K.3.2 Assumption for Cost Estimation

Prices and costs employed for these cost estimation are those prevailing in the MR in 1995 and the value presented in the cost estimation are "net present value (NPV)".

a. Currency Exchange Rate

The following exchange rates are employed in the cost estimation:

1 US$ = 416.2 Chilean pesos *1
= 102.4 Japanese yen *2

Note: *1 Exchange rate of US$/Chilean peso referred the value shown on the column of "interbancario" of the newspaper "El Mercurio" dated 28th October 1995.
*2 Exchange rate of US$/Japanese yen referred the value shown on the newspaper "Nikkei Shimbun" dated 30th October 1995.

b. Estimation of Tipping Fee for Intermediate Treatment Facilities

Tipping fees including profits and insurance costs for intermediate treatment facilities are estimated below.

ba. Construction Cost of Intermediate Facilities

Estimation of construction cost for intermediate treatment facilities are mainly referred to "The World Bank Technical Paper # 93, The World Bank". Since this paper presented costs in 1980's in US dollars, inflation rate in USA of 3.0% per year is assumed for 1980's to 1995 in order to convert those cost into the present value.

bb. Financial Resource for Facilities Construction

It is assumed that financial resource for land acquisition cost and construction cost of intermediate treatment facilities are to be covered by loans for all the amount. Loans conditions are assumed as follows:

- payback period: 15 years;
- interests rate: 6.0% per year

The value (for 14 years payback) indicated in "Evolucion de la Economia en 1994 y

Perspectivas para 1995, Banco Central de Chile, September 1994" is employed for the above assumption.

bc. Net Cost of Intermediate Treatment

Net cost of intermediate treatment is estimated, assuming the life span of an intermediate treatment facility is 15 years. Consequently, unit cost for intermediate treatment are calculated as: "Total net cost (total loan payback and O&M costs for 15 years)" divided by "total ISW amount to be treated for 15 years", i.e., NPV US$ per ton. The calculation is expressed as follows:

$A = (B + C) / D$

A: *unit (US$/ton) cost;*
B: total loan payback;
C: total O&M costs for 15 years (NPV); and
D: total ISW amount to be treated for 15 years.

bd. Tipping Fees

Tipping fees for treatment facilities are calculated by adding profit to the above-mentioned unit cost. Profit of the intermediate treatment handling agents are assumed to be 10%, which should cover the cost of restoration from accidents (such as insurance cost, etc.).

c. Collection and Transport Costs

Collection cost, transport cost, collection and transport cost are defined as follows:

- collection cost: cost incurred from "loading ISW at source" to "transport up to intermediate treatment facilities;
- transport cost: cost incurred from transport of "intermediate treatment facilities" to "final disposal site"; and
- collection and transport cost: cost incurred from "loading ISW at source" to "transport up to final disposal site".

d. Dehydration

All sludges to be generated in factories are assumed to be dehydrated on-site, i.e., at each generation source and the scale of a dehydration facility is calculated at an

average discharge amount which comes from division of total sludge generation amount by number of factories generating sludges.

e. **Storage Cost**

Storage is defined as

- storage on-site, and
- storage at intermediate treatment facilities.

In the Study the former cost is not counted because it shall be born by the generators. Whereas the latter cost is included in the tipping fees of intermediate treatment facilities.

K.3.3 Cost Estimation

An estimation of ISWM business scale is illustrated below. Estimation of cost associated with construction and O&M of intermediate treatment facilities are induced from the consultants' experiences and "The World Bank Technical Paper # 93, The World Bank". Meanwhile cost associated with collection, transport and final disposal are estimated referring to current prices of activities in the MR.

a. **Cost of Collection and Transport**

aa. **Collection Cost**

Cost of collection are largely affected depending on; size of collection vehicle, traffic conditions, etc.. Strictly speaking, it is theoretically possible to estimate the collection cost considering such elements. However, it is impracticable to do so at the stage of the master plan which aims to determine global framework of ISWM. Therefore, the collection cost of ISW in this occasion are estimated referring to current transportation cost of municipal SW in the MR and the empirical data of the consultants. In practice it is estimated 6 US$/ton including profits of collection company based on the following conditions:

- Current collection cost of domestic SW in the MR is 15 to 25 US$/ton;
- Transportation cost from Santiago urban area to Montenegro new

municipal landfill is estimated at 6 US$/ton including cost of transfer operation; and

- Compared with labor intensive work in collecting dispersed small quantity of domestic SW, ISW collection works are for large quantity concentrated at generation source. Therefore the work shows its features similar to that of transportation work.

ab. Transportation Cost

With the same consideration given to the collection cost estimate, following estimation are made with reference to the costs estimated by the Montenegro new municipal landfill project:

-	transportation and disposal cost	12 US$/ton
-	transportation cost with transfer operation	6 US$/ton
-	disposal cost	6 US$/ton

b. Intermediate Treatment Cost

Costs of intermediate treatment (i.e. tipping fees including profit, insurance cost, etc.) are estimated for the followings:

- Solidification (i.e., cement solidification);
- Neutralization;
- Chemical treatment (i.e.,Chemical oxidation);
- Dehydration;
- Incineration; and
- Waste water treatment.

As for dehydration, dehydration measures for Non-HW and HW are assumed to be "solar evaporation on drying bed after gravity concentration" and "centrifugal dehydration after gravity concentration" respectively.

Cost estimates for intermediate treatment are summarized in the Tables K.3.3a and K.3.3b.

Table K.3.3a Initial Costs and O&M Costs of Intermediate Treatment Facilities

Treatment Method	Initial Cost (US$)		Operation and Maintenance Cost (US$/year)	
Solidification	Equipment etc.	1,276,000		
	Design/Supervision	127,600		
	Land Expenses	127,600		
	Contingency	255,200		
	Total	1,786,400	Total	127,600
Neutralization	Equipment etc.	126,000		
	Design/Supervision	12,600		
	Land Expenses	12,600		
	Contingency	25,200		
	Total	176,400	Total	12,600
Chemical Treatment	Equipment etc.	306,600		
	Design/Supervision	30,660		
	Land Expenses	30,660		
	Contingency	61,320		
	Total	429,240	Total	30,660
Dehydration (NH) On-site	Equipment etc.	4,614,400		
	Design/Supervision	461,440		
	Land Expenses	461,440		
	Contingency	922,880		
	Total	6,460,160	Total	1,775,688
Dehydration (H) On-site	Equipment etc.	4,786,700		
	Design/Supervision	478,670		
	Land Expenses	478,670		
	Contingency	957,340		
	Total	6,701,380	Total	1,401,506
Dehydration (NH) Outside	Equipment etc.	138,000		
	Design/Supervision	13,800		
	Land Expenses	13,800		
	Contingency	27,600		
	Total	193,200	Total	54,480
Dehydration (H) Outside	Equipment etc.	52,640		
	Design/Supervision	5,264		
	Land Expenses	5,264		
	Contingency	10,528		
	Total	73,696	Total	15,312
Incineration	Equipment etc.	12,198,000		
	Design/Supervision	1,219,800		
	Land Expenses	1,219,800		
	Contingency	2,439,600		
	Total	17,077,200	Total	1,219,800
Waste Water Treatment On-site	Equipment etc.	30,204,000		
	Design/Supervision	3,020,400		
	Land Expenses	3,020,400		
	Contingency	6,040,800		
	Total	42,285,600	Total	1,510,200
Waste Water Treatment Outside	Equipment etc.	84,450		
	Design/Supervision	8,445		
	Land Expenses	8,445		
	Contingency	16,890		
	Total	118,230	Total	4,223

Table K.3.3b Summary of Intermediate Treatment Costs Estimated

Treatment Method	Item	Amount	Unit
Solidification	Total Treatment Amount	218,550	ton/15 years
	Capital Cost	2,643,876	US$
	O/M Cost	1,914,000	US$/15/years
	Total Cost	4,557,876	US$/15years
	Unit Cost	20.86	US$/ton
	Profit (10%)	2.09	US$/ton
	Price	22.95	US$/ton
Neutralization	Total Treatment Amount	209,085	ton/15years
	Capital Cost	261,072	US$
	O/M Cos	189,000	US$/15years
	Total Cost	450,072	US$/15years
	Unit Cost	2.15	US$/ton
	Profit (10%)	0.22	US$/ton
	Price	2.37	US$/ton
Chemical Treatment	Total Treatment Amount	360,600	ton/15years
	Capital Cost	635,276	US$
	O/M Cost	459,900	US$/15years
	Total Cost	1,095,176	US$/15years
	Unit Cost	3.04	US$/ton
	Profit (10%)	0.30	US$/ton
	Price	3.34	US$/ton
Dehydration (NH) On-site	Total Treatment Amount	1,109,805	ton/15years
	Capital Cost	9,561,053	US$
	O/M Cost	26,635,320	US$/15years
	Total Cost	36,196,373	US$/15years
	Unit Cost	32.62	US$/ton
	Profit (10%)	3.26	US$/ton
	Price	35.88	US$/ton
Dehydration (H) On-site	Total Treatment Amount	313,770	ton/15years
	Capital Cost	9,918,059	US$
	O/M Cost	21,022,590	US$/15years
	Total Cost	30,940,649	US$/15years
	Unit Cost	98.61	US$/ton
	Profit (10%)	9.86	US$/ton
	Price	108.47	US$/ton
Dehydration (NH) Outside	Total Treatment Amount	34,050	ton/15years
	Capital Cost	285,936	US$
	O/M Cost	817,200	US$/15years
	Total Cost	1,103,136	US$/15years
	Unit Cost	32.40	US$/ton
	Profit (10%)	3.24	US$/ton
	Price	35.64	US$/ton
Dehydration (H) Outside	Total Treatment Amount	3,480	ton/15years
	Capital Cost	109,070	US$
	O/M Cost	229,680	US$/15years
	Total Cost	338,750	US$/15years
	Unit Cost	97.34	US$/ton
	Profit (10%)	9.73	US$/ton
	Price	107.07	US$/ton

Incineration	Total Treatment Amount Capital Cost O/M Cost	317,775 25,274,298 18,297,000	ton/15years US$ US$/15years
	Total Cost	43,571,298	US$/15years
	Unit Cost Profit (10%)	137.11 13.71	US$/ton US$/ton
	Price	150.82	US$/ton
Waste Water Treatment On-site	Total Treatment Amount Capital Cost O/M Cost	91,871,045 62,582,792 22,653,000	ton/15years US$ US$/15years
	Total Cost	85,235,792	US$/15years
	Unit Cost Profit (10%)	0.93 0.09	US$/ton US$/ton
	Price	1.02	US$/ton
Waste Water Treatment Outside	Total Treatment Amount Capital Cost O/M Cost	308,156 174,981 63,345	ton/15years US$ US$/15years
	Total Cost	238,326	US$/15years
	Unit Cost Profit (10%)	0.77 0.08	US$/ton US$/ton
	Price	0.85	US$/ton

c. Final Disposal Cost

Final disposal cost (i.e. tipping fee including profit, insurance cost, etc.) of SCL and CL for ISW are estimated referring to the present tipping fee of municipal landfills in the MR and the fees employed in said landfills in Brazil. The cost for IL are estimated based on the assumption that sporadically existing gravel mining pits are available at reasonably small cost (i.e. almost free of charge).

It is assumed that current tipping fee of municipal SW be 6 US$/ton. It is quoted that the tipping fees of respective landfills are in Brazil:

- SCL for ISW 150 ~ 250 US$/ton;
- CL for ISW 30 ~ 80 US$/ton; and
- Municipal landfill 10 ~ 15 US$/ton.

It gives that Tipping fees of SCL and CL for ISW are approximately "15 to 17 times" and "3 to 5 times" of the tipping fee of a municipal landfill respectively (in Brazil). Based on these ratios, tipping fees of respective landfills in the MR are assumed as shown in the Table K.3.3c.

Table K.3.3c Tipping Fees Assumed for Final Disposal

	Brazil	Ratio	Tipping Fees Assumed for Santiago
SCL for ISW	150~250US$/ton	15~17	90 US$
CL for ISW	30~ 80US$/ton	3~ 5	18 US$
MSW	10~ 15US$/ton	1.0	6 US$

Note: Assumed tipping fees are minimum prices of the estimation.

d. Summary

da. Unit Cost of Intermediate Treatment and Disposal

As a summary of above cost estimation, unit costs (including profits, etc.) estimated for collection, transport, intermediate treatment and final disposal are listed in the Table K.3.3d.

Table K.3.3d Unit Costs Estimated

Item	Unit. Cost (US$/ton)
Collection and Transportation (C & T)	
"Collection" for ISW	6.0 US$/ton
"Collection" for Medical Waste	40.0 US$/ton
"Transportation" for ISW and Medical Waste	6.0 US$/ton
"Collection and Transportation" for ISW	12.0 US$/ton
Intermediate Treatment	
Solidification	23.0 US$/ton
Neutralization	2.4 US$/ton
Chemical Treatment	3.4 US$/ton
Dehydration outside (Non-HW)	35.7 US$/DS-ton
Dehydration on-site (Non-HW)	32.6 US$/DS-ton
Dehydration outside (HW)	107.1 US$/DS-ton
Dehydration on-site (HW)	98.6 US$/DS-ton
Incineration	151.0 US$/ton
Waste Water Treatment outside	0.85 US$/ton
Waste Water Treatment on-site	1.02 US$/ton
Disposal	
SCL for ISW (HW)	90.0 US$/ton
CL for ISW (Non-HW/Non-Inert)	18.0 US$/ton
IL for ISW(Inert)	1.5 US$/ton

Note: DS-ton : Dry solid ton

db. Total Costs

Estimation of ISWM business scale (i.e. total costs) are forecasted by multiplying "amounts estimated of ISW to be collected, transported, treated and disposed in 2010" and "respective unit costs estimated above" and totaled, which are shown in the Tables K.3.3e and K.3.3f for the cases of "on-site dehydration" and "outside dehydration"

respectively.

Table K.3.3e Costs of Collection, Transportation, Intermediate Treatment and Final Disposal for 24 ISW Categories in 2010 (On-site Dehydration)

Unit : US$/year

Type of Waste	Intermediate Treatment		Final Disposal	Collection and Transportation	Total
	Outside	On-site			
C-1	0	0	430,000	103,000	533,000
C-2	243,000	0	1,148,000	305,000	1,696,000
C-3	105,000	1,257,000	3,557,000	2,524,000	7,443,000
C-4	18,000	9,465,000	15,904,000	5,168,000	30,555,000
C-5	5,000	0	18,000	5,000	28,000
C-6	28,000	0	0	70,000	98,000
C-7	5,000	0	0	14,000	19,000
C-8	62,000	0	0	2,000	64,000
C-9	373,000	0	0	15,000	388,000
C-10	139,000	0	484,000	274,000	897,000
C-11	386,000	0	24,000	73,000	483,000
C-12	13,000	0	0	24,000	37,000
C-13	0	0	1,001,000	667,000	1,668,000
C-14	0	0	191,000	1,527,000	1,718,000
C-15	0	0	10,000	83,000	93,000
C-16	0	0	727,000	484,000	1,211,000
C-17	0	0	36,000	285,000	321,000
C-18	0	0	21,000	171,000	192,000
C-19	0	0	103,000	69,000	172,000
C-20	0	0	1,070,000	714,000	1,784,000
C-21	0	0	243,000	162,000	405,000
C-22	0	0	365,000	96,000	461,000
C-23	0	0	30,000	67,000	97,000
C-24	825,000	0	532,000	688,000	2,045,000
Total	2,202,000	10,722,000	25,894,000	13,590,000	52,408,000

Table K.3.3e Costs of Collection, Transportation, Intermediate Treatment and Final Disposal for 24 ISW Categories in 2010 (Outside Dehydration)

Unit : US$/year

Type of Waste	Intermediate Treatment	Final Disposal	Collection and Transportation	Total
C-1	0	430,000	103,000	533,000
C-2	243,000	1,148,000	305,000	1,696,000
C-3	1,001,000	3,557,000	3,273,000	7,831,000
C-4	5,852,000	15,904,000	41,391,000	63,147,000
C-5	5,000	18,000	5,000	28,000
C-6	28,000	0	70,000	98,000
C-7	5,000	0	14,000	19,000
C-8	62,000	0	2,000	64,000
C-9	373,000	0	15,000	388,000
C-10	139,000	484,000	274,000	897,000
C-11	386,000	24,000	73,000	483,000
C-12	13,000	0	24,000	37,000
C-13	0	1,001,000	667,000	1,668,000
C-14	0	191,000	1,527,000	1,718,000
C-15	0	10,000	83,000	93,000
C-16	0	727,000	484,000	1,211,000
C-17	0	36,000	285,000	321,000
C-18	0	21,000	171,000	192,000
C-19	0	103,000	69,000	172,000
C-20	0	1,070,000	714,000	1,784,000
C-21	0	243,000	162,000	405,000
C-22	0	365,000	96,000	461,000
C-23	0	30,000	67,000	97,000
C-24	825,000	532,000	688,000	2,045,000
Total	8,932,000	25,894,000	50,562,000	85,388,000

ANNEX L

EXAMINATION OF AN OPTIMUM INSTITUTIONAL SYSTEM FOR ISWM MASTER PLAN

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ANNEX L EXAMINATION OF AN OPTIMUM INSTITUTIONAL SYSTEM FOR ISWM MASTER PLAN

L.1 Legal System Development

a. Principles of the Legal System

The objectives of the administration of industrial waste, previously presented in this report, result in two basic directives:

i. Waste minimization: minimize the generation of waste (especially hazardous waste) -- be it by not generating it, or by utilizing the waste that is inevitably produced.

ii. Proper waste disposal: dispose of wastes with the minimum environmental impact -- by treating all waste and its effluents before they are thrown out into the environment.

The first directive will result in clean production and competitive products in the modern market. It thus combines private industrial interests with those of the State.

The second directive results in a clean and healthy environment, which is of social interest but not directly a concern of enterpreneurs.

The responsibility (ethical and economical) of the generator for the waste produced is a universal premise.

This premise and the two directives should be the foundation of the legal system which, in turn, will support the actions and the institutional organization that will administer waste.

b. Legislation for Waste Minimization

When it is feasible, and as soon as it is possible, the generator should eliminate or reduce the generation of hazardous waste.

This includes programs of intensive training for operators, improved internal communications and the perfection of practices in the plant. This improvement entails

discipline and cleanliness in all sectors; maintenance and plans for emergencies; monitoring of effluents; environmental audits; frequent checking of instruments, valves and other critical points.

More complex actions will attempt to reduce the generation of pollutants at its origin by means of alterations in the treatment or manufacturing processes, in the design of products, or through the substitution of material or energy inputs, and by the utilization of waste.

The State should identify the difficulties of industries in carrying out these actions and offer them incentives to overcome critical difficulties. Tax legislation and long-term subsidizing (10 years for example) should make a quick development feasible in that sense. A cooperative program will be established which stresses the urgency of reducing highly toxic waste generation.

Financing should be aimed at medium and small enterprises, which have greater difficulty in obtaining clean technologies and less financial capacity -- but applicants should display high managerial capability and ability to repay the loan. In this way, financial packages, so long as they are small to begin with, will be made compatible with potential clients. Large companies and multinationals have greater ease in acquiring technology and resources. In addition, the international demands of the ISO-9000 and ISO-14000 pressures incites them, by deeming the concept of care for the environment a "marketing factor" and a "price factor".

