7.1.2 ISWM by Generators (In-Factory)

a. Major Issues on Generator's ISWM in MR

Based on the results of the surveys relating to this Study, fundamental issues of ISWM at waste generators can be focused on the following points.

aa. Dissemination of Proper Knowledge on ISW and Increasing Public Awareness on ISWM

According to a result of the Team's factory survey, although about 80% of the 199 generators surveyed answered that they have designated personnel in charge of waste management, the characteristics of the factory's waste generation is not clearly identified and knowledge about proper ISW treatment and disposal is also insufficient. As a result, inappropriate management of ISW is continuously carried out by waste generator, e.g. discharge of the waste water contaminated by hazardous substances directly to the sewer and/or watercourse and disposal of hazardous ISW to municipal landfill. Most of these cases occurred because of the lack of knowledge.

Accordingly, to realize proper ISWM at waste generation source, dissemination of accurate knowledge on ISW itself and its handling technologies to the waste generators should be given a first priority.

ab. Issues on In-factory Flue Gas and Waste Water Treatment

Another important implication of the Team's survey result is that majority of the surveyed factories that have heat charging and/or watering processes are not equipped with flue gas and/or waste water treatment facilities (84% and 62% respectively), and consequently a considerable amount of dust and APC products and sludge are directly emitted to the environment (sewer, watercourse or atmosphere). Since some of those factories use the raw materials such as heavy metals, solvents, pigment, etc., hazardous materials may have already been discharged into water courses and rivers. Considering such possibility of pollution, remedial actions against flue gas and waste water are to be identified as the top priority of environmental management for most of factories.

Moreover, if flue gas and waste water treatment are carried out by using the end-of-pipe technologies, a large amount of dust and sludge will be captured and generated in factories. Proper treatment and disposal of these additional wastes is another problem for waste generators in the future, especially a burden of cost for proper treatment/disposal.

b. Basic Framework of ISWM and Waste Minimization by Waste Generators

Based on the above-mentioned major issues of ISWM for waste generators, ISWM and waste minimization at generators should be basically implemented by the following steps.

Step 1: Proper identification of generation characteristics of ISW by waste generators

This step is to be taken by disseminating and enhancing the existing manifest system (declaration system), by which proper knowledge and awareness on ISW is to be cultivated.

Step 2: Proper management of ISW and selection of the optimum waste minimization measures to be applied inside factories and its implementation

Based on the accurate identification of waste emission characteristics by generators, the optimum management and minimization methods are to be selected for implementation. Particularly, regarding the anticipated increase of dust and sludge generation by the implementation of end-of-pipe flue gas and waster water treatment methods, it is important to consider the introduction of cleaner production technology in terms of its cost efficiency as well as efficient reduction of waste generation.

c. Waste Auditing as Means of Identifying the Waste Emission Characteristics of the Factories

A manifest system is very useful for public administration to supervise the waste generation and handling practices. However, in terms of examining the potential of waste minimization, the information obtained from the manifest system is very limited. In order to prevent and reduce waste generation, overall industrial production process need to be examined for the identification of waste generation sources, operational problems associated with the production process, and finally the areas where improvement can be made.

A waste audit is a typical means of problems identification by clarifying the overall material flows from input to output through observation, measuring, recording data, collecting and analyzing waste samples. Detailed waste audit manual is published by the UNEP/UNIDO Audit and Reduction Manual for Industrial Emissions and Wastes,

which may be useful if a waste audit is conducted by the factory itself or by a third party.

