic on the national road is however still reasonable and should easily absorb the new traffic induced during the construction phase.

8) Wildlife and Habitats
Since the project site is located in an extension area of the Lima Technology Centre, and has already received ECC for land clearance, the project cannot have any direct impact on natural habitats. Potential indirect impacts on surrounding cultivated fields are unlikely to occur. The baseline data study has shown that this area had a poor biodiversity value. Finally, the project plant will not have any contribution to the degradation of aquatic environment of downstream areas because of its negligible impact on surface water quantity and quality conditions and the absence of ecologically sensitive aquatic habitat in the downstream flow of San Juan river.

(3) Impacts on Public Health and Occupational Health

1) Air Borne Impacts
The potential worsening of ambient air quality in areas located downwind the stack facility like Bagong Pook will always remain far below the levels that could possibly affect the health of people. The quantification of total exposure to air pollutants not measured and not regulated by the Clean Air Act could not be performed in this study with present conditions of data availability.

2) Water Borne Impacts
Water borne health impacts of the project plant are not a significant issue. Surface water is not a source of drinking water. The source of the municipal water supply is deep groundwater. No health effect of the project can reasonably be expected through the consumption of water.

3) Hazards Borne Impacts
Workers on-site will be exposed to health damages through inappropriate handling of hazardous waste materials and chemicals. Industrial hazards and accidents are also a potential source of injuries, health damages and fatalities. However, the study has shown that the application of basic safety rules together with prevention and control measures at the workplace in compliance with existing requirements make such risk very low and quite acceptable.

4) Nuisances Borne Impacts
There are no nuisance borne health impacts that could be induced by the project plant for the public. Workers on-site might be exposed to potential health impacts

through exposure to noise. The application of regulations for hygiene and sanitation at the work place should however make such effects almost negligible.

(4) Impacts on Socio-cultural Environment

1) Introduction
As mentioned above, the physical environment is the main potential receptor of impacts of the project on the environment. Negative impacts on the socio-cultural environment are almost negligible. The induced positive impacts are however significant.

2) Population and Housing
Construction works could induce some temporary burden on housing and basic urban facilities in order to cope with the in-coming new population of workers and their families.

3) Land Use
The location of the project plant should give a relative advantage for attractiveness of the Lima Technology Centre to investors that may generate hazardous waste and want to establish industrial units in the CALABARZON area. Land use planning in the municipality should be positively strengthened.

4) Employment
The project is expected to offer new employment opportunities for an in-coming labour force during construction and operation. The plant will not require more than 50 persons for operation, but indirect and long term effects on employment and income are positive.

5) Amenities, Landscape
Location of the project site in the Lima Technology Centre within an area with low tourism potential makes negligible its landscape effect. The flue gas stack is planned to be 50m high, which is not a factor of potential degradation of landscape.

6) Household Welfare
The possible positive multiplier effects of renewed attractiveness of the area for investors are increased investments and increased local revenues, development of local employment, improvement of household income and part time jobs. The demand for goods and services will give opportunities to women to engage in office works and small business activities, which contributes to the improvement of household welfare.

9.5 Environmental Management Plan

As stated in 9.3, the project plant is planned as a pollution control integrated project, with integration of pollution prevention equipment and monitoring at engineering design level. The first task of the environmental management plan is to ensure that all the measures needed for compliance with laws and regulations pertaining to environmental protection and to protection of safety and health of workers are taken into consideration. Conditions of monitoring and reporting of results will be set in the ECC document. The plan will finally include all other objectives and additional measures able to enhance the positive effects of the project and to mitigate negative side effects. The main specific measures of the environmental management plan are listed below according to construction and operation phases.

The environmental management plan will be supervised and managed by the Pollution Control Officer (or Environmental officer), as required by DENR DAO 26, series of 1991. The Pollution Control Officer will represent the facility for coordinating environmental actions with DENR offices and municipal offices.

9.5.1 Construction Phase

Measures relating to the environmental protection during the construction phase of the project are:

- Proper evacuation and disposal of earth materials during excavation and levelling works and prevention of dust during transportation;
- Proper evacuation and disposal of domestic solid waste and wastewater;
- Works made during the dry season to avoid the possible effects of turbidity of surface water during rainy season;
- Compliance with the occupational safety and health hazards standards
- Control of speed of vehicles and regulation of traffic;
- Developing employment opportunities for local people for construction works and include women in the recruitment process for office jobs and catering;
- Information campaign about the project construction for local government officers;
- Formal information and education campaign (IEC) to local officials and community leaders about construction and progress of works in order to foster cooperation among parties involved in the good implementation of the project;
- Such IEC could be held in small working sessions before leading up to public forums on the project, and using education materials like booklets of information;
- A contingency traffic management scheme to assist local government units in traffic regulation could be set up. Posting a traffic related advisory will be a component.