Chile should pay close attention to norms ISO-9000 and ISO-14000, the first of which is already in full effect, and the other which is expected to be introduced in 1996, where industrial waste constitutes a very determining reference in the evaluation of environmental protection. As a country that exports primary products, such as mining products, fish and fruits, Chile could suffer from the rigorous "environmentally friendly" requirements from the North American, European and Asian markets, including penalties such as violent price devaluation of products which do not conform with their standards. Producers will need certifications of conformity with those norms and the Government should display, beforehand, its "environmentally sustainable" industrial policy.

The proposals to be financed by the program here recommended should focus on minimization, and not the disposal of waste generated today. Investigations and experiments shall not be financed, but rather the contribution of new, tried and tested technologies that can be transferred to industries in the MR will be supported, as a way to expand the financing benefits.

The regulation will establish goals with deadlines to be met by the generators of waste, as well as a penal system.

The State will handle available international conventions to transfer technology, technical information, as well as to train specialized personnel. In this regard, universities and professional associations significantly participate.

The data that is already available on hazardous waste and its generators in the MRS allow the State to choose the waste to be minimized as a priority, considering the points that are listed below, in addition to the extension of the concept of minimization to include recycling or the economic reutilization of waste by third parties:

- the distribution of waste generation in the MR;
- the quantities generated in the MR;
- the availability of technology and alternative materials that do not generate the waste in focus;
- the availability of establishments that are qualified, or that can be made to be qualified, to process/utilize the considered wastes;
- business interests in the processing of the considered waste;
- the effects of these wastes on the environment and on health;
- the financial investments involved.

For example, the economical processing of waste oils and solvents can be mentioned, which should become mandatory, due to strong environmental and economic interests in making it. However, this should not take place at the generating plants themselves, but carried out instead by specialized industries. The technical and economical feasibility of these industries, as well as the demand for "clean" processes to be used, become obligatory issues inside a program of minimization not limited to actions inside the generating establishment.

This focus will help to solve the problem of the waste produced by micro-generators such as dry cleaners, gas stations, various garages scattered all over the city, which should give their waste to specialized third parties.

The minimization of waste, with such conceptual magnitude, needs participation of Ministries for industrial and economic affairs, and legal coverage of the highest level (Law or Supreme Decree) establishing:

- concepts;
- obligations of the generators and penalties (levels) that could be applied;
- directives for the Minimization Program, incentives and funds;

- entities involved and their authorization, control, technical and executive powers;
- transfer of waste and shared responsibility; information to the competent authority.

The operational details will be set by the competent entities: to detail the Program, fixing its goals and procedures, evaluate proposals, manage financial funds, and transfer technologies, expanding the results.

c. Legislation for Proper Waste Disposal

ca. Principal Exposition

The fate of Industrial waste may be burial (landfilling) or it can be treated by means of superficial soil biodegradation. In both cases, the risk of ground contamination must be minimized -- which means the contamination of the soil and of its underground and surface waters.

Industrial waste can be processed thermally, be it by incineration or pyrolysis, which emits the products of oxidation and of thermal decomposition. To minimize air pollution these products must be treated, before their emission. The residues of this treatment, in addition to the ashes and slag, contains toxic waste.

The treatment and destination of waste can be executed within the generator's property, or in another place by a specialized company -- usually the more convenient option.

During all the time that waste is awaiting treatment or disposal, it must be adequately conditioned and stored.

The legislation and its regulation shall fix the responsibilities, obligations and penalties for transgression, and will define the competent entities to administer the disposal and storage of waste, to establish the respective technical norms, as well as to fix acceptable parameters and limits for discharge into the ground, water and air.

Note:
In the sections that follow, the term "Legislation" will be used to describe "legal act", which could be a Law as such or a Supreme Decree -- in accordance with the country's already existing legal coverage.

cb. Concepts to be Fixed in Legislation

cba. Responsibilities of Relevant Sectors

The responsibility of the generator of the waste is maintained until the waste is completely inert (chemically), but the responsibility remains for any effluents, products or by-products of the decharacterization/transformation process or the disposal of the waste.

In the meantime, this responsibility can be shared or transferred to the agent legally and economically entitled to process and/or dispose of the waste. The Legislation should fix the circumstances and limits.

The proprietor of the site where waste is generated or where disposal, treatment or processing of waste takes place, is responsible for the salubrity of the air, soil, and its underground and surface waters, in addition to being responsible for any contamination originating from that site. The Legislation should settle the obligation of monitoring the immediate environmental of he site and the threshold concentrations of admissible contaminating substances in terms of the property. When the threshold value is exceeded, the owner should immediately interrupt the contaminating flow, decontaminate external areas and also the premise. They must also correct the causes of the contamination and revise the design of the previously constructed protections.

Please note that the legal procedure that was just recommended establishes the sole environmental responsibility of the owner for their business, respective studies and designs. The dimensions of the site, the distancing from urban settlements for environmental protection, the quality of the soil, etc. become their greatest preoccupations, as precaution against the immense future costs that will have to be covered by the proprietor. In any case, technical norms and legal restrictions for the use of the soil will help the proprietor select a site and reduce the risks of their activity.

Even though it is a universal orientation that the owner is responsible for keeping their property and surrounding area that could be affected sanitary, it is hard to find clear and complete legal models from other countries with regard to the extension and the persistence in time of that responsibility. The difficulty in keeping the responsibility effective has led numerous States to hold the property of a plant that is to manage hazardous solid waste in their name or establish extremely strict demands and technical norms, aiming to minimize risks but without providing resources to guarantee the responsibility of the owner or of the person in charge of disposal.

Finally, another common way of avoiding the problem is regulating it in very general

terms establishing "obligations" instead of "legal responsibilities", leaving eventual problems for future discussion.

The text proposes that the Authority be guided, regarding the need to settle responsibilities -- even if they are defined in future and only obligations are established for now. Rational means to provide resources for eventual environmental damage caused by hazardous solid waste are proposed.

In any case, private responsibility will not be unlimited, and the State should take precautions in this regard, a point which is also considered in this text.

cbb. Final Disposal

The Legislation will establish the restrictions for the use of the ground for processing/treatment/disposal activities for hazardous waste (which should be not stronger than those established for the chemical industry of high polluting potential). It will determine impediments for landfills for geologic, hydrologic and seismic causes, and restrictions, for the same causes, to processing, treatment and storage plants.

The Regulation will define the waste that is not admissible in a landfill, based on its chemical, biological and liquid content. What will not be accepted is, for example: liquids or semi-fluids (liquid content superior to 70% in mass), solvents or solvent content exceeding 0.1% in solids, oils or oil content exceeding 5% in solids, halogenated organics or content superior to 0.1% in solids, PCBs or contents over 50ppm, any waste classified as reactive, corrosive, or acutely toxic; likewise, organic wastes will not be admitted in a landfill designed for inorganics. Not disposing of organic toxic waste in a landfill will be recommended.

The Regulation will establish the obligation of covering a landfill for industrial waste and maintaining the covering in optimal drainage conditions not only after each cell is completed, but also during the landfilling operation. Mobile roofs and membranes should be considered.

The requirement of inferior barriers made with clay and/or with waterproof materials (natural or synthetic) must be brought together with the demands of drainage and treatment of liquid and gaseous effluents, with covering and monitoring. But innovative engineering solutions in view of the inherent conditions should not be dismissed -- when and if in the Legislation, as well as in their understanding the full future environmental responsibility of the owner is established, a responsibility which is not shared with the government entity, even though it grants the permits. The Legislation should also be clear in that demands are not rigid, but that they evolve with

time, according to events, new products and new knowledge. From these, new demands can arise in the future, including for projects that have already been approved and initiated.

Clayey soil can hinder or stop the progress of contamination. When a design is developed considering this potential fact, it is necessary that it be accompanied by a study that includes a demonstration and calculation of the treatment on the ground (attenuation) for the waste that will be disposed. The Regulation will define the need, while technical norms will establish criteria and evaluation methods.

The Regulation will define the protection and drainage of the ground under a layer of activated soil for the biodegradation of organic waste, detailing in technical norms the protection, operation and monitoring criteria.

In the MR, the burial of hazardous waste deep underground are not considered feasible, and neither is storing or disposal into salt mines (non-existent).

cbc. Processing

Thermal processing is applied with priority for organic toxic substances and, eventually, to organic ones that decompose thermally into non-hazardous final components. The main objective can be the destruction of the toxic residue or its economic utilization. In this last case, "co-processing" in existing industrial thermic equipment would be allowed, that is, the use of the waste as auxiliary fuel.

For either hypotheses, the Regulation will define the conditions of the process, and the parameters and limits of emission, established in relation to the composition of the waste to be processed. It will define which wastes have priority, are admissible, will eventually be admissible, and those that will not be admitted. As a result, it will determine the need to treat gases that are generated in the thermal and treatment process and the appropriate disposal of liquid, semi-fluid and solid waste resulting from the treatments and the process itself. It will also define the need to provide an automatic shutdown equipment, that is, devices that obstruct the entry of waste at the beginning of the process when sensors indicate a leakage or an effluent of inadmissible quality. The adaptation of already existing industrial equipment (for example furnaces, or cement or asphalt kilns) that have as objective the burning or co-processing of waste, should deserve special attention in the Legislation.

Technical requirements, limits and test procedures to verify the efficiency of the thermal processor and of its treatment, control and monitoring units, shall all be established in technical norms.

It is clear that for technical and economic reasons, and also because of location, it is not convenient that industries treat and dispose of their waste themselves (with rare exceptions). Furthermore, it is probably inconvenient for them to invest money and attention to an activity that is not their business objective. It would be more effective to pay a specialized company for the service, and to incorporate the costs into their products. In addition, when knowing these costs, to try to minimize waste in order to stay competitive on the market.

cbd. Industrial Waste Centers

At the same time, public controlling entities could concentrate their activity, with high productivity and at low cost, in fewer places that, are called "Industrial Waste Storage, Processing, Treatment and Disposal Centers" or simply, "Industrial Waste Centers - IWC".

If the State realizes the advantages of IWCs above "individual solutions", it should distinguish and facilitate such entrepreneurial activities, while establishing the necessary and strict rules for their existence and operation. The IWCs will only be feasible when the State establishes and demands the fulfillment of the legislation that is here proposed, or its equivalent.

cbe. Treatment of Industrial Liquid Wastes

The treatment of liquid effluents generates sludge, which is usually hazardous, in larger quantities than the waste from the industrial process. For this reason, it is important to orientate the industries so that their effluent treatment projects include the drying out of the sludge as well as an appropriate destination for it. This should be monitored through an assessment of the plant design and construction before awarding the necessary permits.

Upon consideration of the following two facts;

i. The Ministry of Public Works (MOP) / Superintendencia de Servicios Sanitarios (SISS) is presently the Competent Authority to set requirements and assess the projects (under Regulation N°351 of 26-11-1993 from Law N°3133, which establishes the requirement for effluent treatment), but it has no legal power to apply penalties but to appoint the infraction to the Service of Health, or to initiate a legal process for justice ;

ii. The procedures to be fulfilled by an industry before obtaining approval for its project are very complex (it is required to apply for the permit via the

provincial governor and the approval and authorization for the project must be established by Ministerial Decree after a positive evaluation by the SSS/MOP, and the approval of the Service of Health to the final disposal of sludge);

- It is easy to presume that will be very slow the speed to supply needs of effluent treatment plants in Chile.

- It is recommended a review of the regulation through an agreement between MOP, MS and CONAMA as a typical multi-ministrial question. And it is necessary have in mind the big amount of sludge that will result (as ISW) from the effluent treatment.

d. Maximum Amplitude Legislation

Note:
In the items that follow, the term "Legislation" will be used with the meaning of "legal act", which could be a Law as such or a Supreme Decree -- in accordance with the country's already existing legal coverage.

da. Under the Principle of the Waste Generator's Responsibility

The legislation will establish the obligation, under set penalties, of the provider (manufacturer or importer and, jointly, the retailer) to receive and provide adequate disposal to all packages of agricultural and domestic toxic products at no additional cost for the purchaser. This applies particularly to: biocides (herbicides, insecticides, fungicides and others); batteries with Hg, Cd and/or Ni; lamps and appliances with Hg.

The Regulation will establish, under set penalties, the obligation and time period for chemical and petroleum industries, as well as others to be chosen by the Competent Authority in accordance with its priorities, of presenting:

- the Declaration of Generated Industrial Waste, pointing out the hazardous waste with its chemical contents and respective lixiviation tests;
- Minimization/Processing or Treatment/Disposal or Storage Plan for hazardous waste;
- the Schedule of Development of the Plan, with reference to the decision by the Company's Top Administration of approving it and the pertaining costs.

The Regulation will define the preference for collective (central) systems for treatment and disposal of industrial waste, as well as the acceptability of a central storage for wastes -- so long as these are destined to a unit of the central system that is already approved, alongside the schedule of its implantation, by the competent authority. This very complex matter will be complemented by executive level norms.

The Legislation will define the concepts of "generator" (which may include all waste transfers to processors), "transporter", and "receiver", "owner of a site that receives waste", and "operator". It will define their responsibilities before the environment and public health, and the circumstances when those responsibilities will be shared. This chapter will be very dependant on the judicial precepts on "Civil Responsibility - CR".

To make the above mentioned responsibilities feasible, we recommend:

- stimulate the offer, in the market, of civil responsibility insurance for "gradual contamination" in addition to the usual "sudden contamination", applicable to environmental damage;
- create a Provisional Fund for Remediation of Contaminated Soil -- whose constitution and application would have the North American "Superfund" and other similar initiatives as references, but whose resources should be generated by a mandatory surcharge price of ISW soil disposal; and whose application should be only to remediate contributors' sites.

The Legislation will settle the obligation of each Comuna in selecting and preserving, in its Urban Development Plan, a minimum of one sites (with an area no smaller than 50 hectares) for the disposal (preceded by treatment and/or processing) of hazardous industrial waste. The selection of the site should be accompanied by the necessary Environmental Impact Assessment and respective Environmental Impact Declaration, where the minimal mitigation measures will be presented, and which should be approved by the competent authority. The Comunas that do not possess a feasible site for such an activity will be allowed to present a Contract with another Comuna, duly approved by their Municipal Councils, which agrees to receive the waste of the former, under the conditions established in the Contract. In this way, the problem of the location of Industrial Waste Centers will be solved, under the principle: "generator holds responsibility", applied to the generating/benefitting community of industrial activity.

The Legislation will establish a program (long term) to identify sites utilized for disposing industrial waste, their respective users and also to evaluate the extension and intensity of their likely contamination. In order to remedy these sites, priorities including these users and related Comunas should be established in later stage.

db. For Environmental Protection and National Development

The Legislation shall determine the competent entities that are to examine the critical points with regard to accidents with hazardous products in highways (by frequency of accidents and by environmental vulnerability), and will foresee the concession of incentives for insurance companies and private entrepreneurs to install emergency attention and communication bases in the highways more heavily affected by the flow of hazardous products.

The Regulation will ratify the need for EIAs and respective EIDs for all the plants destined for the management of hazardous industrial waste, and will determine the competent entity that will offer to those interested the minimum contents of the study for every kind of industrial venture.

The Regulation will fix the obligations of monitoring, controlling and inspecting the generators and plants that handle hazardous industrial waste. It will also indicate the public competent entities.

The Legislation will establish the integral responsibility of the owner of a sanitary landfill for the entry of hazardous industrial waste, and will determine the competent authority to institute instruments and methodologies to identify and penalize all undue entrance.

The Legislation will incite private activities in Universities, Research Institutes, Technical Information Centers, and laboratories, aiming to:

- minimize hazardous industrial waste;
- transfer technologies for the MR;
- adapt industrial plants for processing hazardous industrial waste.

Referring to the considerations on treatment of industrial liquid effluents, it is recommended a review of the regulation through an agreement between MOP, MS and CONAMA as a typical multi-ministerial issue :

- by simplifying and lowering the hierarchical level required for project approval;
- by defining one single Competent Authority for project assessment and evaluation, as well as for applying penalties through an administrative rather than legal process ;
- by defining the procedures for project approval and for resources ;
- by withdrawing the requirement for public participation and for EIA/EID

since the purpose is to reduce the environmental impact according to previously established technical standards ; and

- by requiring that the projects comply with its technical standards, so they can be accepted for the assessment procedure and so they can be approved.

e. Characteristics of the Legal and Technical Normative Acts

The legal act must impose obligations, time periods and penalties, and must also define the competent authority to carry them out. It must link itself with previously dictated acts, but must expressly revoke those that are in conflict.

The legal act has the maximum amplitude of the authority that promulgates it. At the regional level, it should be promulgated by the regional authority and, at the national level, by the national authority, bearing in mind the "specificity" or "diversity" of the matter to be regulated (that is, the object of the legal act). This means for example, that the subject matter of constitutional competency (or by political-administrative structure) of the Ministry of Health will be regulated by the legal act, be it at national or regional level, and that the issues of multi-ministerial competency should be regulated by the legal act of each Ministry, in what pertains to the competencies that are granted by the greater act.

The acts of the higher authorities are more generic and more concise than the inferior ones, which aim for executive details, in order to be sufficiently practical.

The technical-normative acts (norms, instructions, standards) must be authorized by a legal act, or must be approved by the legally competent authority. The systematization and the writing of these acts is different from that of legal acts because they are aimed towards different professionals, who need data of a technical character to execute their activities.

The legal and technical-normative acts are essential instruments in the management of the issues that they pertain to, that is why they have to be feasible and, in this way, attend to the present and near-future reality. The dates of edition and of applicability of an act, as well as the periods it determines should thus be sensibly defined.

f. Hierarchy of the Recommended Regulation

fa. Legal Acts of Multi-Ministerial Characteristics

Note:
The multi-ministerial or supra-ministerial promulgation of the following acts will make uniform concepts and criteria, and will elevate to a rightful level the debates, decisions and definitions of competency regarding topics of multi-ministerial interest.

i. LA-MC-1 (Legal Acts of Multi-Ministerial Characteristics 1): Institution (already existing) of Environmental Impact Assessments (EIA) and consequent Environmental Impact Declarations (EID).

ii. LA-MC-2: Definition of concepts, responsibilities and basic obligations, which have as objects:
   - concepts:
     generator - receiver - transporter - operator - owner (of a site or plant) - provider (manufacturer, importer, retailer) - industrial solid waste (ISW) - hazardous waste (HW).
   - responsibilities:
     generator - receiver - transporter - operator - provider- owner - Comuna; shared responsibility - joint liability - transfer of responsibility.
   - general obligations:
     of the responsible agents (above mentioned) in front of the Competent Authority (CA) and of it in front of them; obligation of the CA to establish and publish legal and technical-normative acts for the information of the responsible agents.

iii. LA-MC-3: Definition of the integral responsibility of the owner of a sanitary landfill for the consequences of receiving any HW; definition of the CA, which should determine the instruments and methodologies to identify and penalize any illegal receptions.

iv. LA-MC-4: Establishment of a program for the minimization of hazardous industrial waste (with obligations for all industries) and of a fund to incentivate clean production (destined towards small and medium enterprises). This act will establish the basic criteria for the concession of loans, and will define the financial agent and the technical agent that will evaluate the proposals, monitor the execution of approved plans, evaluate the results and stimulate the transference of developed technology.