The waste audit can identify the problems at various level. A waste audit of a region can indicate the specific problem industries. Hence, at plant level, waste generation sources can be identified during particular processes. This system may be useful for factories to clearly identify the waste emission characteristics and the possible areas of waste minimization.

d. Possible Areas of Waste Minimization

Possible areas of waste minimization varies with type of industries, applied production processes, use of raw materials, energy input processes, operational conditions associated with industrial process, etc.. Each factory should find the areas of waste minimization by clearly identifying the production process associated with waste generation on the basis of examining the material balance. However, to provide a basic idea, the Study makes a brief explanation regarding the possible areas of waste minimization in accordance with the basic process of industrial production, which is mainly divided into raw material procurement and production phases.

da. Possible Areas of Waste Minimization in Raw Material Procurement Phase

Possible areas of waste minimization in this phase are:

- increase the use of recycled or wasted materials and to promote their use; and
- substitute energy resources that has low waste generation or pollutant emission.

daa. Use of Recycled or Wasted Materials

The use of recycled or wasted resources as raw material is an important option for reducing the wastes to be otherwise generated by extracting new raw materials for industrial production.

In addition to the development of recycled products and its use, it is also necessary to develop technologies of removing impurities from the wastes as well as from recycled materials for upgrading the quality of products. Sorting and pre-treatment of wastes may be necessary to increase the use of recycled products.

dab. Fuel Substitution

To minimize the generation of air pollution substances during fuel combustion, low pollutant emission energy is needed to be preferred as energy sources in factories. The reduction of air pollutant also decreases the generation amount of dust and APC products. However, energy security is another important view to be taken into account in selecting the best available energy resources. The following options of fuel substitution may be considered as waste minimization measures.

- increasing the use of LNG (Liquefied Natural Gas) and LPG (Liquefied Petroleum Gas) as an energy source
- use of waste materials as fuels (waste tires, etc.)
- use of renewable energies (photovoltaic, solar heat, wind power, hydro-power, geothermal power, etc)

db. Possible Areas of Waste Minimization in Production Phase

Major possible areas of waste minimization is found in production processes for most manufacturing industries. Improving the production process not only reduce the waste generation but also brings about positive effects, i.e. reduction or even elimination of environmental pollution, energy and raw materials saving, increasing productivity, and so forth. The areas of waste minimization in this phase consist of :

- energy saving
- improving production process for raw (input) materials saving
- effective reutilization of materials generated in production process
- improving production process for reduction of wastes and pollutant emission.
- reducing the use of hazardous materials
- research and development of innovative environmentally friendly production process

dba. Energy Saving

Energy saving measures are mainly divided into two types, namely improvement of production process for energy saving and introduction of unutilized energy and waste heat utilization system.

i. Improvement of production process for energy saving

Minimization of energy consumption in production process can be principally

conducted by the following type of process improvement :

- Simplification and/or efficiency improvement of production process;
- Strict energy consumption control and management; and
- Introduction of high efficiency production facilities and/or equipment.

ii. Introduction of unutilized energy and waste heat utilization system

Examples of waste heat and unutilized energy using technologies to be introduced to the factories are:

- Co-generation system, heat pomp system, and waste heat boilers; and
- Collection technologies of medium and low temperature energy (heat).

dbb. Improvement of Production Process for Raw Materials Saving

Examples are very limited, but the following improvement methods are considered regarding this type.

- Development of ink-jet dyeing*1 technology for saving dye
  (synthetic fibre industry)
- Development of no sizing yarn*2 which saves the use of starch.
  (synthetic fibre industry)
- Development of high efficiency coating (painting) technology to save paints
  (automobile industry)

*1: ink-jet dyeing
It is an innovative dyeing technology presently being developed in Japan to increase efficiency in the use of dye. The ink-jet is a method of high speed printing technologies with which ink is sprayed on paper with static electricity. This technology is widely used for printers. Japanese dyeing industry is presently examining the application of this technology for dyeing.