9.5.2 Operation Phase

Main measures relating to the environmental protection during the operation phase of the project are:

- Preparation of environmental audits to regularly evaluate the environmental performances of the facility and serve as a quality check of effective enforcement of environmental management procedures;

- Environmental quality agreement among the plant operator and local authorities; and application / qualification for ISO 14001;
- Greening of vicinity of the facility. This measure is already a requirement of ECC delivered for development of the Lima Technology Centre;
- Comprehensive safety and health program, including an emergency response program and a plan of communication with local communities in case of emergency;
- Recording and reporting of environmental hazards and health damages (which is however a basic requirement of occupational safety and health hazards standards);
- Regulation and monitoring of upward land value adjustment in the municipality to prepare for the induced increase of locators in Lima Technology Centre;
- Pro-active and responsive land use and development plans should be formulated to maximize potential economic benefits of the facility;
- Developing productive collaboration with government, potential clients and developers through a permanent medium like a website. At the same time, it enhances the transparency of the project;
- Development of a traffic management scheme including directional signage and warning signs along roads;
- Development of a comprehensive training program for the employees engaged in hazardous waste handling and operation. Its general objective is to make them aware of safety conditions and good practices and to prepare them to emergency plan actions.

9.6 Conclusion: Technical Acceptability of Impacts

The checklist of the importance of potential impacts of the project, with the standpoint that it will be designed as an integrated pollution control facility and implemented in an environment-friendly manner, is summarised in Table 9.6.1. It shows that the importance of adverse impacts is made minimal, while positive impacts are boosted according to the proposed measures. The adverse residual impacts associated with the construction phase will be temporary and manageable.

The global impact of the project on environment is obviously positive for the welfare and quality of life of people since it provides a way to eliminate the hazardous waste generated by industrial plants on a regional basis in the best environmental conditions.

The question of negative impacts of the project could be raised for the local communities living around the project site. The study has shown, however, that these impacts are very limited in scope and importance. The first reason for such potential performance is that the concept of integrated pollution control facility has been given a crucial importance in the engineering design of the project. The second reason is that an integrated environmental management plan has been conceptualised in order to minimise potential adverse impacts and maximise potential benefits. Then, the study has shown a good level of environmental acceptability of 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 those that can raise in terms of occupational health and industrial hazards and accidents. These are however similar to those of a classic industrial plant and require strict safety and prevention countermeasures.

Since the environmental benefit of the project for public health and natural ecosystems of the whole CALABARZON area is not questionable, it is concluded that the possible small side effects of the project are quite reasonable and acceptable.

Table 9.6.1 Evaluation Results on Technical Acceptability of Impacts

Expected Impacts	C1	C2	C3	O1	O2	O3
NATURAL ENVIRONMENT						
Threat of environmental hazard from toxic and hazardous chemicals	-			-		
Effect on surface and groundwater quality	-			-		
Effect on water diversion and withdrawal	0			0		
Effect on air quality and atmosphere	-			-		
Effect on noise / sonic environment	-			-		
Impact of geological conditions to the project	0			-		
Effect on open space and recreation	0			0		
BIOLOGICAL ENVIRONMENT						
Effect on Terrestrial Vegetation	-			-		
Effect on Fish and Wildlife	-			-		
Effect on Aquatic Flora and Fauna	-			-		
SOCIO-ECONOMIC CULTURAL ENVIRONMENT						
Effect on public and workers health and safety	-			-	-	
Effect on community structure	0			0		
Effect on land use and values	0					+
Effect on population dynamics and employment		+	+		+	+
Effect on livelihood and income		+	+		+	+
Effect on local planning, coordination and economic growth			+			+
Effect on workers' living standard			+			+
Effect on women's and children's Welfare		+	+			+
Effect on archaeology and culture	0			0		
Effect on vehicular traffic	-			-		

\+ The project has positive impact,
\- The project has negative,
\- The project has no impact.
Half-toned columns given in the table showed the estimated magnitude of each impact:
C: Construction phase of the Project, O: Operation phase of the project
1: Magnitude of impact is minimal or nil even if it arises.
2: Magnitude of impact is moderate if it arises
3: Magnitude of impact is significant if it arises.