The technical agent of the fund will also be the manager of the program, and will be in charge of detailing it and of involving private enterprises, laboratories, universities, centers of technical information and other institutions in its administration.

v. LA-MC-5: Imposition, under threat of penalties, of the production and sale of only lubricants and solvents that can be processed for re-use, and imposition for reclaiming oils and solvents under requisites that will be established and monitored by the CA.

vi. LA-MC-6: Imposition, under threat of penalties, of the secure storage of electric machines containing dielectric with PCBs (polychlorinated biphenyls), as well as products and liquid or solid wastes containing or contaminated with PCBs, until they are taken away for adequate disposal, in Chile or abroad. The act will determine that those machines remain in use for all of their serviceable lives, prohibiting that they be re-supplied with that or another dielectric unless it had been completely decontaminated. It will also define the CA that will regulate the issue and oversee its fulfilment.

vii. LA-MC-7: Imposition of impediments and restrictions for the use of land for storing, processing, treating, or disposing activities for HW. Definition of the CA to promulgate complementary and technical-normative acts.

viii. LA-MC-8: Institution of civil responsibility insurances against environmental damages for gradual or sudden causes, and definition of the executive and advising authorities.

ix. LA-MC-9: Resolution to study the ways to provide highways that are heavily impacted by the traffic of hazardous products with emergency attention bases.

x. LA-MC-10: Definition of the concept of Industrial Waste Centers and of the levels of joint liability, shared and transferred responsibility towards them from the generator. Requirement of EIAs/EIDs for their approval, anticipating all units to be implemented, and requirement that individual permits be granted with the approval of the design of each unit. Resolution that an IWC is granted preference and eventual privilege of the region and of the Comunas, considering its positive industrial and environmental characteristics. Definition of the CA to evaluate projects and grant permits.

Requirement that the prices of the IWC services include a part to be collected into Soil Remediation Provisional Fund, to guarantee the responsibility of the owner of the soil disposal site.

xi. LA-MC-11: Imposition that each Comuna be compelled to choose and reserve, in its Urban Development Plan, one or more sites for the disposal of HW, but enabling them to associate with other Comunas for the use of a same site, outside their territory. Assignation of the CA to advise the election of sites and coordinate associations among Comunas.

xii. LA-MC-12: Imposition, under threat of penalties, that the provider receive from the consumer without new cost, all packages of agricultural and home toxic products, and take them to an appropriate destination. The CA is to be defined.

xiii. LA-MC-13: Definition of CA to inspect and penalize, to evaluate projects and to establish the necessary technical norms for the following items, concerning to industrial liquid effluents treatment projects :

- submittance of the project to the assessment procedure ;
- content of the project, including data regarding sludge ; and
- characterization parameters for effluents, treated waster and sludge, as well as the standards for discharging water into public collection systems and into natural water flows.

xiv. LA-MC-14: Establishment of the competence of the CA to manage, regulate and evaluate projects of activities referring to ISWM and to industrial effluent treatment plants, in the MR (already exist).

fb. Legal Acts of the Competent Authority

General Procedure:
Once the judicial bases and the CA are defined, by consensus or by superior decision, it will be the CA's duty to detail the legal acts at an executive level.

Previously mentioned LA-MC-2, -3, -4, -5, -6, -7,-9, -10, -11, -12, -13, and -14 will be detailed at Resolution level and so will the following:

i. LA-CA-1 (Legal Acts of the Competent Authority 1): Regulation for the disposal of industrial waste on the ground, be it in a landfill or for biodegradation in a layer of activated ground soil.

ii. LA-CA-2: Regulation of the thermal process of incineration or pyrolysis, be it with the sole intention to destroy, or the intention to energetically use the waste. The adaptation of existing industrial units to obtain permits to process waste will also be regulated. Penalties shall be specified.

iii. LA-CA-3: Regulation of central storage, which will be allowed when it is associated to a IWC with approved terrain and design, as well as the physical-financial time schedule of its construction. Penalties.

iv. LA-CA-4: Regulation of storage, processing, treatment and disposal activities for industrial waste, that take place inside or outside the generating establishment. Definition of the responsibilities and demands of the CA regarding monitoring and information for control, under threat of penalties.

v. LA-CA-5: Regulations to identify sites that have received industrial waste and those responsible, in order to evaluate environmental effects and to define priorities for decontamination.

vi. LA-CA-6: Imposition, under threat of penalties, that industries with over 500 employees and all chemical and petroleum industries compulsorily and within a given time limit present:
- Declaration of industrial waste they generate, characterizing the HW with its chemical content and leaching tests;
- Plan of Minimization and Processing of the HW they generate;
- Time schedule of the Development of the Plan, approved by the Top Administration of the enterprise.

vii LA-CA-7: Reorganization of SESMA/PROCEFF/PROGRESI to manage, regulate and evaluate projects of activities referring to ISW and industrial effluent treatment plants, in the MR.

fc. Technical-Normative Acts of the Competent Authority

Note:
These constitute the most dynamic, mutable and executive part of the series of acts, comprising norms and technical instructions, methods and standards.

They must be supported by a legal act or be approved specifically by the CA.

The need for technical-normative acts that complement legal acts presented in previous sections is evident, also for LA-MC-1, -4, -6, -7 and -10, and LA-CA-1, -2, -3, -6 and -13, and the following:

i. TA-CA-1 (Technical-Normative Acts of the Competent Authority 1): Instruction for monitoring and environmental audits in potentially polluting plants.

ii. TA-CA-2: Instructions for the checking of valves, instruments, tanks and other industrial devices that are frequent causes of soil contamination.

iii. TA-CA-3: Instructions for the training of operators with the objective of minimizing the loses and wastes in the operations and in the internal transportation to the factory.

iv. TA-CA-4: Procedures for the classification of ISW.

fd. Suggested Distribution of Competencies

The distribution is visualized in the diagram below (Figure L.1a), in which only one gray area of double competence, stands out.

This duplicity (overlapping) results from the fact that the technical norms are normally, national scopes in Chile. For this reason, they are established directly by the Ministry of Health, drafted by their Environmental Program Department. However, the Health Ministry can establish them with regional restriction.

On the other hand, SESMA possesses competence to establish resolutions about certain local matters and the corresponding technical instructions.

The Diagram (Figure 8.1.1a) should be interpreted:

- National prerequisites and guidelines give rise to the legal base, which be established through pluri-ministerial consensus or by a decision of the MS (superior competent authority);
- The legal base is materialized in Laws, Supreme Decrees and Resolutions;
- In order to be easily understood and become sufficiently operative, resolutions tend to be detailed in technical norms and technical instructions;
- Technical norms are instituted by resolutions of the MS with national or

local level;

- Technical instructions clarify the terms of resolution, making them sufficiently operative for the local needs, meanwhile technical procedures for the same purposes are no published; and
- Technical instructions are instituted by resolutions or administrative acts of the executive regional competent authority (SESMA).

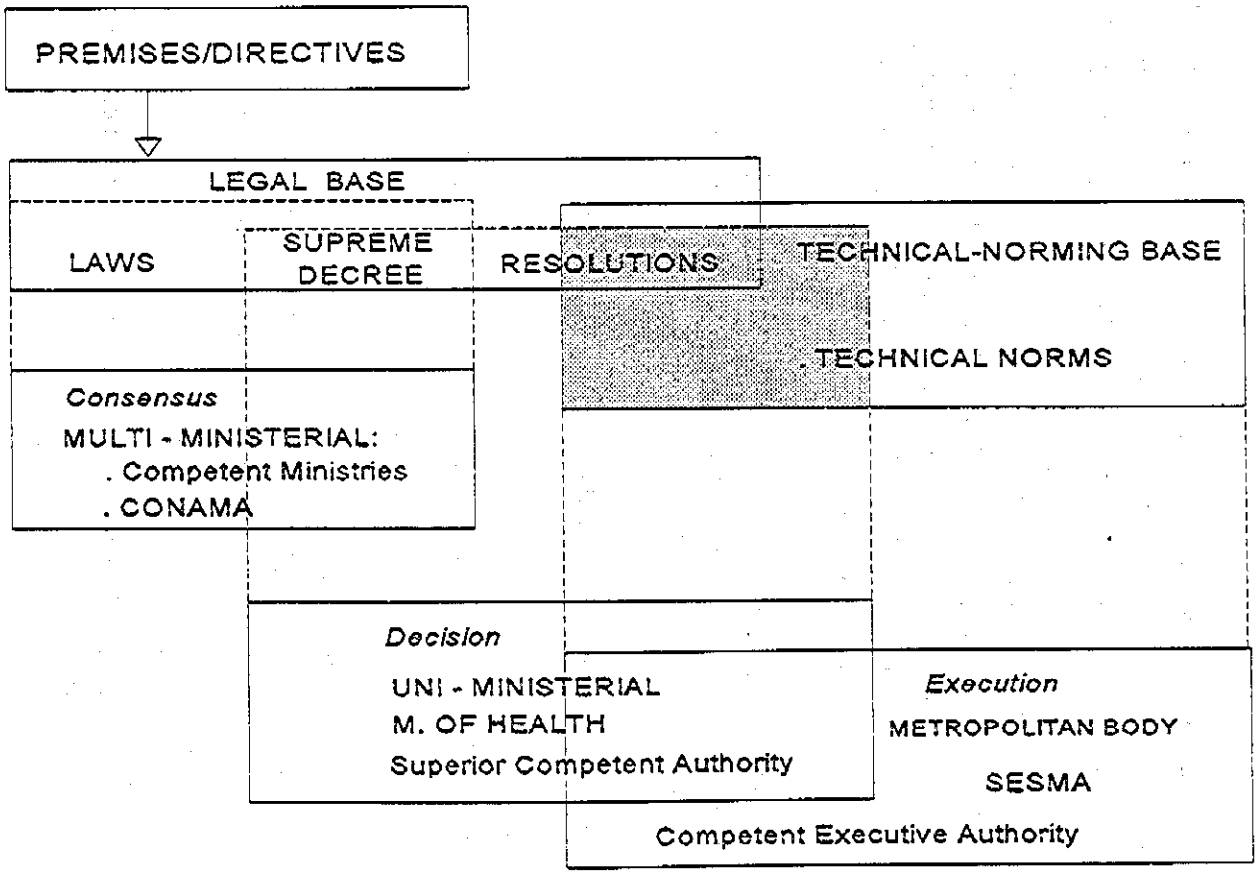

Figure L.1a Distribution of Competences

L.2 Institutional and Organizational Development

a. Institutional Development

The "Competent Authority", repeatedly cited in the preceding section, is the specific technical entity of the Government, sometimes executive but always attentive to edict regulations and propose those of multiple competence that affect its objective.

It is advised that only one and permanent CA be instituted for the issues that affect industrial waste, except if the main objective of the issue is not industrial waste -- hypothesis where the joint-operation of the CA should be expected for ISWM.

As long as the CA has national amplitude, for the MR it will delegate its executive and technical-normative competence to a regional entity. This will allow for quick and realistic actions, because of the closeness with the problems and their agents. Legal acts, in the meantime, should remain at a national level, so they maintain their maximum authority and uniformity.

The delegation here proposed will be carried out in usual administrative terms, within a Ministry or Secretariat, as well as by functional delegation of authority (or competence), from one to another Ministry, or Secretariat, or Public Entity.

Under these main considerations, the following would be fixed:

CONAMA:
The normative national entity, that shall establish or coordinate the legal acts of multi-ministerial character;

MINISTRY OF HEALTH:
The normative national entity, that will establish the legal acts concerning issues of its exclusive competence, and propose acts of multi-ministerial character to CONAMA;

SESMA:
The executive metropolitan entity, that will also establish technical-normative acts pertaining to the MR;

COREMA:
The qualified entity that congregates the high regional authorities to approve/reject EIAs/EIDs, operating in close collaboration with CONAMA and attending the civil society of the MR, which participates in its Consulting Council.

This proposal is easily justified because CONAMA is the entity created in the General Secretariat of the Presidency to coordinate the national policy for the environment, involving the entire National Government, which presupposes the proposition of multi-ministerial legal acts.

In the MR, CONAMA seems sufficiently structured to elaborate and submit proposals to the Executive Board, in addition to fulfilling its regional functions and coordinating international cooperation programs.

Furthermore, the Ministry of Health possesses the widest range of legal competence by the Sanitary Code, which grants it with very strong powers to penalize, and even interdict, infracting establishments. Its Department of Environmental Programs is normative on a national scale, and the Metropolitan Environmental Health Service - SESMA, is its executive in the MR, with a relevant performance in the control of industrial solid waste, of emissions and effluents. With referring to the control of the discharge, this also overlaps in the area of the Sanitary Services of Superintendence (SISS), in accordance with the Law N°3.133/16 and the regulation D.S. MOP N°351/92.

b. Organizational Development

Note: only the executive organization will be considered, that is, SESMA.

ba. The Metropolitan Environmental Health Service - SESMA - Current

Ordinarily, administrative structures tend to be rigid, compartmentalized, with fixed personnel. SESMA, on the contrary, is structured in an innovative way with a Technical Department organized into Programs created to fulfill pre-established objectives, and with two support departments: Administrative and Legal, and the Auditing department.

An organization structured on the basis of "objectives to be attained" minimizes bureaucracy, enables inter-relations among technicians and brings them closer to the directors. It is very flexible, able to divide, reduce or eliminate a Program, consistent with temporal priorities and needs. This "transitory character" can weaken, however, an executive entity of unlimited duration that is to manage a matter that is very sensitive to pressures and controversies. Such is the case of the management of industrial waste, which is currently a PROCEFF (Program of Control of Fixed Source Emissions) sub-program and found in other scattered programs. The antidote for this weakness will be its integration and elevation to Industrial Waste Program level.

At a later stage, the SESMA Technical Department should become two departments with homogeneous attributes. The current intention is to identify one department for biologic matters -- such as zoonosis, food control, sanitary education -- and another for engineering matters -- such as basic sanitation, industrial waste and emissions, environmental monitoring, etc.

The current administrative structure of SESMA is presented below (Figure 4.3.2a).

bb. Structural Alterations of SESMA - Proposal

bba. Evolution

SESMA will be the administrative body through PROCEFF (Fixed Emission Sources Program), which will have to evolve towards PROGRESI (Industrial Residues Management Program). This involves and evolution from the concept of "Fixed Emission Sources Control" (which today includes air emissions and ISW) towards the concept of "Integrated Management of Industrial Residues" (which will include air emissions, liquid effluents, solid waste and the minimization of all of them as they are inter-dependent).

Initially (1996), PROCEFF will formally establish the ISW Sub-Program (which today exists informally) and will intensify the training of its personnel, mainly for providing guidance during the preparation of the technical and legal norms proposed in this Master Plan.

In the year 1997, PROGRESI will be constituted with its four integrated sub-programs as well as Logistical Support and a Legal Advisory Staff, all under the Program Chief Office. The Logistical Support will include a register for each industry and, progressively, data on all wastes generated by each industry as well as its efforts towards minimization. Each sub-program will manage its own objectives, but will have direct access to all registered data in order to better assess the environmental status of the industry.

In the near future, inspections to the industry which will involve all environmental aspects at once may be carried out.

Full establishment of PROGRESI is expected before the year 2010.

bbb. Sub-programs

The PROGRESI (Industrial Residues Management Program) integrates four sub-

programs comprising all kinds of residues generated in an industry, and the measures to minimize these residues, as follows:

i Air Emission Sub-program for :

- permits
- inspections
- audits

ii. Slid Waste Sub-program comprising:

- origin-destination control of waste;
- technical instruction for waste management;
- permits and enforcement;
- dangerous goods transportation control; and
- soil monitoring.

iii. Liquid Effluents Sub-program, for :

- permits and enforcement; and
- effluent monitoring by self-control

iv. Waste Minimization Sub-program, comprising :

- technical information
- training
- project and technology

The first sub-program will continue to exercise the technical functions of PROCEFF, except one ISW.

The speed sub-program will control (qualitatively and quantitatively) the generated waste, its transportation and destination, as well the receiving establishments (that process, treat or dispose of waste), which will inspect and grant permit to.
It will establish and publish the technical normative acts about waste, their management and disposal.

It will also be in charge of controlling the transportation of hazardous waste and dangerous goods (cooperating with Ministry of Transportation's control). As well of establishing and evaluating soil/groundwater monitoring programs for sites subject to contamination by waste or industrial activities, making the pertinent demands.

The third sub-program aims to analyze and evaluate projects of industrial waste water treatment, concluding on its approved amount, as well as to inspect industries over their effluent treatment plan.

It will also establishes and evaluate the results of self-control program for monitoring drainage or treated effluents.

The forth sub-program will provide technical information about substances, their toxicology, restriction in the environment etc., to professionals and companies, at very low prince.

It will also provide courses and seminars for the formation and training of professionals in the management, use and prevention of waste.

For both activities, institutions of education and research will be mobilized, in addition to international information centers.

Through this sub-program, SESMA will work in cooperation with industrial, economical, financial public and private organizations that will be involved in programs of water minimizations, and will participate of the evaluation of projects and proposals for loans aiming to that purpose.

The logistic support will maintain and improve a database to collect or access information of technical and juridical matters, that should be of great value to prepare and develop regulations and norms, not only to satisfy the authorities' management needs.