*2: no sizing yarn
As the sludge generated from sizing process is the biggest source of industrial waste in dyeing industry, Japanese industries are presently developing the so-called no sizing yarn which can be wove into cloth without any size.

dbc. Reutilization of Materials Generated in Production Process

Reutilization of materials generated in production process do not have to be limited to inside factories, but should be expanded to outside factories by inter-sectoral cooperation in this field. The relevant methods and technologies here are categorized into the following types:

- in-factory (in-process) recycling
- development of recycling and reutilization technologies inside production process
- Expanding the use of recycled products outside factories

i. In-factory (in-process) recycling

In-factory recycling implies the reuse of the generated materials inside its own production process or other activities inside factories. Thermal recycling of generated materials by combustion is also included in this type.

ii. Development of recycling and reutilization technologies inside production process

To promote in-factory recycling and reuse, efficient collection and recycling technologies are needed to be developed. Such technologies include:

- high efficiency collection and recycling technologies of waste oil
- development of collecting recyclable material from aluminum hydroxide sludge
- recycling of waste sand from foundries
- collection of raw materials for polyester that are eluted from the production process of synthetic fibers

iii. Expanding the use of recycled products outside factories

Some of the generated materials in production process may be more useful in other industries. Wider use of generated materials increases the possibility of more waste minimization. The industrial wastes which may be utilized for other industries include, for example :

- sulfur and sulfuric acid generated from non-ferrous metal and oil products industries
- copper slag generated from non-ferrous metal industry

- steel slags generated from iron & steel industry
- sludge, incineration ashes, and dust generated from synthetic fibre industry

dbd. Improving Production Process for Reduction of Wastes and Pollutant Emission

In the case of factories in MR, the first priority is to be given to the reduction of air and water pollutants although it causes the increase of ISW generation and may cost much. Therefore, the facilities and equipment that capture these pollution substances should be installed for the existing factories as soon as possible. In the longer term, however, more efficient methods of reducing wastes and pollutant emission is to be applied, which is generally called Cleaner Production Technology (CPT). Especially, regarding the reduction of waste water discharge, application of the Closed Water Use System may be subject to the examination in the future.

dbe. Reducing the Use of Hazardous Materials

Reducing the use of hazardous materials is one of the important issues to be widely examined by all factories.

dbf. Research and Development of Innovative Environmentally Friendly Production Process

The last and the most important technologies to be developed in the future is, as mentioned above, advanced CPT (newly developed and developing CPT), which innovatively convert production processes into environmentally friendly ones.

e. *Implementation Plan of In-Factory ISWM and Waste Minimization*

In-factory ISWM is, in principle, self-efforts of proper ISWM and waste minimization by generators in coordination with ISW handling agents. As the measures for proper ISWM and waste minimization vary with type of industries, scale of factories, applied production system, and so forth, it is not practical to refer to the implementation plan for each type of industry. Even within one type of manufacturing industry, ISWM and waste minimization measures may be completely different between factories. Therefore, the Study proposed the implementation plan by setting up the common goals and targets to be achieved by ISW generator up to 2010.

ea. Goals

The proposed goals of in-factory ISWM and waste minimization in 2010 are:

- To realize proper in-factory control of ISW based on the overall identification of waste generation and pollutant emission characteristics of own factories.
- To minimize the pollutant emission to the environment by utilizing the best available pollution abatement technologies.
- To minimize waste generation by incorporating the best available material recycling and reutilization technologies or introducing advanced CPT into the production system.
- To reduce the use of hazardous materials that may generate HW by the generator's continuous efforts of technology development.

eb. Targets

The targets of the master plan are proposed for three periods, i.e. the short-term (1996-2000), the medium-term (2001-2005), and the long-term (2006-2010), as given in Table 7.1.2a below.

Table 7.1.2a Generator's Targets of In-factory ISWM and Waste Minimization (1996-2010)

Short-term (1996-2000)

1. Manifest system
   - Generation of ISW is accurately identified and reported to the authorities as required under the improved manifest system (declaration system).

2. Environmental audit
   - Identification of waste generation and pollutant emission characteristics is to be commenced by the generators (environmental audit).

3. Flue gas and waste water treatment
   - Installation of end-of-pipe facilities is to be carried out in the existing factories.