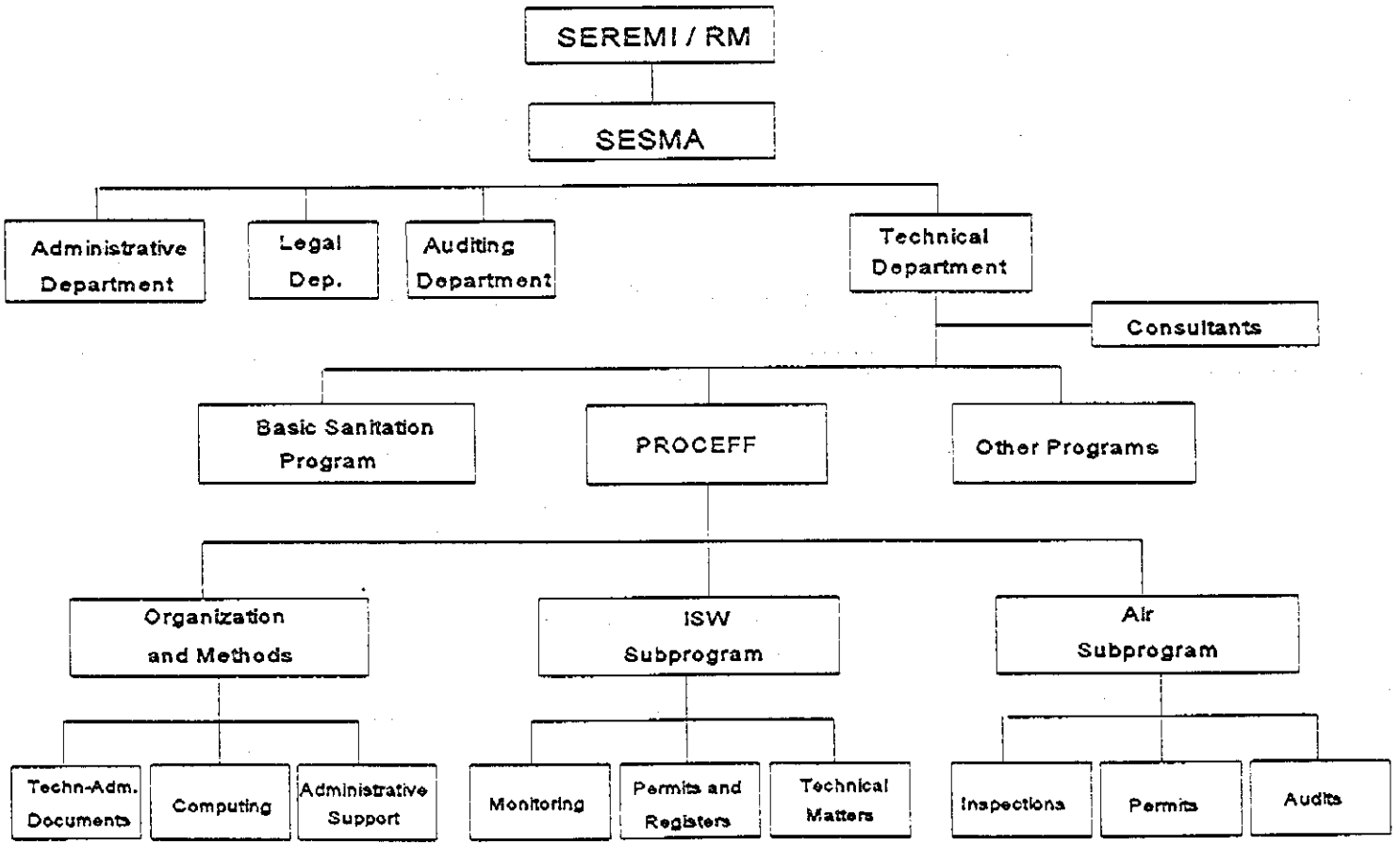

Figure L.2a Present Organizational Chart of SESMA

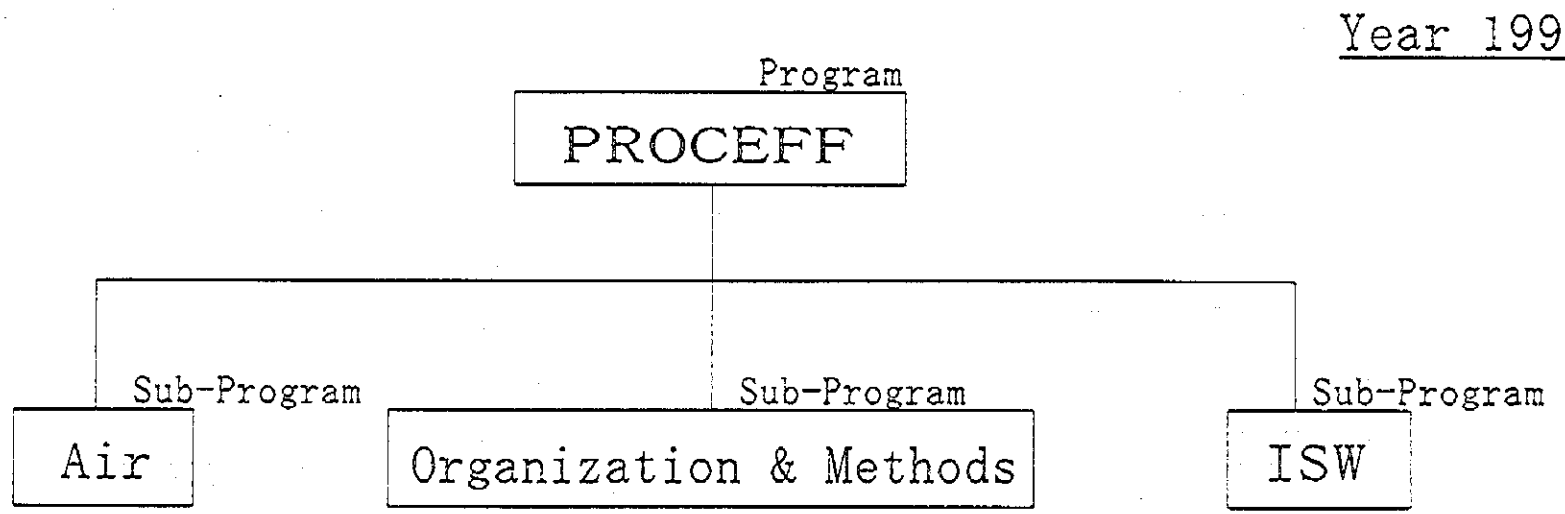

Figure L.2b Proposed Organizational Chart of PROCEFF

Year 1997

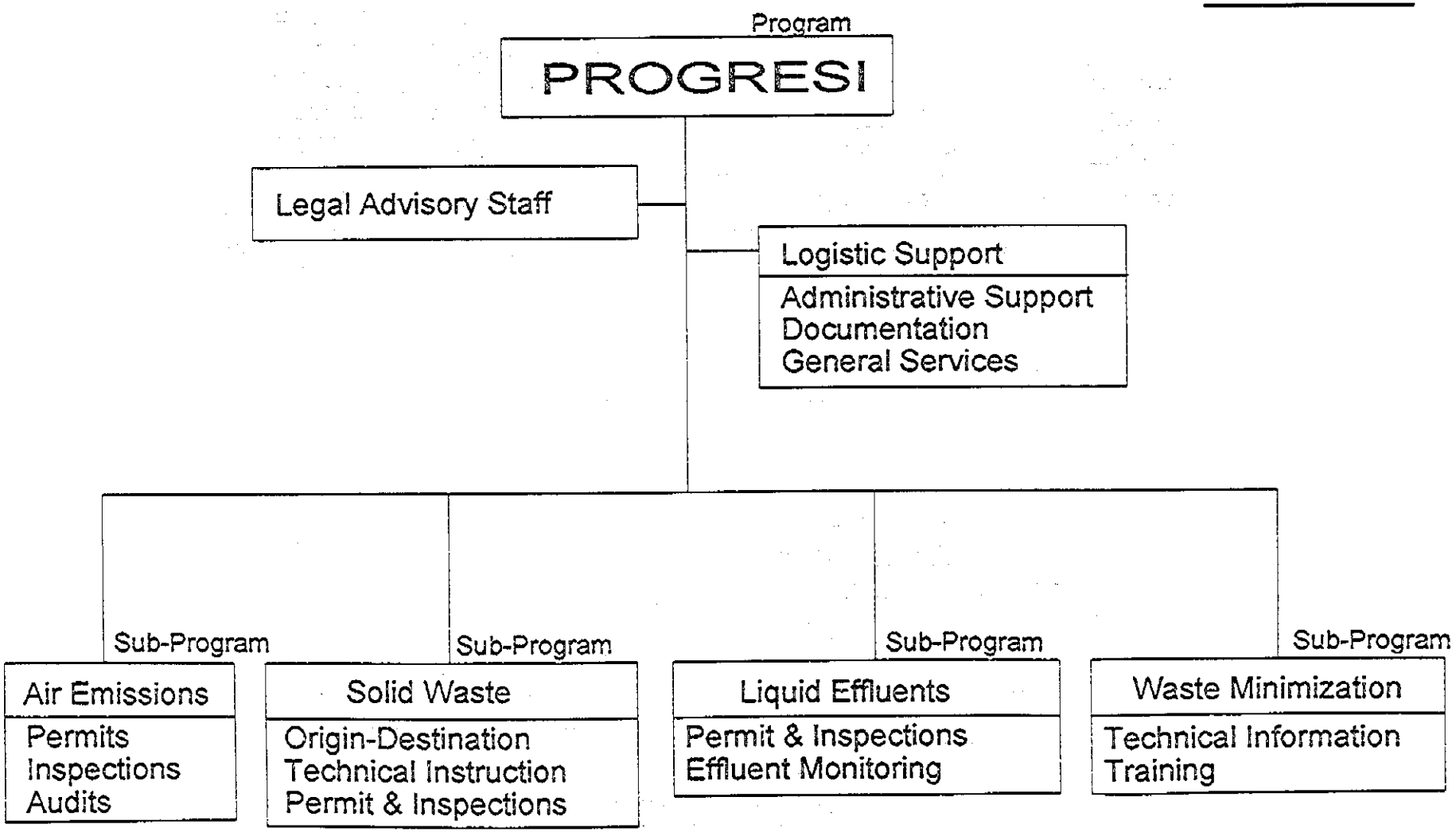

Figure L.2c Proposed Organizational Chart of PROGRESI (Year 1997)

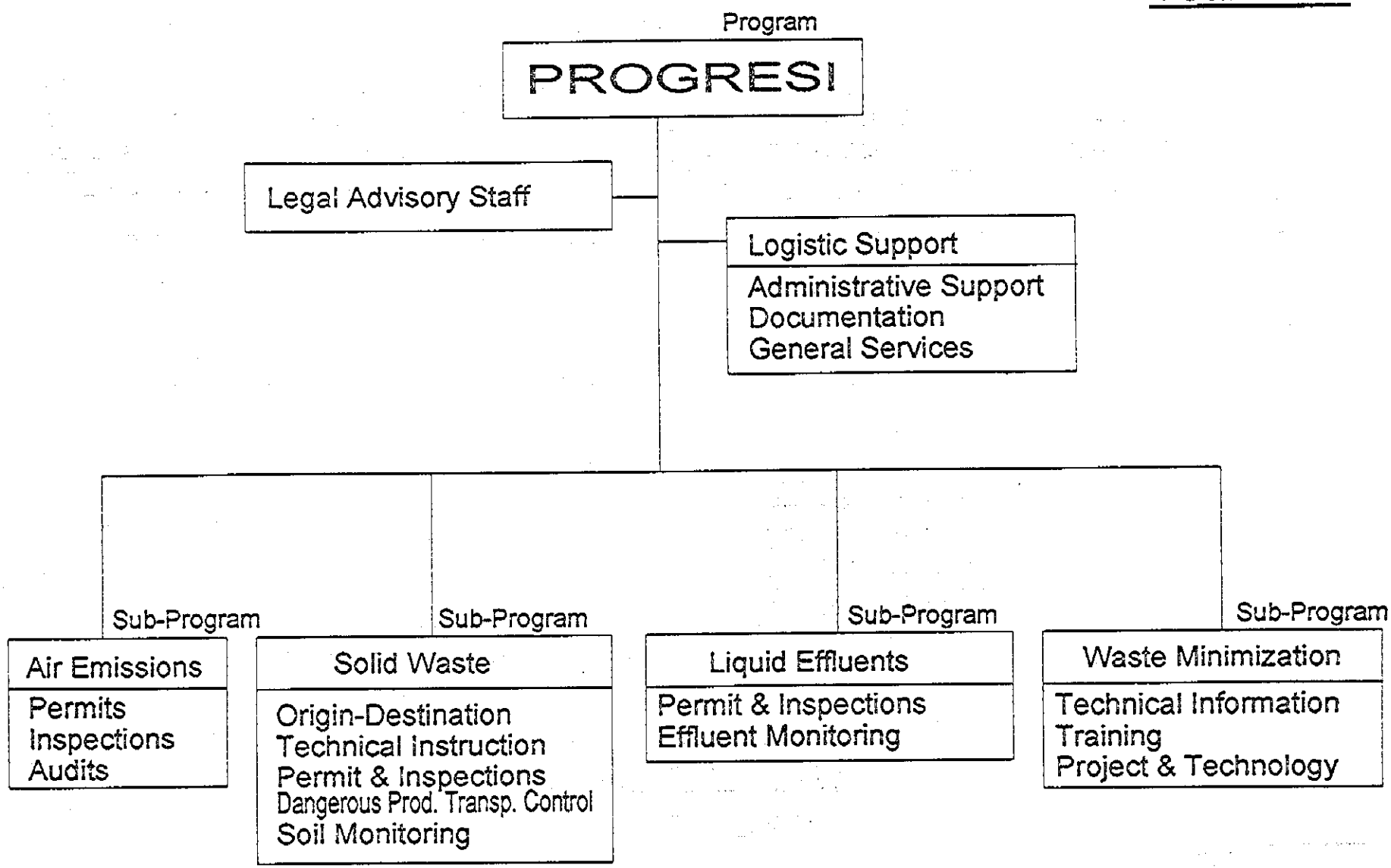

Figure L.2d Proposed Organizational Chart of PROGRESI (Year 2005)

L.3 Strategy for the Short Term Administration of ISW

a. General Strategy

Three facts constitute the basis of the strategy proposed:

- the action of the controlling entity and the supply of executive services in the market are interdependent;
- the controlling entity already has available data and resources to initiate an effective action and there are enterprises interested in offering executive services; and
- both bases, legal and technical-normative, are insufficient but they already possess (in this and other studies) orientations to develop further.

Please note that the supply of services, which is essential to the administration of industrial waste, requires permits from the Competent Authority, and it in turn needs legal and normative bases to evaluate and grant permits.

Even though a perfect legal base should precede the normative acts, it has not happened this way in other countries and it will most likely not happen in Chile, given that legal acts take time because of their complexity and because of lack of experience in the matter.

Thus in the short term, it is recommended that normative and regulative acts be developed, supported by already existing legal acts and foreign normative experiences, which should be carefully adapted to the Chilean context.

Of the regulations recommended in section f. of L.1, we choose the following as priority issues in the short term:

- as a regulatory basis (to be selected from existing acts, complemented and consolidated): LA-MC-2, LA-MC-7, LA-CA-1, LA-MC-10, LA-CA-3 and -4, LA-CA-2, LA-MC-13 and LA-CA-7;
- technical instructions and standards: for the above mentioned issues.

The classification of industrial waste has special importance for all management and control -- in addition to its economic importance which allows providers of services to assess the potential market and for generators to search for options to not generate waste with high management costs.

Conjugating both these economic interests, and the immediate availability of data on the origin and quantities of generated industrial waste in the MR of Santiago, together with the classification of said waste according to a simple and very effective criteria for all the objectives of waste management, it is recommended that the "Procedures for the Classification of Industrial waste; TA-CA-4" (presented in the next section) are immediately put into use.

The remaining selected issues result from the appearance of private companies interested in setting up landfills for hazardous and non-hazardous industrial waste, and also in taking HW to cement furnaces. Surely, it will be necessary to make a decision on the storage of HW outside generating establishments. The Competent Authority should be prepared to counsel those interested and evaluate their proposals, establishing the necessary technical instructions and setting, for general information, its concepts on "responsibility" -- even though this critical issue requires broader legal support, in the future.

b. Procedure for the Classification of Industrial Waste

A procedure for the classification of ISW is presented as shown in Figure L.3a.

p-1 Industrial Waste is classified according to Reference I.

p-2 Reference 1 should be periodically revised by SESMA, based on the improved knowledge of the waste and technical-scientific development.

p-3 The Generator could require SESMA to make a change in the categorization of its waste (HW⇔Non-HW⇔LW), justifying its requirement with a study carried out and supported by a laboratory registered with SESMA for that purpose.

p-4 The above mentioned study should inform:

i. Name of the company; address and size (number of employees, constructed area) of the factory; treatment of effluents.

ii. Characterization of the industry:
Type of industry, products, industrial process, components that may be present in effluents or in the industrial waste.

iii. Quantification and characterization of the effluents (pH and

chemical composition) and of the industrial waste (pH, chemical composition, water content, specific gravity, physical state).

Observation:

The characterizations should be made in relation to the components informed in ii.; if this information is not provided, or by request of SESMA, the characterizations should follow Reference II.

iv. Proof that the industrial waste is not flammable, reactive, corrosive, or toxic -- through the characterization presented in iii. or the test referred to in Reference III.

v. Leaching test of the industrial waste according to Reference IV, and analysis of the leached in relation to the chemical characteristics presented in iii.

vi. Proof that the industrial waste is hazardous (HW) or non-hazardous (NON-HW) in accordance with v. or, in case it is not enough, through evaluation of the industrial waste and of its chemical content in relation to the following points:

- dosage or concentration, and load of potential contaminants;
- nature of the risk presented by the industrial waste to the environment and to people;
- persistence and/or bio-accumulation in living organisms;
- potential migration of hazardous substances resulting from the decomposition of the industrial waste;
- potential attenuation of the hazardous property, as a function of the proposed disposal;
- other significant aspects.

Observation:

The waste shall be considered HW if proof of its safety is not convincing.

p-5 An industrial waste could be considered "inert" when it is not HW and the extract obtained from it, in accordance with the solubilization test referred to in Reference V, is in accordance with the chemical characteristics of potable water, referred to in Reference VI.

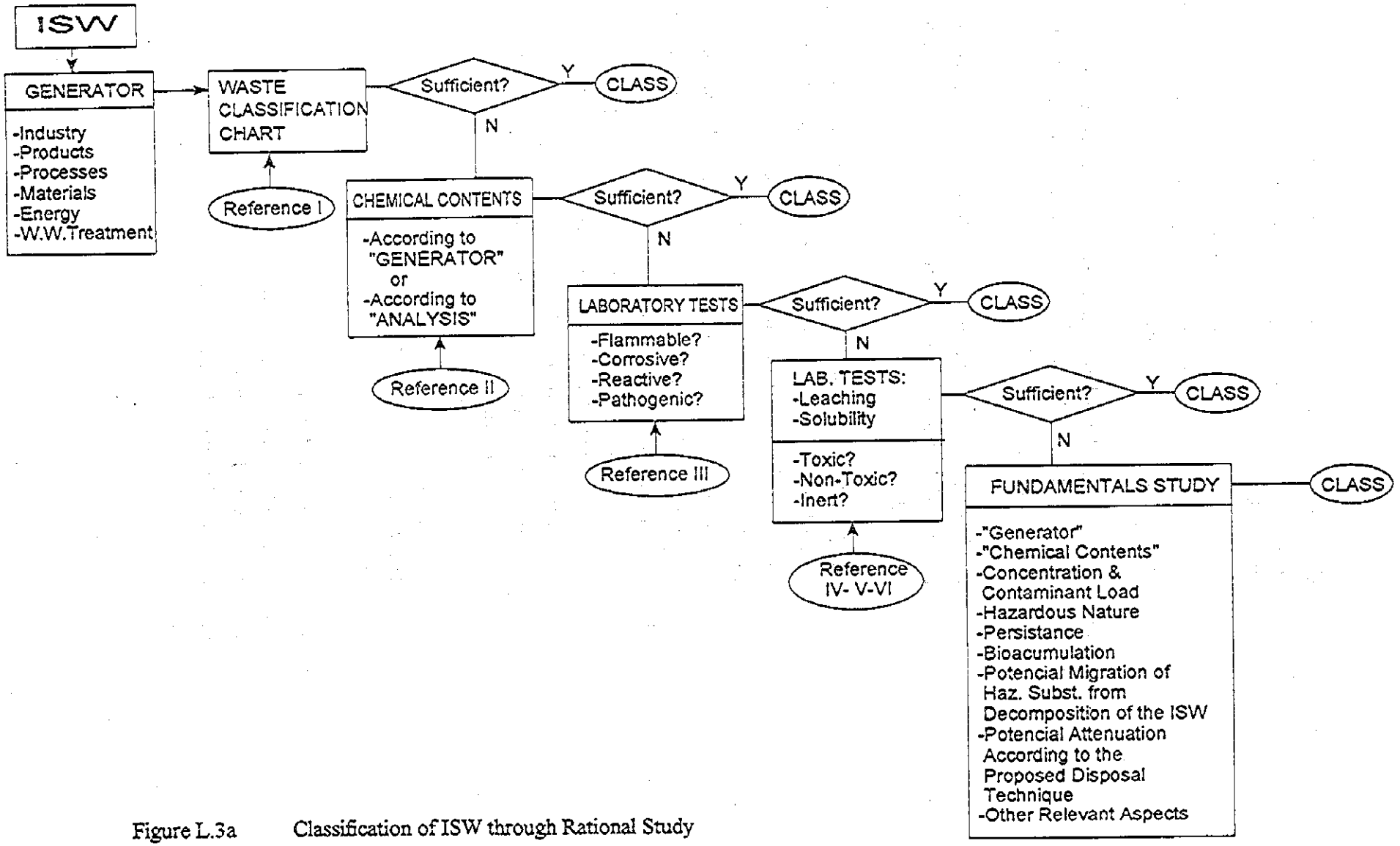

Figure L.3a Classification of ISW through Rational Study

List of References:

Reference I: "Waste Classification" Chart as presented in Table I.1.2d in Annex I.

Reference II: Chemical content to be analyzed in industrial waste (from the list of unacceptable waste for sanitary landfills and for industrial landfills).

Chemical content to be analyzed in IW will be fixed according to the regulation and technical norms for industrial landfill and other disposal methods.

It is useful to take as parameters substances that have restricted or no acceptance in land-fills and their limits, to be composed with the concentration in the waste. The waste should be characterized according to the parameters and acceptance limits in each class of landfill.

As references, SESMA could take those established by US-EPA for sanitary and for special (for HW) landfills. In parameters restricted for "controlled" and "Stable" landfills in Japan, as follows :

Parameters	*Limits : mg/l*
Cadmium and its compounds	*0.3*
Mercury and its compounds	*0.005*
Lead and its compounds	*3*
Arsenic and its compounds	*1.5*
Chromium hexavalents and its compounds	*1.5*
Cyanide compounds	*1*
Alkylmercury compounds	*not detected*
Organic phosphorous compounds	*1*
PCB	*0.003*
Trichloroethylene	*0.3*
Tetrechoroethylene	*0.1*
Waste acid	*not acceptable*
Waste alkali	*not acceptable*
Waste oil	*not acceptable*

Reference III: Standardized methods for the qualification of inflammables, corrosives and reactives (USA): "The Method for Evaluating Solid Waste, Physical/Chemical Methods." EPA Publication SW-846.

Reference IV: Leaching test in acid pH (USA): Method 1311(TCLP: Toxicity Characteristic Leaching Procedure) in "The Method for Evaluating Solid Waste, Physical/Chemical Methods" EPA Publication SW-846.

Observations: *1) SESMA could demand a leaching test in accordance with another method that it considers more adequate for the industrial waste under study.*
2) To its judgement, SESMA could accept 100 times the maximum admissible dosage in drinking water (see Reference VI) as dosage-limit for the parameters not expressed in the list of chemical content of the lixiviated extract.

Reference V: Solubilization Test in Neutral pH (Brazil)

1. Objective

This Norm establishes the necessary conditions ro differentiate Class II (Non-HW/Non-Inert) and III (Inert) waste. It is only applicable to waste in a solid physical state.

2. Norms and/or Complementary Documents

In the application of this Norm it is necessary to consult:

NBR 10004	Solid waste - Classification
NBR 10007	Sampling of waste - Procedure
AWWA-APHA-WPCI	Standard methods for the examination of water and wastewater
USEPA TEST METHODS FOR EVALUATING SOLID WASTE	Physical/Chemical Methods SW 846

3. General Conditions

3.1 Equipment

The equipment to be utilized consists of:

i. Agitator that can prevent the stratification of the sample during agitation; submits all particles of the sample to contact with water and guarantees homogeneous mixing during its functioning period.
ii. Filtration device that permits the separation of all particles of a diameter equal or superior to 0.45 μm.

3.2 Field samples

The collection of waste samples must follow the prescriptions of NBR 10007.

3.3 Procedure

The following procedure must be adopted:

i. Place a representative sample of 250g (dry basis) of the waste in a 1500ml flask;

Note: The operation must be carried out with a duplicate.

ii. Add 1000ml of deionized or distilled water and stir the sample at low speed, for 5 min.;

iii. Seal the flask and let it sit for 7 days;

iv. Filter the solution with a filtering device equipped with a filtrating membrane of 0.45 μm porosity;

v. Preserve the filtrate for future chemical analysis consistent with the parameter to be determined according to the WPCI or US-EPA Test Methods for Evaluating Solid Waste; Physical/chemical Methods SW 846.

4. Interpretation of Data

For the purpose of waste classification compare the obtained data with that which is constant in the table below (List No.8 of NBR 10004).

Standards for the solubilization test

Pollutant	Maximum limit in the extract (mg/l)
Arsenic	0.05
Barium	1.0
Cadmium	0.005
Lead	0.05
Cyanide	0.1
Total Chrome	0.05
Phenol	0.001
Fluoride	1.5
Mercury	0.001
Nitrate (mg N/l)	10.0
Silver	0.05
Selenium	0.01
Aldrin	3.0×10^{-5}
Chlordane (all the isomers)	3.0×10^{-4}
DDT (all the isomers)	1.0×10^{-3}
Dieldrin	3.0×10^{-5}
Endrin	2.0×10^{-4}
Epoxy-heptachloride	1.0×10^{-4}
Heptachloride	1.0×10^{-4}

Pollutant	Maximum limit in the extract (mg/l)
Hexachlorobenzene	1.0×10^{-5}
Lindane	3.0×10^{-3}
Methoxychlor	0.03
Pentachlorophenol	0.01
Toxaphene	5.0×10^{-3}
2,4-D	0.1
2,4,5-T	2.0×10^{-3}
2,4,5-TP	0.03
Organic phoshporides and carbamates	0.1
Aluminum	0.2
Chloride	250.0
Copper	1.0
Hardness (mg $CaCO_3$/l)	500.0
Iron	0.3
Manganese	0.1
Sodium	200.0
Surfactants (tensoactives)	0.2
Sulphate (mg SO_4/l)	400.0
Zinc	5.0

Note: Values obtained from the WHO - Guidelines for Drinking Water Quality - Vol.I - Recommendations Geneva - 1984 and completed with Resolution No. 56 Bsb, of 14.13.77, of the Ministry of Health - Brazilean Standard of Water Potability.

Reference VI: Characteristics of Drinking Water (USA)

US-EPA Primary Drinking Water Regulations

Volatile organic chemicals	mg/L (Existing)
Trichloroethylene	0.005
Carbon tetrachloride	0.005
Vinyl chloride	0.002
1,2-Dichloroethane	0.005
Benzene	0.005
1,1-Dichloroethylene	0.007
1,1,1-Trichloroethane	0.2
p-Dichlorobenzene	0.075

Inorganic chemicals	mg/L (Promulgated 12/90)
Arsenic (to repropose)	0.03
Asbestos (fibers/l > 10 μm)	7×10^6
Barium (proposed)	2
Cadmium	0.005
Chromium	0.1
Copper (proposed)	OCC*1
Lead (proposed)	OCC*1
Mercury	0.002
Nitrate (as N)	10
Nitrite (as N)	1
Selenium	0.05
Fluoride (promulgated 4/86)	4
Synthetic organic chemicals	**mg/L (Promulgated 12/90)**
Acrylamide	TT*2
Alachlor	0.002
Aldicarb (proposed)	0.003
Aldicarb sulfoxide (proposed)	0.003
Aldicarb sulfone (proposed)	0.003
Atrazine	0.003
Carbofuran	0.04
Chlordane	0.002
cis-1,2-Dichloroethylene	0.07
DBCP	0.0002
1,2-Dichloropropane	0.005
o-Dichlorobenzene	0.6
2,4-D	0.07
EDB	0.00005
Epichlorohydrin	TT*2
Ethylbenzene	0.7
Heptachlor	0.0004
Heptachlor epoxide	0.0002
Lindane	0.0002
Methoxychlor	0.04
Monochlorobenzene	0.1
Polyclorinated biphenyls	0.0005
Pentachlorophenol (proposed)	0.001
Styrene	0.1
Tetrachloroethylene	0.005
Toluene	1
2,4,5-TP	0.05
Toxaphene	0.003
Trans-1,2-Dichloroethylene	0.1
Xylenes	10

Note: OCC*1: optimal corrosion control

TT*2: treatment technology specified polymer addition practices (i.e., limited dosage)

c. Treatment of Industrial Liquid Effluents

The treatment of liquid effluents generates sludge, which is usually hazardous, in larger quantities than the waste from the industrial process. For this reason, it is important to orientate the industries so that their effluent treatment projects include the drying out of the sludge as well as an appropriate destination for it. This should be monitored through an assessment of the plant design and construction before awarding the necessary permits.

An agreement between The Ministry of Public Works (MOP) and MS, with the consideration of CONAMA if necessary, should fix just one entity responsible for evaluation and approval of effluent treatment plants (project, installation and operation), as well its inspection. This entity should be SESMA, in the MR.

Technical instructions for presentation of the project to the competent authority, with the minimum contents list, should be prepared and published for consultants usage.

These measures were developed in the item **f.** of **L.1**, and certainly will incentive projects and implementation of treatment plants, with consequent generation of sludge.

In agreement with the (theoretical) flow for the implementation of effluents' treatment, promotion for private undertaking of waste processing/treatment/transportation/ destination will be carried out.

d. Scenario for Legal System Development

da. Scenario Synthesis

A scenario for legal system development is drafted for the discussion with the relevant organizations concerned and tabulated in Table L.3a.

Table L.3a Scenario for Legal System Development

Item-letter	1996	1997	2000	2005
LA-MC-1	T			
LA-MC-2	D		L	
LA-MC-3		D		
LA-MC-4				L/D/T
LA-MC-5		D		
LA-MC-6		D/T		
LA-MC-7	T/D			
LA-MC-8			L	
LA-MC-9			L/D	T
LA-MC-10	D	T	L	
LA-MC-11		L	D	
LA-MC-12			D/L	
LA-MC-13	L/D/T	D		
LA-MC-14	L/D			
LA-CA-1	T/D	T		
LA-CA-2	T/D	T	D	
LA-CA-3	D	T		
LA-CA-4		D		
LA-CA-5			D	
LA-CA-6		T/D		
LA-CA-7	D			
TA-CA-1				T
TA-CA-2				T
TA-CA-3				T
TA-CA-4	T			

Note:

L = High level legal act, such as a Supreme Decree (SD), involving the coordination of multiple organisms or ministries.

D = Supreme Decree (SD) or Resolution of the Ministry of Health.

T = Technical Instruction or Enforcement by Resolution.

Reference to Table L.3a

1. Legal Acts of Multi-Ministerial Characteristics

LA-MC-1: EIA-EID.

LA-MC-2: Definitions of concepts, responsibilities and obligations:

- Concepts
- Responsibilities

. Obligations of private agents towards CA, and vice-versa;

CA: to establish and inform of legal and technical-normative acts.

LA-MC-3: Responsibility of the owner of a sanitary landfill for receiving HW.

LA-MC-4: HW Minimization Program; obligations for all industries; financial loans for medium and small industries.

LA-MC-5: Recovery of used solvents and lubricants.

LA-MC-6: Control and storage of machines and devices containing dielectric with PCBs.

LA-MC-7: Prohibitions for the use of land or restrictions for HW disposal/ treatment/storage plants.

LA-MC-8: Insurance against environmental damage ("accumulative effects").

LA-MC-9: Study of critical points on highways for emergency response to accidents. Control of transportation of hazardous products.

LA-MC-10: Central Integrated Facilities for HW: concepts/responsibilities/ transference of responsibilities/restrictions/permits/authorities.

Provisional Fund for Soil Decontamination: provided through (compulsory) additional % in the prices of services.

LA-MC-11: Each Municipality must provide a site for disposal of IW in its territory (or in another Municipality's territory through agreement).

LA-MC-12: The supplier of toxic products (domestic and agricultural) should receive contaminated packages from customers and transport them to appropriate destination.

LA-MC-13: Competence (CA) to inspect and penalize industries, to

evaluate projects and to fix technical norms for projects -- all referring to industrial effluent treatment plants.

LA-MC-14: Competence of CA to manage, regulate and evaluate projects on ISW and industrial waste water treatment plants in the MR.

2. Legal Acts of the "Competent Authority" (CA)

LA-MC-2, -3, -4, -5, -6, -7, -9, -10, -11, -12, -13 and -14 should be detailed through the Supreme Decree or Resolution; so should the following:

LA-CA-1: Burial or topsoil biotreatment.

LA-CA-2: Thermal processing (incineration and pyrolysis) in exclusive plants and existing industrial plants.

LA-CA-3: Creation of a Central Warehouse as part of a Central Treatment/Disposal Plant.

LA-CA-4: Regulation of storage, processing, treatment and disposal activities of IW.

LA-CA-5: Regulation to detect unlawful entrance of IW in a site, and subsequent actions.

LA-CA-6: Enforcement that generators present, according to the priorities determined by the CA, the characterization of the HW that they produce and the plan to minimize/process/treat/dispose of the HW, with respective schedule approved by the Administration.

LA-CA-7: Reorganization of SESMA/PROCEFF/PROGRESI.

3. Technical norms from the "Competent Authority" (CA)

LA-MC-1, -4, -6, -7 and -10, and LA-CA-1, -2, -3, -6 and -13 should be detailed through Resolutions or Technical Instructions; as should the following:

TA-CA-1: Monitoring and environmental audits in polluting plants.

TA-CA-2: Checking of valves, instruments, tanks and other devices that are potential sources of soil contamination.

TA-CA-3: Training operators to minimize spillage and wastage during industrial operations and internal transportation.

TA-CA-4: Procedure for the classification of ISW.

db. Development in 1996

The supply and demand market of services will be sufficiently informed, and the Competent Authority able to start evaluating their proposals.

i. The Authority (CA) at executive level will be organized. (LA-MC-14 and LA-CA-7)

ii. The following will be established: (LA-MC-2)
- Concepts: Generator/Receiver/Transporter/industrial (solid) waste/ hazardous (solid) waste/responsibility/shared responsibility/joint liability/site permits/installation permits/operation permits.
- Obligations: Generator/Receiver/Transporter/Owner of a facility/ Operator of a facility (for ISW).
  Observation: these concepts and obligations should be improved and fixed at higher legal act by the year 2000.

iii. The minimum contents and procedures for EIA/EID referring to facilities for ISW will be established (Storage, Processing, Treatment, Disposal). (LA-MC-1)

iv. Classes and procedures to classify ISW will be fixed, as well as to change (if possible) the class of an ISW. (TA-CA-4)

v. To be established through Resolutions: (LA-MC-7)
- Areas where facilities for ISW - S,P,T,D are not allowed;
- Site restrictions for the implantation of facilities for ISW - S,P,T,D;
- Competent Authority to evaluate and license these facilities.

vi. Technical rules will be established for: (LA-CA-1 and -2)
- Land filling with ISW;
- Biodegradation of ISW on ground activated soil;
- Incineration of ISW (in exclusive incinerators).

vii. Regulations will be established for: (LA-CA-1, -2 and -3)
- Soil disposal or treatment of ISW;
- Incineration of ISW in exclusive incinerators and in existent industrial thermal processing plants;
- Central storehouse of ISW, as part of an integrated system for ISW - S,P,T,D.

viii. To be established by legal act: (LA-MC-10)
- Concept of central integrated ISW- S,P,T,D plant;
- Restrictions, permit system, demands needed for approval; Authority;
- Responsibilities of the owner and of the customers;
- To the costs of the services a percentage for a future Provisional Fund for Soil Decontamination should be added.
  Observation: the Provisional Fund, insurances, and responsibilities should be considered in a higher legal act by the year 2000.

ix. To be established by legal acts and technical rules: (LA-MC-13)
- Minimum contents, standard form and procedures to submit a project for Industrial Liquid Effluent Plants, including expected type and amount of sludge, its drying and destination;
- Parameters and acceptance limits for natural water streams and for engineered collection systems;
- Permits, routines and competent authority.

x. To be identified by legal acts i.e. SD and Regulation: (LA-MC-14 and LA-CA-7)
- Competence of MS/SESMA, in the MR, to manage, regulate and evaluate for permitting the projects on ISW and industrial effluent treatment plants.
- Reorganization of SESMA/PROCEFF/PROGRESI.

dc. Development in 1997

The Authority organizes some critical points, stimulating the market to offer solutions for these points.

The Authority issues the principal rules for ISW - S,P,T,D, that are missing.

The Municipalities collaborate to make feasible the use of adequate lands to install ISW facilities.

i. To be enforced through Supreme Decree (SD): (LA-MC-3, -5 and -6)
   - Control and storage of electrical equipment filled with oils containing PCBs;
   - Recovery of used solvents and lubricants by clean processes; and
   - Prohibition of receiving hazardous waste in a sanitary landfill.

ii. The obligations on the following will be enforced through Regulations: (LA-MC-13, LA-CA-4 and -6)
   - Treatment of liquid effluents according to priorities and schedule fixed by the Authority;
   - Proposal to the Authority, according to fixed priorities and schedule, of the Generator's plan for S,P,T,D of his HW; and
   - Storing the HW at the Generator's or an outside authorized property, as alternative to an internal P.T. or D., until an authorized plant is installed for the P.T. or D. of the HW.

iii. Regulations for Storage, Processing, Treatment and Disposal (S,P,T,D) facilities will be established, at the Generating site or in an authorized property. (LA-CA-4)

iv. Technical instructions will be established for: (LA-MC-6, LA-CA-1, -2, -3 and -6)
   - Storage and transportation of equipment containing PCBs;
   - Central storage of ISW as part of an integrated system;
   - Soil disposal and ground soil biotreatment of ISW;
   - Incineration of ISW in exclusive plants; and
   - Plants that should be proposed by Generators of HW for S,P,T,D.

v. The obligations of all Municipalities for providing adequate land for ISW disposal will be established by higher level legal act. This land can be inside municipal territory or outside through agreement with other municipalities. (LA-MC-11)

dd. Development by 2000

The Authority will improve and complement the legislation by considering previous results and the experience during the first years.

i. Responsibilities will be well-defined through higher level acts and economic instruments will be created to make them feasible: (LA-MC-2, -8, -10 and LA-CA-2 and -5)

- Responsibilities of: Generator, Receiver, transporter, Owner and Operator of an ISW - S,P,T,D plant;
- Transferred and mutual responsibility, joint liability;
- Conditions for insurance against environmental damage ("gradual effects");
- Provisional Fund for Soil Decontamination;
- Incineration of HW in existing industrial non-specialized facilities;
- Responsibility of the Owner of an unauthorized property for receiving HW.

ii. The obligations of the supplier will be established, in addition to the procedures for receiving from customers contaminated packages of toxic domestic and farm products and give them an adequate destination without further cost. (LA-MC-12)

iii. The obligation of the Authority to determine critical points in the principal highways and propose plans for emergency response to accidents will be established through legal act. (LA-MC-9)

de. Development by 2005

The means for S, P, T, D (Storage, Processing, Treatment, Disposal) of ISW are established and the Authority is supplied with human resources and an appropriate structure to develop the Clean Production Sub-program, of interest for the ISW, Liquid Effluents and Air Emission Sub-Programs.

i. The Clean Production Sub-Program will be established through high level legal act, then regulated and provided with technical instructions, fixing obligations, goals and loans for Generators. (LA-MC-4)

ii. Technical instructions will be established for: (LA-MC-9 and TA-CA-1, -2, -3)
- Monitoring and environmental audit inside factories;
- Checking potential sources of spillage inside factories and combustible storage and service plants;
- Training operators to minimize wastes;
- Controlling safe transport of dangerous substances in the MR.

L.4 Development of Human Resources

L.4.1 PROGRESI

a. Professionals and Training Program

Even though what is under consideration is the development of an executive entity, it is very important to pay attention to the double technical and regulatory character of that entity and, consequently, to its personnel.

Even if they have an engineering background, the higher level PROGRESI professionals should still acquire a good knowledge of environmental law. A consultancy is not enough, because the technical and regulatory character will be present in all the industrial waste administration activities.