4. Use of recycled or abandoned materials in factories (primary stage)
   - Sorting of the recyclable / non-recyclable ISW is to be initiated inside factories.

5. Primary energy saving efforts are carried out by factories
   - The worker's awareness on energy saving is to be increased.
   - Factory operation is improved to be more energy conscious.
   - Energy consumption inside factory is controlled and supervised.
   - Old or less energy efficient facilities are renewed.

6. Primary raw materials saving efforts are carried out by factories
   - The worker's awareness on raw materials saving is to be increased.

Medium-term (2001-2005)

1. Environmental audit
   - Waste generation and pollutant emission characteristics of own factories are identified by generators.

2. Use of recycled and abandoned materials
   - Use of the recycled and/or abandoned materials for industrial production is sufficiently conducted by factories.

3. Fuel substitution
   - The possibility of fuel substitution is to be examined by factories.

4. Energy saving
   - Introduction of conventional high efficiency production facilities / equipment is carried out.
   - Introduction of unused energy and/or waste heat utilization system is to be examined for application.

5. Raw materials saving
   - Conventional raw materials saving methods are examined for application.

6. In-factory recycling through the change of process
   - Conventional in-factory recycling methods are examined for application.

7. Reducing the use of hazardous materials
   - The use of non-hazardous materials are examined for application.

Long-term (2006-2010)

1. The conventional waste minimization technologies and methods (inc. CPT) are to be widely applied by factories.

2. Research and development of advanced (newly developed) CPT is to be carried out.

ec. Necessary policy measures for target compliance

Policy measures requiring compliance with the above targets are specified in the prerequisite for establishment of on-site ISWM (see Table 6.2.3a in the main text). Some of the additional policy tools may be needed such as :

- guidelines/manuals for environmental audit of industrial production process;
- regional (or maybe national) inventory of CPT and material recycling/reutilization technologies;
- government sponsored demonstration program of technologies relating to waste minimization (trade fairs, exhibitions, etc.); and
- providing incentives to the factories of applying environmentally friendly technologies (awards, labeling of environmentally friendly products, etc.).

7.2 Examination of Technical Standard

7.2.1 Outline of Contents for Technical Standards

a. Principle of Establishing Technical Standard

In order to establish standards for technical systems (e.g. storage, collection, transport, intermediate treatment, recycling and final disposal), the following issues need to be solved:

- coordination of various related authorities be taken;
- in-depth examination by many experts and personnel from related authorities be placed and coordinated;
- quite a long time be spent for the work of standard establishment.

Therefore, technical standards can not easily be established in such a short time as given for the Study. Fortunately an ISWM manual was drafted in May 1995 by a local consultant as a joint study of Ministry of Economy (Department of Commercial and Industrial Policy) and CONAMA. Although the manual seems insufficient to be employed as technical standards of individual technical systems (technical standards for e.g. incineration facilities, final disposal facilities, etc.), it could serve as basis for the standards compilation work. Other standards (such as those in USA, Brazil) should be referred and intrinsic Chilean conditions (natural, social, economic, etc.) should be

taken into consideration, where all related authorities discuss at length in examining and establishing standards for individual technical systems.

Individual technical systems to be established are listed and the outline of contents to be presented in respective standards of individual technical systems are indicated below.

b. Outline of Contents of Each Technical Standard

ba. Standards Applicable to Generators of HW

i. General
- Purpose, scope, and applicability
- Hazardous waste determination

ii. The manifest
- General requirements
- Acquisition of manifests
- Number of copies
- Use of the manifest

iii. Pre-transport requirements
- Packaging
- Labeling
- Marking
- Placarding
- Accumulation time

iv. Recordkeeping and reporting
- Recordkeeping
- Ordinary reporting
- Additional reporting

v. Exports of HW
- Applicability
- Definitions
- General requirements
- Notification of intent to export
- Special manifest requirements
- Ordinary reports