That is why for PROGRESI high level professionals we recommend:

i. Basic graduation:
   - chemical engineering (processes);
   - civil engineering (soils/geotechnics);
   - geology (prospect/hydro geology);
   - law (civil/public); and
   - chemistry (analytic).

ii. Post-graduation:
   - environmental engineering;
   - sanitary engineering;
   - underground waters;
   - environmental law; and
   - organic and inorganic laboratory analysis.

iii. Complementary superior courses:
   - theory and practice of the treatment of liquid effluents;
   - design of treatment plants for liquid effluents;
   - soil chemistry;
   - contamination mechanism of the soil and its waters;
   - soil identification in the field and the laboratory;
   - thermal processes of incineration and pyrolysis;
   - transportation of hazardous products;

- concepts of environmental law for engineers;
- concepts of environmental engineering for lawyers; and
- analytic chemistry for engineers.

iv. Technical-scientific extension:
- management of sludge resulting from the treatment of industrial effluents;
- design of landfills for hazardous and non-hazardous industrial waste;
- design of beds for biological treatment in ground soil;
- operation of landfills for industrial waste;
- design and monitoring operation of soil and underground waters;
- investigation of contaminants in soil and its waters;
- attention to accidents with hazardous products;
- adaptation of industrial plants for the thermal processing of hazardous wastes;
- processes of chemical and physical fixation of contaminants in industrial products;
- solidification processes of hazardous industrial waste;
- minimization of the generation of hazardous industrial waste without change in the industrial process;
- minimization of the generation of hazardous industrial waste with change in the industrial process; and
- audits for the minimization of hazardous industrial waste generation.

v. Practical training:
- survey of industrial waste sources in factories;
- sampling of industrial waste in factories;
- characterization (chemical, physical, biological) of industrial waste;
- classification of industrial waste;
- sampling of soil and underground water;
- laboratory analytic methods;
- Travel and Contingency Plan for hazardous products;
- attention to accidents with hazardous products on highways;
- conditioning and storage of hazardous industrial waste;
- inspections to find hazardous waste in sanitary landfills;
- inspections to find hazardous waste in empty lots;
- foreign technical norms for industrial waste;
- national technical norms for industrial waste; and
- operation of a Technical Information System (TIS).

vi. Computerized Technical Information:

- implementation of a TIS connected to existing networks and provided with a CD-ROM, for use of the public and SESMA; and
- implementation of a Specialized Library (industrial waste, toxicology, industrial waste management), for use of the public and SESMA.

The medium level professionals will also undertake important tasks in PROGRESI. In what pertains to technical professions, we recommend:

i. Basic graduation:
   - general technical chemistry;
   - analytic technical chemistry (laboratory technician);
   - geotechnic services;
   - technician in civil engineering; and
   - technician in technical documentation.

ii. Specialized or complementary training:
   - *organic and inorganic laboratory analysis;*
   - sampling of liquids and solids by means of underground water monitors;
   - soil boring survey;
   - the Technical Information System;
   - maintenance of a specialized library;
   - the Declaration System for industrial waste.

iii. Practical training:
   - laboratory analysis;
   - sampling;
   - soil boring surveys;
   - operation of a TIS; and
   - operation and maintenance of a specialized library of the Declaration System for industrial waste.

The training of PROGRESI professionals has priority, but training should also be extended to professionals of private companies that generate industrial waste and to consulting firms.

The objectives and the actions of the public entity of control, of the generators and of the waste handling agents should be well articulated for success to be achieved. The better prepared private agents are the more productive and fast public action will be. This magnifies the importance of training both parties.

The integration with educational institutions of various levels, as well as international collaboration, should be mobilized by SESMA, and right after, by the Ministry of Health and CONAMA.

b. Manpower for PROGRESI

Manpower for PROGRESI at last stage of implementation are summarized in the table below.

Table L.4.1a Summary of Manpower

Program	Function	Profession	Quality
Overall Program	Chief of Program	Engineer	1
	Assistant	Engineer	1
	Secretary	Secretary	1
	Legal Advice	Lawyer (Senior)	1
		Lawyer	1
	Sub-total		5
Logistic Support	Chief	Manager	1
	Secretary	Secretary	1
	Typewriting	Typist	3
	Documentation	Documentation Technician	1
		Documentation Supporting Staff	2
		Filing Clerk	1
		Typist	1
		Document Receptionist	1
	General Service	Chief	1
		Transportation Manager	1
		Material Supplier	1
		Maintenance Manager	1
		Housekeeper	1
		Message Boy	1
	Sub-total		17
Air Emission	Chief	Engineer	1
	Assistant	Engineer	1
	Secretary	Secretary	1
	Emission Permits	Engineer (Senior)	1
		Engineer	3
	Inspections	Engineer	1
		Environmental Expert	2
		Supporting Staff	2
	Audits	Engineer	2
		Environmental Expert	2
	Sub-total		16
Solid Waste	Chief	Engineer	1
	Assistant	Engineer	1
	Secretary	Secretary	2
	Maintenance System	Engineer	2
		Computer Operator	2
	Technical Instruction	Engineer	1
	Permission & Licence	Engineer	1
		Assistant Engineer	4
		Supporting Staff	2
	Hazardous Material Control	Engineer	1
		Assistant Engineer	2
		Environmental Expert	2
	Monitoring	Geologist	1
		Chemist	1
		Soil Boring Operator	1
		Supporting Staff	2
	Sub-total		26
Liquid Effluent	Chief	Engineer	1
	Permits & Fiscalization	Engineer	1
	Monitoring	Supporting Staff	2
	Sub-total		4
Waste Minimization	Chief	Engineer	1
	Training	Professor	1
	Technical Information System	Information Expert	1
	Project & Technology Appraisal	In-process Technology Engineer	1
		Industrial Engineer	1
	Sub-total		5
Total			73

L.4.2 National Center for the Environment - CENMA

a. Background

The Government of Chile decided to found CENMA and it counts with the cooperation of the Government of Japan to implant it. A Basic Project study has been prepared in the first semester of 1995, together with CONAMA, the University of Chile and JICA (Japan International Cooperation Agency). In that same period the institutional bases for the Center were set, as a non-profit corporation under private law regulations, linked to the University of Chile but with financial and administrative autonomy.

CENMA will be located on the campus of the University, in La Reina, Santiago, and it is hoped that it will begin operation in March 1996.

b. Master Plan of the CENMA Project

The CENMA Project will be implemented in accordance with the Master Plan described below.

b.1 Objective of the Project

In order to support the formulation and implementation of environmental protection policies in the Republic of Chile, the purpose of the project is to enable the Center to conduct training, resarch and development relevant to environmental matters, as well as to provide environmental information.

b.2 Outputs of the Project

The outputs of the Project are:

- to develop methods to simulate and forecast air pollution episodes in order to alleviate heavy air contamination over the Metropolitan Region;
- to develop methodologies for waste quality evaluation and treatment techniques;
- to develop methodologies for the analysis of industrial solid waste and to evaluate current methods of disposal;
- to develop methodologies for the analysis of air pollutants as well as methods to monitor air quality;

- to contribute to the establishment of an environmental information system, in both the MR and at the national level;
- to faciliate human resource development;
- to enhance Environemntal Impact Assessment (EIA) and environmental management systems; and
- to establish the facilities and equipment neccessary to conduct the activities of the Project.

b.3 Activities of the Project

b.3.1 Forecast of Air Pollution Episodes

- To strengthen the Chilean meteorological observation network, and upper air observation capabilities in order to improve the knowledge of the structure of mesoscale meteorological phenomena;
- To strengthen the atmospheric simulation capabilities at the MR. and develop a model for the air-quality including photochemical processes; and
- To develop objective weather forecasting methods including numerical weather forecasting data.

b.3.2 Water Quality Management and Industrial Liquid Wastes

- To study methods of monitoring water quality and water quality management in the MR;
- To study analytical methods of water quality;
- To study the present situation of industrial waste water discharge; and
- To study appropriate waste water treatment methods for each type of industry.

b.3.3 Management of Industrial Solid Wastes

- To study methods of analysis of toxic and hazardous substances;
- To develop surveillance methods to know hazardous industrial solid waste generation;
- To develop surveillance methods to know the present conditions of uncontrolled disposal through an awareness of the status quo of pollution; and
- To study appropriate treatment methods for industrial solid wastes based on the investigation and data gathered.

b.3.4 Air Quality Control

- To study methods of air pollutants sampling and analysis;
- To assess ambient air quality conditions through automatic monitoring stations and, as when required, manual sampling and analysis;
- To characterize the present conditions in the emission of air pollutants through sampling and analysis; and
- To gather, generate, and provide the scientific knowledge needed to support the planning of a policy for the reduction of air pollutants.

b.3.5 Environmental Information

- To collect the environmental data and information based on the research and development programs;
- To process the data collected; and
- To support the MACAM network (Automatic Monitoring of Atmospheric Contaminants and Meteorological Variables).

b.3.6 Training

- To prepare the texts and manuals to be used in the training programs considering the outputs of the Research and Development programs;
- To conduct the courses and seminars as required for training and extension; and
- To evaluate the results of training and seminars.

b.3.7 EIA and Environmental Management

- To collect information on the EIA cases; and
- To study procedures on EIA and effective environmental management.

b.3.8 Equipment

- To establish a system to maintain and repair the equipment; and
- To put the equipment into operation.

c. Cooperation Programs to be Provided by the Government of Japan

According to the Records of Discussions on the Japanese technical cooperation for the CENMA Project, the Government of Japan will provide the following cooperation

programs for the Project:

c.1 Dispatch of Japanese Experts

The Japanese Government will provide the services of the Japanese experts described below.

i. A chief adviser
ii. A coordinator
iii. Long-term experts in the fields of:
   - forecast of air pollution episodes;
   - water quality management and industrial liquid wastes;
   - management of industrial solid wastes; and
   - air quality control.
iv. Short-term experts
   Short-term experts will be dispatched, when the need arises, for the smooth and successful implementation of the Project.

c.2 Provision of Machinery and Equipment

The Government of Japan will provide such machinery, equipment and other materials necessary for the implementation of the Project.

c.3 Training of Chilean Personnel in Japan

The Government of Japan will receive the Chilean personnel connected with the Project for technical training in Japan.

c.4 Term of Cooperation

The duration of technical cooperation for the Project by JICA will be five (5) years from June 1st, 1995.

d. Expected Contribution by CENMA Project

d.1 Request by the Chilean Side

At the meeting for the discussion of DF/R, the Chilean side requested that the Team help to clarify the priorities with regard to the work to be developed by the JICA experts of CENMA in relation to the activities of the ISWM Master Plan. Although the

Chilean side requested to clarify "the priorities with regard to the work to be developed by the JICA experts", the Team presents herewith "the expected contribution by CENMA project" instead due to the following reasons:

- Since JICA's cooperation program for CENMA project is different one from this Study, which is conducted based on the Records of Discussion (R/D) on the Japanese technical cooperation for the project. The priorities of the works to be developed in the CENMA project shall be decided by the people involved in the project through the discussions. It is recommended that Chilean side starts in-depth discuss with the JICA experts after the work to be developed by the experts are determined within the framework of CENMA.
- It is a principle that the activities of the ISWM Master Plan should be executed by the Chilean side and the CENMA project could only support or assist them. For instance, a technical guideline for hazardous waste landfill shall be developed by the Chilean side but not by the experts of CENMA. In this regard, Team presents this context in order to avoid mis-understanding.

d.2 Target and Strategy of the ISWM Master Plan

The ISWM Master Plan sets up strategies in principle to reach "targets". Strategies comprise:

i realization of thorough on-site ISWM and

ii. formulation of ISWM market which is based upon market mechanism and enables appropriate treatment, disposal, and resource recovery.

Namely, based on PPP (polluter pays principle), an outline of ISWM that treatment and disposal of ISW be carried out by private sectors should be formulated. Hence, the authorities should prepare systems of legislation, guidelines, monitoring and guidance that promote said formulation.

The Master Plan period is divided into two: i.e., the first period as until year 2000 (which corresponds to the term of cooperation for the CENMA by JICA) and the second period as until year 2010. The strategy up to Year 2000 is summarized below.

- The current conditions of ISW generation and treatment are to be clarified in accordance with 333 ISW categories of CDSI in large factories. Identification of HW is also to be made by large factories based on the regulations of the MS. Voluntary reporting from generators to authorities are to be realized.

- More or less half of industries in the region should equip facilities of waste water and exhaust gas treatment. Sludge, LW, and dust are to be managed and controlled as ISW.
- Through the compilation of the information submitted by waste generators and on-site investigation, the authorities shall gain the capability to examine reports from factories and plans proposed by private sectors.
- HW treatment/disposal facilities shall be in practice operated. Authorities' monitoring and guidance over private ISWM sectors' activities are to be strengthened. Illegal treatment/disposal and dumping should be eliminated.

d.3 Expected Contribution by CENMA

According to the R/D of CENMA project, the following three (3) fields are relevant to the activities for the implementation of the ISWM Master Plan :

- water quality management and industrial liquid wastes;
- management of industrial solid wastes; and
- air quality control.

Upon consideration of the contents of the R/D of CENMA project and the Master Plan strategy up to Year 2000, the expected contribution to the activities of the Master Plan by CENMA in respective fields, i.e. Industrial Liquid Wastes Field (ILWF), Industrial Solid Waste Field (ISWF) and Air Quality Control Field (AQCF) are presented in tables below.

Table L.4.2a Expected Contribution by CENMA Project to the Targets for Establishment of Appropriate On-site ISWM

Master Plan Target	Industrial Liquid Wastes Field	ISW Field	Air Quality Control Field
TARGET-1 ISWM should be based on the 333 classification of CDSI. Actual state of ISWM at generation should be truly reported by factories as requested by the authorities (including the declaration system).	No relation.	The advice for improving the present declaration system is expected.	No relation.
Waste water and gas emission should be treated on-site. Sludge, LW, dust, etc. should be managed as ISW.	The study of proper waste water treatment methods is highly expected.	The advice for on-site management of sludge, LW, dust, etc. is expected.	The study on monitoring methods of air pollution control on-site is expected.
TARGET-3 Processes and materials which may generate HW according to the regulation of MS should be recognized. HW should be identified and declared to authorities.	The study of analytical methods of waste water quality is highly expected.	The study of methods of analysis of toxic and hazardous substances is highly expected.	No relation.
TARGET-4 Analytical identification of HW should be carried out. Appropriate on-site ISWM and proper treatment/disposal should be maintained.	Less expected.	The study of methods of monitoring on-site management of HW is highly expected.	No relation.
Target-5 Higher (than legislative requirement) level of HW management (e.g. through process/material alteration for waste minimization) should be aimed.	Less expected.	Less expected.	Less expected.

Table L.4.2b Expected Contribution by CENMA project to the Targets for Formulation of ISWM Market Mechanism

Targets	Policy Objectives	ILWF	ISWF	AQCF
Target-1 Construction of appropriate HW treatment and disposal facilities by private sectors				
	Preparation of standards for structure and operation/maintenance	No	LEW	No
	Establishment of control system for ISWM facilities siting in relation to urban planning and environment	No	LEW	No
	Strengthening administrative capabilities of assessing facilities siting	No	LEW	No
	Improvement of EIA system regarding siting of facilities	No	LEW	No
	Establishment of public participation system regarding the siting of facilities	No	LEW	No
	Establishment of permission procedure for an ISWM facility siting	No	LEW	No
Target-2 Elimination of illegal treatment and disposal activities (e.g. illegal dumping, unauthorized treatment and disposal activities, etc.)				
	Provision of laws/regulations for suspending operation and removal of illegal treatment and disposal facilities	No	LEW	No
	Establishment of supervision and guidance system for proper waste treatment, acceptance of wastes, and facilities operation	No	EW	No
	Authorization to the responsible administration for report collection, on-site inspection and empowered administrative measures, etc.	No	LEW	No
Target-3 Disposal of HW (stored by generators, etc.) at licenced treatment/disposal facilities				
	Supervision and guidance of appropriate on-site ISWM	EW	EW	EW
	Control of entrusted treatment/disposal activities by the declaration system	No	EW	No
	Use of administrative measures (order of suspension, etc.) against illegal actions (e.g. entrusting ISW disposal to illegal routes, etc.)	No	LEW	No
Target-4 Formulation of sound ISWM market for proper operation and management of ISWM facilities.				
	Strict control of illegal treatment and disposal of ISW	No	LEW	No
	Applying the duty of compensation for environmental pollution and damages upon the polluters including ISW handling agents.	No	LEW	No
	System obligating the insurance and/or fund for compensation as a collateral condition of permission of the treatment and final disposal siting.	No	LEW	No
	Increasing the awareness of generators regarding the necessity of paying the cost for HW treatment and disposal, as well as of reducing the cost by waste minimization and appropriate management.	LEW	LEW	LEW

Remarks:
ILWF: Industrial Liquid Waste Field
ISWF: Industrial Solid Waste Field
AQCF: Air Quality Control Field
HEW: Highly Expected Work
EW: Expected Work
LEW: Less Expected Work
No: No Relation

L.5 Examination of Executing Bodies

a. Executing Bodies

The executing bodies will be divided into two sectors, i.e. public and private sectors. The roles of the executing bodies are described as follows:

i. Public sector:
- Regulations, standards, methods
- Control, monitoring
- Permits, registers.
- Technical information
- Human resources development
- Incentive program for cleaner production.

ii. Private sector:
- Consultancy, laboratories
- Activities for minimizing residues
- Recycling, residue exchange
- Processing ISW in existing plants prepared for this purpose
- Processing ISW for construction materials
- Central processing, treatment and disposal plant (CPTDP)
- Storage facility as part of a CPTDP
- Transportation of ISW
- Emergency response (accidents in roads, streets and factories)
- Soil decontamination
- Underground storage tank monitoring, installation, substitution.

b. Cost Recovery Method for Environmental Remediation

The price for the ISW transportation and disposal services consists of:

Price = Cost + Profit + Provisional Fund Rate

Provisional fund destination: (only to abate effects of soil contamination by ISW) is as follows:

i. Soil disposal services (landfills, bio-degradation):
- Soil remediation (includes groundwater)

- Reparations of soil and water basins or streams due to effects of leaching
- Reconstruction of facilities or grounds due to gradual contamination by disposed ISW.

ii. Transportation services:
- Soil remediation (includes groundwater)
- Reparations of soil and water basins or streams due to contamination caused by accidents
- Emergency response preventing soil and water contamination.

NOTE: The proposed destinations do not include indemnification for loss of materials, vehicles, equipments or human life -- that can be covered by ordinary insurance for civil responsibility for sudden contamination.

L.6 Disputes for Localization and Neighborhood Consensus

L.6.1 Introduction

In view of formulating ISW treatment/disposal system, smooth and agreed localization and operation of facilities are of utmost importance.

In this respect, regulations specifying facilities' structure and O&M practice should be prepared beforehand. Meanwhile at the same time, procedures for ISWM facilities' localization permission including how to formulate neighborhood consensus should also be consolidated.

There are quite a few examples in industrialized countries that consolidation of region-wide and/or nationwide SW disposal systems were impinged and delayed due to that neither said procedure nor a mechanism to incorporate neighborhood consensus into project planning is substantiated in authorities' administrative framework. The current municipal SWM project in the MR alike the examples had series of related problems.

In this regard aiming at "promotion of appropriate and smooth localization of SWM facilities in future" and "establishment of a mechanism of localization permission and neighborhood consensus" background of disputes for localization and neighborhood consensus are examined herewith in this regard.

L.6.2 Japan's Status Quo in Localization Permission and Mechanism of Neighborhood Consensus

In Japan, City Planning Law regulates area where SWM facilities are allowed to be localized (i.e., SWM facilities can not be localized in those areas where this law prohibit). Furthermore, Waste Disposal and Public Cleansing Law stipulates that promoting sector should apply his proposed project to a prefectural governor for approval of facilities construction. After passing the authority's inspection on constructed facilities for its appropriateness and specification-compliance, business (operation) permission is given to the promoting sectors and then said facilities operation is allowed.

Permission procedures principally adopted in Japan are as follows:

i. The promoting agent should prepare his proposal in compliance with the format required and submit to the related department of the local government. (preliminary application)

ii. The related department of the local government, with reference to the plan proposed, reviews the proposal including its attached EIA and then examine the project content and point out probable arguments. Consequently, discussion between the agent and related government is held for coordination such as revision/modification (or in case refusal) of initial project. (preliminary examination)

iii. Once consensus upon basic content of project between the promoting agent and related department of local government are reached (preliminary examination is given), a plenary application is submitted and is referred to official/formal examination. (Substantial examinations are mainly carried out in the preliminary examination stage. Confirmation of planning content is mainly carried out in the formal examination.) Finally facility localization is permitted.

iv. On completion of facilities construction, local government shall carry out on-site inspection, in order to confirm e.g. whether they are constructed as are planned, whether required functions are equipped, whether operational organization is consolidated. After confirmation, facilities operation and SWM business are permitted.

As explained above, permission procedures based upon legislation are in effect simple:

a local government will examine the content of the proposed plan, and permission is given if problems are not foreseen.

However, in the course of those legislative procedures in Japan, objections and disputes against plans drawn in the absence of neighbors' participation have increased and related community movements are expanded to criticize local government. Consequently which are increasingly affecting elections of local governors and members of municipal assembly.

Under such circumstances local governments, who have power of permission regarding localization of ISW disposal sites, have adopted following measures:

i. Local governors respectively establish municipal ordinances which stipulate (technical) standards in consideration of environmental preservation and disaster prevention in the area e.g.:

- minimum percentage of green area to be retained in the project area,
- buffer distance to adjacent area,
- maximum concentration limits for treated leachate discharge into sewage,
- embankment slope,
- flood regulation pond, etc..

Those standards should be observed in the proposal of promoting agent as preconditions for localization application. Namely, proposal not complying with these regulations is subject to rejection.

ii. Apart from these requirements in proposal planning, obtainment of following neighborhood consensus is obliged to promoting agent as preconditions on application submission:

- approximately 70% to 100% of consent (to project) from habitants within 100 to 500 meters from the project site,
- consent from people with water use right in rivers where leachate are to be discharged (e.g. an agricultural cooperative association, a freshwater fishermen's union, a party with potable water use right), and from neighboring communal organization.

iii. Prefectural governors often call for opinions from mayors/chiefs of cities, towns and villages concerned for the project. Where there are positive and

consensual responses in majority from mayors/chiefs for the project, which may contribute to prefectural governor's acceptance of application.

Those measures showed substantial effect in restricting problematic moneymaking-oriented SW treatment/disposal projects. On the other hand, some SW treatment/disposal projects realized in poor municipalities/communities (who face financial limitation), whose neighborhood consent was gained through economic incentives to local bodies, introduced another set of problems concerned with local politics.

Meanwhile, (due to surge of protest movement,) even sound projects, which cleared all technical regulations and administrative procedures and paid meticulous attentions to environmental preservation and disaster prevention, faced difficulties in realization. Most projects resulted in vain.

Whereas, the adoption of those measures by local government could imply:

i. Hesitation of local government in enforcing his power of permission,

ii. Local government passed substantial judgement of proposed project in hand of habitants, communities and/or mayors/chiefs of villages, and

iii. It could be viewed that local government abandoned his administrative responsibilities.

Which resulted in increase of troubles and disputes between agent and neighbors.

Under such circumstances, some local governments, with aims of practicing administrative power to issue permission, come to establish ordinances which stipulate procedures of permission.

In practice, following measures come to be employed by local governments in order to clarify localization permission processes which being formerly ambiguous.

i. Mechanism that content of project proposed by the agent be made open to public widely (including neighbor and related communal organization) and opinions be proposed to the local government. i.e., it officially obligates "open to public" and opts "opinions/proposals from neighbors and related organization".

ii. Local government stands at a neutral position among promoting agent,

persons interested and concerned including neighboring habitants and opposing people and organizations. Based on such condition, local government should coordinate project content, clarify points of dispute, express his observation on the issues and finally place judgement on issues. Namely it regulates that a local government as a body responsible for issuance of permission should finalize the decision for disputes.

Among Japanese local governments in this transitional situation mentioned above, some local governments keep passive attitude in permission procedures like described formerly and some local governments take active attitude in permission procedures like described in latter part.

Localization of SWM treatment/disposal facilities in Japan in practice, is neither smoothly promoted nor accepted with consensus of neighbors, unlike through ideal permission procedures recommended.

Nevertheless, gradual improvement of local governments' initiatives in "Localization and Neighborhood Consensus" is observed in the orientation of procedure formulation such as:

i. to obligate project plans be open to public,

ii. to hold opportunities for opposing parties to discuss conflicting issues and to seek solutions (e.g. plan modification and re-arrangement, inclusion of mitigation measures, etc.), and

iii. to recommend subscription of "environmental risk insurance".

L.6.3 Status-quo in Localization Permission and Mechanism of Neighborhood Consensus in MR

The Team's observation upon the MR's status quo in permission procedures and neighborhood consensus are summarized hereunder with referring to MR's recent problems related with localization of domestic SW disposal site and Japanese experiences in the context.

a. *Findings of POS and "Follow-up Research for POS"*

Followings are found through the POS and "Follow-up Research for POS":

i. Poor communication in the past of both public authorities and SWM promoting sectors towards neighborhood community (such as, lack of public hearing, project implementation without notification, promises not kept, information concealment, etc.) worsened the situation and induced stronger objections by neighbors.

ii. Meanwhile, since neither information were disclosed nor in-advance campaigns were not taken place, there are quite a few objections which are mainly based upon their prejudice and mis-conception. It is found that most objections against "incineration facilities" were based upon the prejudice that "incineration means source of smog". Therefore, it is observed that sufficient campaigns and education by promoting sectors are indispensable for establishing "neighborhood consensus" for construction of SWM facilities.

iii. While it is said that there was no successful case of formulation of neighborhood consensus by "compensation" in Chile in the past, as far as observed in this "Follow-up Research for POS", there are few people in the participants in the free discussions who are interested in their "job opportunity" as a compensation for the facilities construction. There seems to be an indication that some sort of compensatory offers (e.g. job opportunity, etc.) might work for accepting the construction with conditions. Meanwhile since the reason why they make "objection without exception and/or strong objection" are considerably attributable to mal- and insufficient- communication in the past, it is needless to say that improvement of communication is indispensable as one of main prerequisites for the formulation of the neighborhood consensus.

b. Permission Procedure which incorporates "Neighborhood Consensus"

It was found in the "follow-up research for POS" that the system to reflect the neighbors' opinions towards the localization of SWM facilities is not well prepared in the permission procedure of the facilities localization, which consequently hinders the neighborhood's ability to understand such projects.

Furthermore, since inappropriate treatment/disposal by illegal dumping is prevalent in the MR, people's distrust towards SWM facilities is accentuated. On the other hand, because correct information regarding SWM facilities are not transmitted or well explained, the neighbors' understanding (of SWM facilities) remains minimal.

As such, the difficulties in obtaining the neighbors' understanding and cooperation for SWM facilities' localization and their nature might be same as that in Japan and other countries.

However it is important, in examining the permission procedures, to pay close attention to what is intrinsic to Chile of the present situation. This is:

i. SWM facilities in Chile are mostly operated by private sectors. In this context, it is quite unlikely that public sectors deal and are responsible for the operation of ISWM facilities. This means that a local government remains the entity responsible for permission and authorization but does not become an ISWM executing body. The local government is able to enforce independent evaluation for ISWM business proposals from executing sectors.

ii. In various countries (like in Japan), the local government requires that a proposal of the promoting sector should include in-advance consensus of the neighborhood and/or related community. Whereas there it is a prerequisite condition/background that neighboring people are able to express their opinion and/or consent/rejection, such stipulations are not secured in the present (political/cultural) status quo in Chile. If appropriate and sufficient information and knowledge to judge suitability of localization of ISWM facilities are not available for neighboring people (including people in general) at present in Chile, conventional neighborhood consensus procedures (from developed countries) cannot be substantiated in Chile's reality.

In view of this, administrative authorities (e.g. local governments) in Chile should secure the conditions that related information be made open to the public, that neighboring people be able to express their opinion/consent/rejection, and that transparency in related procedures be maintained. Furthermore, on the condition that the above-mentioned conditions are secured by the administrative authorities, the process to finalize permission or deny permission for ISWM facilities' localization should be clearly defined and operated.

In practice, measures such as the ones that follow should be necessary to realize a localization of ISWM facilities subject to neighborhood understanding and consensus.

i. Necessary planning particulars (such as structural requirement, O&M standards for SWM facilities, preservation measures for surrounding environment, etc.) should be established and serve as prerequisites for the

permission.

ii. Submission of EIA (at the same time of proposal submission) should be obligated to the promoting sector.

iii. Once a proposal is received and certain examinations by administrative authorities are completed, when a proposal is deemed feasible the information should be made available to the facility's neighbors and presumably affected people (e.g. people that use water downstream). Opinions from related people should be received within a certain time period.

iv. In response to the opinions expressed by the related people, recommendations of revision and/or modifications of the project (or recommendation that the project be withdrawn) should be issued by the authorities. The local authority is responsible for the final judgement of permission or non-permission of a project.

v. On the assumption that the above procedures are secured, where the local authority faces the situation of having to issue a responsible final judgement for a project (of permission or denial of permission), if a committee composed of academics, other related authorities, industrial societies' entities, environmental groups, etc. could be formed and requested for comments, it may provide a significant reference for the judgement that the authority issues.

However, the consolidation of procedures such as the ones mentioned above alone would never cancel the fear and anxieties like the ones expressed by neighbors and related, presumably affected, people. Examples are illustrated below:

- ISWM facilities are detrimental to the regional image,
- environmental pollution might be induced due to inappropriate treatment,
- facilities' construction and O&M might not be carried out as initially proposed in practice,
- when the promoting sector is bankrupt, disposal sites remain abandoned,
- when environmental pollution and damage occurs, promoting sectors' unwillingness to compensate and/or their financial limitation results in no remedy and no compensation.

These fears and apprehensions are prevalent worldwide for all people living close to proposed SWM sites. Therefore, "goals, targets and strategies of the Master Plan", it

is necessary to call all efforts so that target issues for the "formulation of an appropriate ISWM Market Mechanism" be complied with one by one.

L.7 Evaluation of the Master Plan

The principal objective of evaluation here is to appraise the necessities and viabilities of the Master Plan of industrial SWM in MR. The evaluation is to be carried out from the economic, technical, and environmental viewpoints.

L.7.1 Economic Evaluation of the Master Plan

In conducting the economic evaluation of the master plan, it should be taken into account that industrial solid waste handling activities are principally developed by the private sector in MR on the basis of free market policy. The main roles of public sector is to control and supervise ISWM by ISW generators and ISW handling agents. In this regard, the economic evaluation of the master plan here is focused on the following subjects:

a. Evaluation of the prospect of ISW handling business in 2010

One of the important economic benefits to be created by the master plan is the expansion of ISWM business market in MR. The anticipated market scale of ISWM business may also be some of Chilean entrepreneurs' primary concern. Therefore, as a part of economic evaluation, the Study projected the future market scale of ISWM business in MR by estimating the total ISW handling price for each type of business, namely collection and transport, intermediate treatment, and final disposal on the basis of forecasted ISW generation and estimated unit price of ISW handling. Table L.7.1a on next page shows the market scale of ISW handling business on handling price basis for each type of waste.

Table L.7.1a Market Scale of ISW Collection & Transportation, Intermediate Treatment and Disposal in 2010 (1995 handling price basis)

Type of Waste	Collection & Transport	Intermediate Treatment	Final Disposal	Total
Ash (including those from incinerator)	103,000	0	430,000	533,000
Dust and APC products	305,000	243,000	1,148,000	1,696,000
Inorganic sludge	2,524,000	105,000	3,557,000	6,186,000
Organic sludge	5,168,000	18,000	15,904,000	21,090,000
Asbestos	5,000	5,000	18,000	28,000
Acids	70,000	28,000	0	98,000
Alkalis	14,000	5,000	0	19,000
Solvents	2,000	62,000	0	64,000
Oily waste	15,000	373,000	0	388,000
Inorganic chemical residues	274,000	139,000	484,000	897,000
Organic chemical residues	73,000	386,000	24,000	483,000
Other liquid waste	24,000	13,000	0	37,000
Waste from food production	667,000	0	1,001,000	1,668,000
Glass and ceramics	1,527,000	0	191,000	1,718,000
Metal and scrap	83,000	0	10,000	93,000
Paper and cardboard	484,000	0	727,000	1,211,000
Plastic waste	285,000	0	36,000	321,000
Rubber waste	171,000	0	21,000	192,000
Textile and leather waste	69,000	0	103,000	172,000
Waste similar to domestic waste	714,000	0	1,070,000	1,784,000
Wood	162,000	0	243,000	405,000
Slag from melting	96,000	0	365,000	461,000
Construction waste	67,000	0	30,000	97,000
Other solid waste	688,000	825,000	532,000	2,045,000
Total	13,590,000	2,202,000	25,894,000	41,686,000

Remark: APC=Air pollution control

The total ISW handling business market in MR is estimated to be around 41.7 million US dollars (1995 price) based on handling price. It covers about 0.036% of the forecasted GNP of 114.9 billion dollars in 2010 or 0.067% of GNP in 1995 (62,500

million US dollars). As given in Figure L.7.1a below, final disposal business forms the biggest market which is about 62% of the total ISW handling business market. The remaining market is covered by collection and transport (33%) and intermediate treatment (5%).

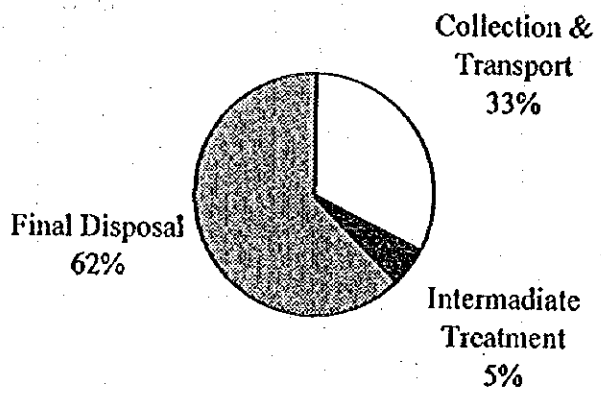

Figure L.7.1a Distribution of ISW Handling Market by Type of Business

The following three figures (Figure L.7.1b, L.7.1c, L.7.1d) indicates the distribution of cost specified by type of waste for each category of ISW handling businesses.

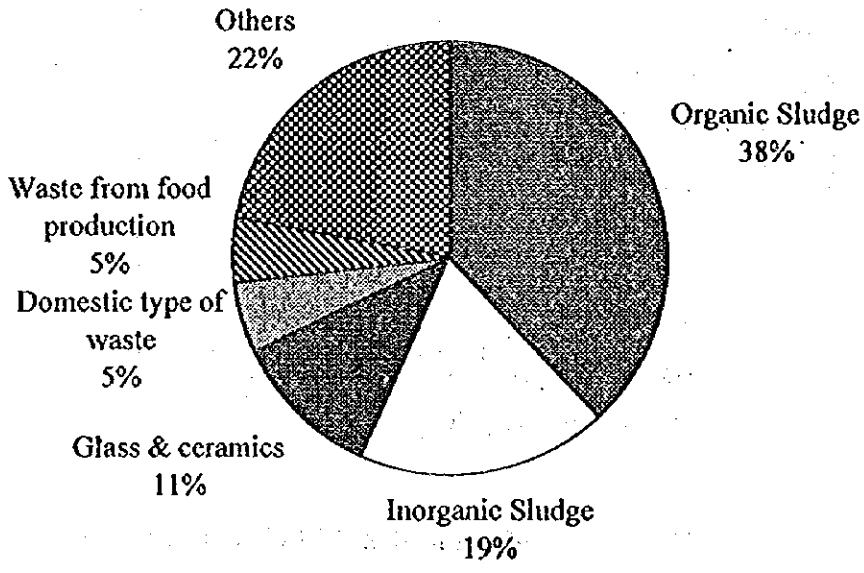

Figure L.7.1b Composition of ISW Collection/Transport Cost by Type of Waste

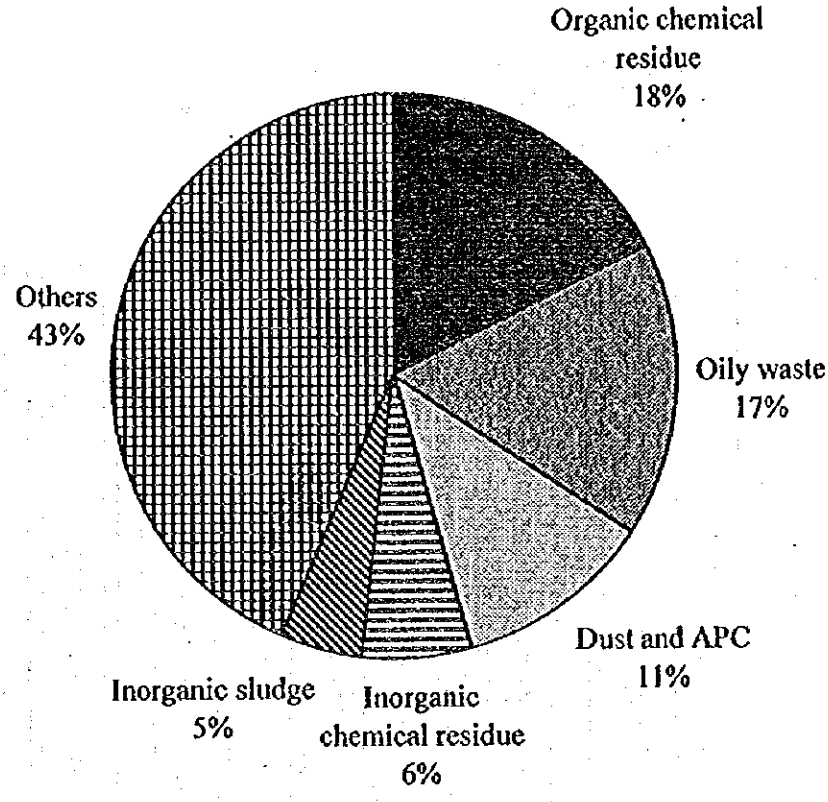

Figure L.7.1c Composition of Intermediate Treatment Cost by Type of Waste

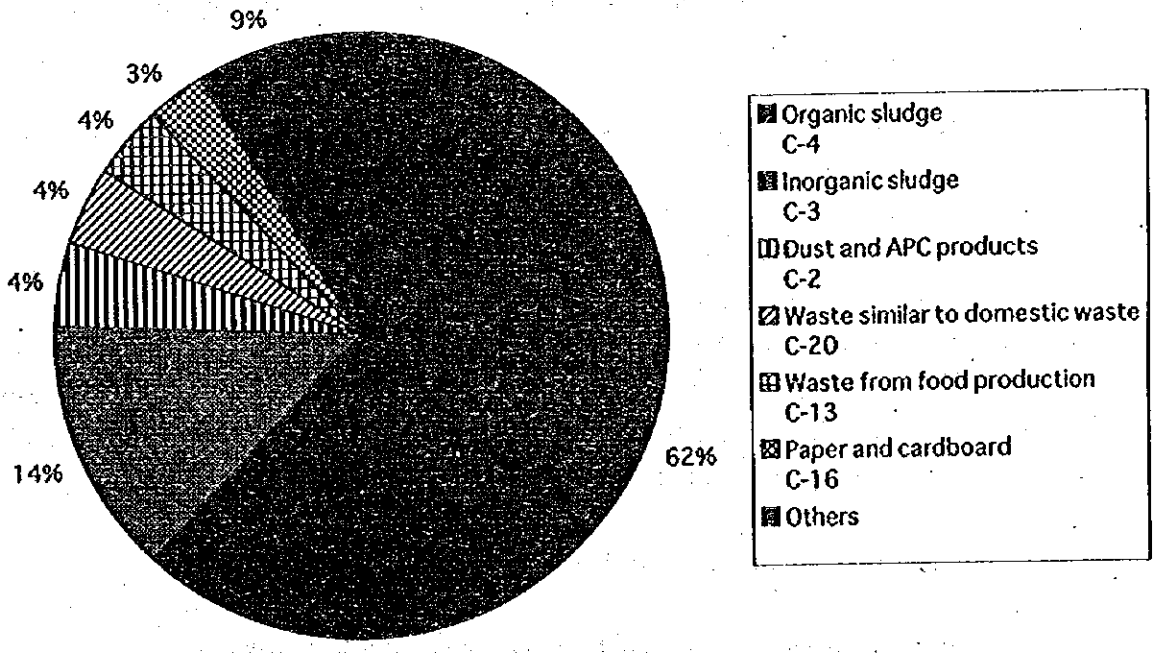

Figure L.7.1d Composition of Final Disposal Cost by Type of Waste

Meanwhile, Figure L.7.1e indicates the ratio of ISW handling cost specified by type of handling for each category of waste. It can be found that cost allocation is different between waste types.