- Annual reports
- Recordkeeping

bb. Standards Applicable to Transporters of HW

i. General
- Scope
- Transfer facility requirements

ii. Compliance with the manifest system and recordkeeping
- The manifest system
- Compliance with the manifest
- Recordkeeping

iii. HW discharges
- Immediate action
- Discharge clean up

bc. Standards for Owners and Operators of HW Treatment, Storage and Disposal Facilities

i. General
- Purpose, scope and applicability
- Imminent hazard action

ii. General facility standards
- Applicability
- Required notices
- General waste analysis
- Security
- General inspection requirements
- Personnel training
- General requirements for ignitable, reactive or incompatible wastes
- Location standards
- Construction quality assurance program

iii. Preparedness and prevention
- Applicability
- Design and operation of facility
- Required equipment
- Testing and maintenance of equipment

- Access to communications or alarm system
- Required aisle space
- Arrangements with local authorities

iv. Contingency plan and emergency procedures
- Applicability
- Purpose and implementation of contingency plan
- Content of contingency plan
- Copies of contingency plan
- Amendment of contingency plan
- Emergency coordinator
- Emergency procedures

v. Manifest system, recordkeeping and reporting
- Applicability
- Use of manifest system
- Manifest discrepancies
- Operating record
- Availability, retention and disposition of records
- Unmanifested waste report

vi. Releases from solid waste management units
- Applicability
- Required programs
- Ground-water protection standard
- Hazardous constituents
- Concentration limits
- Point of compliance
- Compliance period
- General ground-water monitoring requirements
- Monitoring program

vii. Closure and post-closure
- Applicability
- Closure performance standard
- Closure plan; amendment of plan
- Closure; time allowed for closure
- Disposal or decontamination of equipment, structures and soils
- Certification of closure
- Survey map
- Post-closure care and use of property

- Post-closure plan; amendment of plan
- Post-closure notices
- Certification of completion of post-closure care

viii. Financial requirements
- Applicability
- Cost estimate for closure
- Financial assurance for closure
- Cost estimate for post-closure care
- Financial assurance for post-closure care
- Use of a mechanism for financial assurance of both closure and post-closure care
- Liability requirements
- Incapacity of owners or operators, guarantors, or financial institutions

ix. Use and management of containers
- Applicability
- Condition of containers
- Compatibility of waste with containers
- Management of containers
- Inspections
- Containment
- Special requirements for ignitable or reactive waste
- Special requirements of incompatible wastes
- Closure

x. Tank-systems
- Applicability
- Assessment of existing tank system's integrity
- Design and installation of new tank systems or components
- Containment and detection of releases
- General operating requirements
- Inspections
- Response to leaks or spills and disposition of leaking or unfit-for-use tank systems
- Closure and post-closure care
- Special requirements for ignitable or reactive wastes
- Special requirements for incompatible wastes

xi. Landfills

- Applicability
- Design and operating requirements
- Leakage rate
- Monitoring and inspection
- Response actions
- Surveying and recordkeeping
- Closure and post-closure care
- Special requirements for ignitable or reactive waste
- Special requirements for incompatible wastes
- Special requirements for bulk and containerized liquids
- Special requirements for containers

xii. Incinerators

- Applicability
- Waste analysis
- Principal organic hazardous constituents
- Performance standards
- Hazardous waste incinerator permits.
- Operating requirements
- Monitoring and inspections
- Closure

xiii. Air emission standards

- Applicability
- Definitions
- Standards
- Test methods and procedures
- Recordkeeping requirements
- Reporting requirements

bd. Landfill Disposal Restrictions

i. General

- Purpose, scope and applicability
- Definitions applicable in this part
- Dilution prohibited as a substitute for treatment
- Treatment surface impoundment exemption
- Petitions to allow land disposal of a waste prohibited
- Waste analysis and recordkeeping