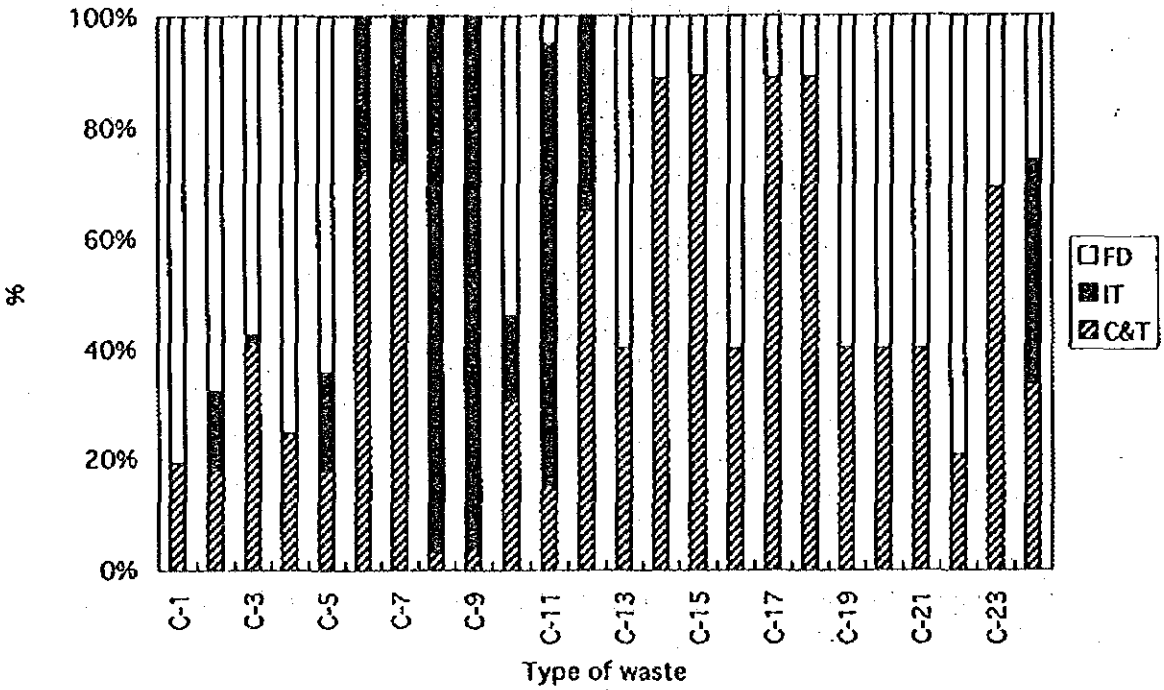

Figure L.7.1e Estimated Cost Allocation ISW Handling by Type of Waste

b. Evaluation on the reasonability of the cost of public administration and generators for implementing the master plan

The expansion of ISW handling business market is to be realized by the improved public administration on ISWM in accordance with the master plan. Therefore, the incremental cost of public administration on ISWM is needed to be examined from cost-efficiency viewpoint. In addition, since the total ISW handling business market is fully based on whether the generators have intent of paying the cost of ISW handling, it is necessary to examine the generators' financial capabilities.

ba. Cost of public administration

Based on the manpower plan for the newly established organization PROGRESI, the Study estimated the public administration cost as given in Table L.7.1b below.

Table L.7.1b Estimation of Incremental Cost of Public Administration for the Implementation of the Master Plan (Year 2010)

Program	Manpower Formation	Manpower Cost (US$/month)
Overall Program	Chief(1) Deputy chief (1) Secretary (1) Lawyer (2)	7,100
Logistic support	Manager (1) Secretary (1) Typist (1) Documentation staff (8) General service staff (6)	8,400
Air emission control	Chief (1) Deputy chief (1) Secretary (1) Engineers for emission permits management (4) Engineers and experts for inspection (5) Engineers and experts for audit (2)	19,100
Solid waste management	Chief (1) Deputy chief (1) Secretary (2) Engineers and experts for manifest system control (4) Technical experts for SWM (1) Engineers and experts for permission & license (7) Engineers and experts for Hazardous SW control (5) Monitoring experts (5)	28,200
Liquid effluent control	Chief (1) Engineer for effluent discharge permits (1) Monitoring staff (2)	4,000
Cleaner production	Chief (1) Training expert (1) Information management expert (1) Engineers for technological appraisal (2)	6,800
	Manpower cost total (US$/month) (US$/year)	73,600 883,200
	Overhead cost (50% of manpower cost)	441,600
	Total (US$/year at 1995 price)	**1,324,800**

The incremental cost of public administration for implementing the master plan is, as given in the table above, estimated to be about 1.3 million US dollars in 2010. Its ratio to the total ISW handling business market (on handling price basis) is only about 3.1%. Accordingly, it indicates that approximately 41.7 million dollars of ISW handling business market is to be created by conducting the proper control and management of ISW in accordance with the master plan at a cost of 1.3 million US dollars.

bb. Sensitivity analysis on the generators' cost of ISW handling

To assess viability of the cost to be covered by ISW generators, the Study made a sensitive analysis by setting up an alternative scenario of ISWM in 2010. The difference between the alternative scenario and the master plan is in the reduction ratio of sludge amount on-site (inside factories). In the alternative scenario, the water content of sludge at generation source is assumed as 90% for inorganic sludge and 99% for organic one respectively while the master plan assumes that it is 85% for both types of sludge on-site. In other words, the alternative scenario assumes that sludge dehydration is made only outside factories by ISW handling agents and there is no reduction of sludge amount on-site by generators. Table L.7.1c compares the total ISW handling cost between the case of alternative scenario and master plan.

Table L.7.1c Comparison of ISW Handling Cost in 2010 Between Alternative Scenario and Master Plan

Unit: US$/year

	Alternative Scenario	Master Plan
Collection & Transportation	50,562,000	13,590,000
Intermediate Treatment (dehydration on-site)	0	10,722,000
Intermediate Treatment (outside factory)	8,932,000	825,000
Final Disposal	25,894,000	25,894,000
Total	**85,388,000**	**52,408,000**

As obviously found in the table above, reduction of sludge amount at generation source is a crucial factor to limit incremental cost of ISW handling especially for collection and transportation in future. In addition, the necessity of in-factory reduction of sludge amount is also supported by the estimation results regarding the ratios of the total ISW handling cost to the total output value for each type of manufacturing industry in 2010.

In this estimation, the total ISW handling cost includes collection and transportation, intermediate treatment (both on-site and outside factories), and final disposal. The total output value for each type of manufacturing industry, on the other hand, is forecasted by utilizing the increase rate of production which was used for projecting the number of employees and existing output value data available in the CORFO (Corporación de Fomento de la Producción) Study. Table L.7.1d and L.7.1e show the results of estimation for each case of alternative scenario and master plan respectively.

Table L.7.1.d Ratio of ISW Handling Cost to the Output Value in Manufacturing Industry in 2010 (Alternative Scenario)

CIIU	Sub-Sector	Sales per employee in 2010 (US$/year)	ISWM cost per employee (US$/year)	Ratio (%)
311	Food Manufacturing	18,966	261	1.38%
313	Beverage Industries	54,504	759	1.39%
314	Tobacco Industries	64,890	96	0.15%
321	Textile Industries	14,033	54	0.38%
322	Wearing Apparel Manufacturing	10,508	5	0.05%
323	Leather Industries	12,639	613	4.85%
324	Leather Footwear manufacturing	10,243	3	0.03%
331	Wood & Cork Industries	11,704	45	0.38%
332	Wooden Furniture & Fixture	9,264	19	0.20%
341	Pulp & Paper Manufacturing	43,292	1,524	3.52%
342	Printing and Publishing	26,125	40	0.15%
351	Industrial Chemical Products	32,785	742	2.26%
352	Other Chemical Products	59,672	133	0.22%
354	Petroleum & Coal Products	20,224	238	1.18%
355	Rubber Products Manufacturing	23,455	196	0.83%
356	Plastic Products Manufacturing	20,693	16	0.08%
361	Potteries, Tiles, and Other Clays	8,469	370	4.37%
362	Glass Products Manufacturing	39,637	450	1.14%
369	Non-Metallic Mineral Products	46,882	926	1.98%
371	Iron & Steel Industries	19,460	696	3.58%
372	Non-Ferrous Metal Products	50,131	48	0.10%
381	Metal Products Manufacturing	20,393	66	0.32%
382	Non-Electrical Machinery	20,380	9	0.04%
383	Electrical Machinery	33,582	48	0.14%
384	Transport Equipment	16,107	15	0.09%
385	Professional, Scientific, Optics	23,359	163	0.70%
390	Other Manufacturing Industries	5,539	15	0.26%
	Average			1.10%

Table L.7.1e Ratio of ISW Handling Cost to the Output Value in Manufacturing Industry in 2010 (Master Plan)

CIIU	Sub-Sector	Sales per employee in 2010 (US$/year)	ISWM cost per employee (US$/year)	Ratio (%)
311	Food Manufacturing	18,966	155	0.82%
313	Beverage Industries	54,504	485	0.89%
314	Tobacco Industries	64,890	96	0.15%
321	Textile Industries	14,033	34	0.24%
322	Wearing Apparel Manufacturing	10,508	4	0.04%
323	Leather Industries	12,639	345	2.73%
324	Leather Footwear manufacturing	10,243	3	0.03%
331	Wood & Cork Industries	11,704	45	0.38%
332	Wooden Furniture & Fixture	9,264	19	0.20%
341	Pulp & Paper Manufacturing	43,292	855	1.98%
342	Printing and Publishing	26,125	40	0.15%
351	Industrial Chemical Products	32,785	406	1.24%
352	Other Chemical Products	59,672	77	0.13%
354	Petroleum & Coal Products	20,224	131	0.65%
355	Rubber Products Manufacturing	23,455	124	0.53%
356	Plastic Products Manufacturing	20,693	12	0.06%
361	Potteries, Tiles, and Other Clays	8,469	354	4.19%
362	Glass Products Manufacturing	39,637	289	0.73%
369	Non-Metallic Mineral Products	46,882	604	1.29%
371	Iron & Steel Industries	19,460	447	2.29%
372	Non-Ferrous Metal Products	50,131	44	0.09%
381	Metal Products Manufacturing	20,393	51	0.25%
382	Non-Electrical Machinery	20,380	9	0.04%
383	Electrical Machinery	33,582	42	0.12%
384	Transport Equipment	16,107	9	0.06%
385	Professional, Scientific, Optics	23,359	162	0.69%
390	Other Manufacturing Industries	5,539	10	0.18%
	Average			0.75%

As a result, the average ratio of ISW handling cost to the total output value is 1.10% in alternative scenario, which is much higher than the ratio of 0.75% in the master plan. This result also implies that reduction of sludge amount at generation source is a reasonable option to be employed by generators for limiting the incremental cost of ISW handling in future. However, it should be noted that dehydration cost of sludge on-site is calculated based on the average sludge discharge amount. Therefore, the cost for small and medium scale industries shall be higher than the average.

On the other hand, even in the case of master plan, there are 6 types of manufacturing industries in which the ratio of ISW handling cost exceed 1% of the total output value. Because the affordable limit of ISW handling cost is said to be 1% of the total output value in Japan, it may be hard for these industries to pay the cost of ISW handling. Table L.7.1f specifies the percentage distribution of ISW handling cost by type of waste for these 6 industries.

Table L.7.1f Waste-specific Percentage Distribution of ISW Handling Cost

Type of industry	Waste-specific percentage distribution of ISW handling cost (%)			
Leather industry	Organic sludge 71.7%	Inorganic sludge 17.5%	Leather waste 6.8%	Others 4%
Paper & pulp	Organic sludge 72.5%	Inorganic sludge 17.7%	Paper & cardboard 2.9%	Others 6.9%
Industrial chemical products	Organic sludge 76.5%	Inorganic sludge 18.6%	Other liquid waste 2.3%	Others 2.6%
Potteries & ceramic products	Glass & ceramics 78.4%	Dust & APC 14.6%	Organic sludge 4.2%	Others 2.8%
Non-metallic mineral products	Organic sludge 49.4%	Inorganic sludge 12.0%	Dust and APC 7.4%	Others 31.2%
Iron & steel industry	Organic sludge 51.9%	Inorganic sludge 12.6%	Slag 12.1%	Others 23.4%

Except for potteries and ceramic industry, sludge handling cost still covers a big part of ISW handling cost in the 5 industries. Therefore, it may be necessary for these industries to make further efforts of efficiently handling sludge generated, such as the application of low cost treatment technology, recycling of treated sludge, and so forth.

Regarding potteries and ceramic industries, on the other hand, the possibility of limiting the handling cost may be found in recycling of glass and ceramic wastes as well as sludge and dust.

Moreover, reduction of sludge amount at source by generators may be a heavy burden especially for small industrial enterprises. Accordingly, it is important that the authority shall promote joint construction and operation of dehydration facilities, recycling of ISW and so on.

c. Benefits of the master plan for the future Chilean economy

In addition to the direct economic effect of creating a new ISW handling business market, implementation of the master plan is inferred to bring the following positive effects towards the future economy in MR:

ca. Benefits to the future international trade under NAFTA (North American Free Trade Agreement) and/or the standard for environmental management of ISO (International Organization for Standardization) 14000

As found in the recent trend of the establishment of the provision regarding environmental management in NAFTA and formulation of the international environmental management standard called ISO 14000, implementation of proper environmental management is estimated to be a principal term of participating in the international trade market in the near future. Therefore, to develop and expand the international market for the Chilean domestic products, domestic enterprises in Chile have to comply with the environmental management to be required under NAFTA and ISO 14000 as soon as possible. In this regard, execution of the master plan will be also important for all the Chilean entrepreneurs to expand their market at international level.

cb. Benefits in terms of developing relevant industries

Establishment of overall ISWM system in MR will not only expand the market of ISW handling business, but also create new or additional business opportunities relevant to ISWM. The expected types of business market to be created or increased are:

- Pollution abatement equipment manufacturing industry
  (Flue gas/waste water treatment facilities and equipment, environmental monitoring equipment, etc.)
- Industries relevant to the introduction of cleaner production technology
  (energy / material saving equipment, water recirculation technology, waste heat collection and recycling technology, etc.)
- Environmental service industries
  (Plant design and engineering service related to the introduction of

CPT, environmental monitoring service, environmental consulting service, etc.)

cc. Benefits in terms of introducing foreign capital investment to MR.

Establishing proper environmental management system including ISWM is one of important conditions to promote foreign capital investment in MR since in most of developed countries foreign investment project is also required to conduct strict environmental management as required in domestic investment. Therefore, foreign investment to less environmentally conscious countries may decrease in the near future. On the other hand, if overall ISWM is executed in accordance with the master plan in Chile, a high quality ISW treatment and disposal is made possible with much lower cost than developed countries. It may be a big advantage in promoting foreign capital investment to MR. Thus, implementation of the master plan can also be identified as an important policy measures for the promotion of foreign capital investment.

L.7.2 Technical Evaluation of the Master Plan

The basic objective of the master plan on ISWM in MR is to establish the most appropriate public administration system for properly controlling ISW handing process from generation source to the final disposal based on the accurate identification of waste characteristics. Hence, technical evaluation of the master plan here is to examine whether the public administration system development plan is well established enough to manage and supervise ISW emission control (storage, treatment, and disposal) at source (ISW generators) and ISW handling (collection and transportation, intermediate treatment, and final disposal) by private sector. From this viewpoint, the Study made technical evaluation of the master plan with respect to administrative measures applied and technical capability of implementing the above measures.

a. Evaluation of the administrative measures to be applied

Administrative measures that were adopted in the master plan were settled as shown in Table L.7.2a below.

Table L.7.2a Administrative Measures for Supervising ISWM in the Process from Generation to Final Disposal

ISWM Stage	Administrative Measures
ISWM at source (inside factory)	@ Waste generation control by manifest system (declaration system) (Investigation items) - Identifying generation characteristics of ISW for each type of industry based on the data of material & energy input, types of products, and material input/output balance. - Identifying the potential of environmental pollution by flue gas and waste water. - Clarifying present condition of ISW generation. - Clarifying present condition of in-factory ISW management, treatment, and disposal. - Clarifying present condition of consigned ISW handling
ISWM outside factory	@ ICRT (Ignitability, Corrosivity, Reactivity, and Toxicity) test (Testing items) - Identifying hazardous/non-hazardousness - Identifying appropriate intermediate treatment methods - Identifying appropriate disposal methods @ Leaching test (Testing item) - Identifying hazardous/non-hazardousness of the wastes after intermediate treatment - Identifying appropriate type of disposal site (SCL/CL/IL) @ Solubilization test (Testing item) - Identifying appropriate type of disposal site (CL/IL)

The above administrative measures are to be taken on the basis of self-reporting by the waste generators and waste handling agents. Accordingly, cross-examination of the report forms an important part of public administration so as to avoid false reporting by the generators and/or agents. It is also important to establish legal framework that strictly regulates the self-reporting system. These necessary actions of public administration are all specified in the master plan in detail. As far as the public administration of ISWM is carried out in accordance with the master plan, therefore, the objective of the master plan will certainly be accomplished by the year 2010.

b. Evaluation on technical capability of implementing the master plan

Regarding the municipal solid waste management in MR, technology level is high enough even comparing with developing countries', especially on landfill technology. Therefore, it is considered that Chilean private sector has enough capability of handling advanced ISW treatment and disposal technologies. Concerning the ISWM, on the other hand, a number of mishandling cases can be found mainly due to the lack of knowledge on ISW itself and its proper handling methods. In order to improve such present conditions, the Study gives extensive instructions in the master plan. For instance, the study formulated conceptual flows of waste treatment and disposal for