ii. Prohibitions on land disposal

iii. Treatment standards
- Applicability of treatment standards

iv. Prohibitions on storage

be. Guidelines for the Thermal Processing of Solid Wastes

i. General provisions
- Scope
- Definitions

ii. Requirements and recommended procedures
- Solid wastes accepted
- Solid wastes excluded
- Site selection
- General design
- Water quality
- Air quality
- Vectors
- Aesthetics
- Residue
- Safety
- General operations
- Records

bf. Guidelines for the Land Disposal of Solid Wastes

i. General provisions
- Scope
- Definitions

ii. Requirements and recommended procedures
- Solid wastes accepted
- Solid wastes excluded
- Site selection
- Design
- Water quality
- Air quality
- Gas control

- Vectors
- Aesthetics
- Cover material
- Compaction

7.2.2 Examination of Structure for Final Disposal Facilities

As mentioned above, the Study in principle does not handle individual technical standards. However, since final disposal facilities, especially HW final disposal facilities draw attentions as the most crucial and urgent issue to be solved, structures for them are examined below in order to facilitate the establishment of a final disposal facility.

a. Types of Final Disposal Facilities

Upon consideration the principal function required of final disposal facilities, 3 types of final disposal facilities, in accordance with the degree of hazardousness of the SW to be disposed of, are proposed in this Study. Table 7.2.2a shows 3 types of landfills and the types of waste to be disposed there.

Table 7.2.2a Types of Landfill

Types of Landfill	Types of Waste
Strictly Controlled Landfill (SCL)	Hazardous Waste
Controlled Landfill (CL)	Non-Hazardous, Non-Inert Waste
Inert Landfill (IL)	Inert Waste

b. Leachate

Leachate is the most liable source of pollution from final disposal facilities to adjacent areas. Since, precipitation and evapotranspiration in the MR are 300-600 mm/year and 1,350-1,800 mm/year respectively, evapotranspiration exceeds precipitation. Therefore, in the MR it is not necessary for leachate generated at disposal sites to be taken outside of the system and trea . Excessive leachate generated in the rainy season (if any) may be kept in a retarding pond and later circulated in the landfill.

In principle, the collection and circulation of leachate accelerates the evaporation of the leachate's waster content and it suffices as a treatment method, if enough storage

facilities (pits) for temporary excess leachate are installed. However, in the southern regions in Chile where precipitation exceeds evapotranspiration, leachate generated at disposal sites should be led outside of the system and discharged after treatment (e.g. Puerto Montt has an annual precipitation of about 2,000 mm).

c. Waterproof Structure

As mentioned above, leachate is the most likely source of pollution from final disposal facilities to adjacent areas, and that is why a waterproof structure for the disposal facility itself is essential in order to prevent such pollution.

A comparison was made regarding the types of required waterproof structures and standards in permeability depending on the kind of final disposal facilities employed in Japan, Brazil, EU, Denmark and the USA. While "clay liner", "synthetic liner" and/or their combination are adopted for the waterproof structure of SCL in other countries but Japan, there are similarities in standards adopted for CL in all countries.

In Brazil and the EU, although there are no specifications regarding waterproof structures for IL, waste to be disposed in IL is subject to the solubilization test which judges whether it is technically inert or not. Therefore, if the solubilization test is employed and observed in judging acceptability of waste in IL, it is suggested that no specific waterproof structure is mandatory.

Consequently, the Study proposes standards for bottom and side waterproofing structures and required impermeability in Table 7.2.2b based on US-EPA standard.

Table 7.2.2b Proposed Bottom and Sides' Waterproof Structure

Items	Strictly Controlled Landfill (SCL)	Controlled Landfill (CL)	Inert Landfill (IL)
Synthetic Liner	Double with thickness more than 30 mil (0.762 mm)*1	Single with thickness more than 30 mil (0.762 mm)*1	No requirements
Clay Liner	A three(3)-foot (91.44 cm) layer of compacted soil with a hydraulic conductivity of no more than 1×10^{-7} cm/sec.	A two(2)-foot (60.96 cm) layer of compacted soil with a hydraulic conductivity of no more than 1×10^{-7} cm/sec.	No requirements

Note: *1: Synthetic liner components consisting of high density polyethylene (HDPE) shall be at least 60 mil (1.524 mm) thick.

Standard structures for the final coverage layer of disposal facilities in Japan, Brazil,

Denmark and US-EPA are compared.

As a result, the Study proposes criteria for the final coverage waterproof structure and required impermeability in Table 7.2.2c.

Table 7.2.2c Proposed Standards for Waterproof Structure for Final Coverage Layer

Items	Strictly Controlled Landfill (SCL)	Controlled Landfill (CL)	Inert Landfill (IL)
Synthetic Liner	Single with thickness more than 30 mil (0.762 mm)*1	No requirements	No requirements
Clay Liner	A two(2)-foot (60.96 cm) layer of compacted soil with a hydraulic conductivity of no more than 1×10^{-7} cm/sec.	A two(2)-foot (60.96 cm) layer of compacted soil with a hydraulic conductivity of no more than 1×10^{-5} cm/sec.	No requirements

Note: *1: Synthetic liner components consisting of high density polyethelene (HDPE) shall be at least 60 mil (1.524 mm) thick.

7.3 Investigation and Initial Environmental Evaluation (IEE) of Candidate Sites for Hazardous Waste Disposal

Work has been conducted for some time with the aim of identifying suitable landfill sites in the Metropolitan Region for hazardous waste (HW).

One of the current problems is that the three existing, major landfills around Santiago, Cerro de Renca, Lo Errázuriz and Lepanto, are all almost full. Another problem is that there is no suitable treatment and disposal facilities for HW in or around Santiago.

ISW is largely disposed of on municipal landfill sites if it is suitable for disposal on these landfills, but for HW there is no alternative to on-site storage in the waste generating factories, etc.

7.3.1 Selection of Candidate Sites for an HW Disposal

A study has been carried out recently by CRIOT, the Regional Committee of Territorial Infrastructure and Legislation in the Metropolitan Región. This study has aimed at identifying possible locations for the disposal of domestic SW. This work has resulted in selecting a locality in the northern part of the region, in the municipality of Til-Til

near the village Montenegro, as the most suitable locality.

For this site an Environmental Impact Assessment study has been carried out for the Kenbourne Environmental Engineering company (Kenbourne Ingeniería Ambiental S.A (KIASA) by the engineering faculty of the Catholic University of Valparaíso (la Escuela de Ingeniería en Construccion de la Facultad de Ingeniería de la Universidad Católica de Valparaíso).

Based on this, the competent national and regional authorities in the MR have approved the construction and operation of a landfill for domestic waste on the Montenegro site. A detailed engineering project is about to be approved by SESMA, a small part of the landfill is expected to be in operation from December 1995 and the landfill to be in full operation from March 1996.

At the onset of the Study, the Team developed a set of guidelines for the selection of candidate sites for major ISWM facilities. These guidelines were part of the Progress Report of the Study (March 1995) and are attached to the Final Report as Annex J.1, Suggested Guidelines for Selection of Potential Areas for Major Facilities for Industrial Solid Waste Management.

On the basis of the above, the Chilean Counterpart Team has selected 11 candidate sites for further consideration under the Study. These candidate sites are:

1. Montenegro (next to the potential domestic waste site selected on the basis of the CRIOT study)
2. Cerro Carneros
3. Quilapilún (Tres Orejas)
4. Estación Puangue
5. San Diego
6. Santa Amelia
7. Mandinga
8. Escorial Norte
9. Rincón los Rulos
10. Las Canteras
11. El Convento

The localizations of the candidate sites are indicated on the map of the Metropolitan Region overleaf (Figure 7.3.1a).

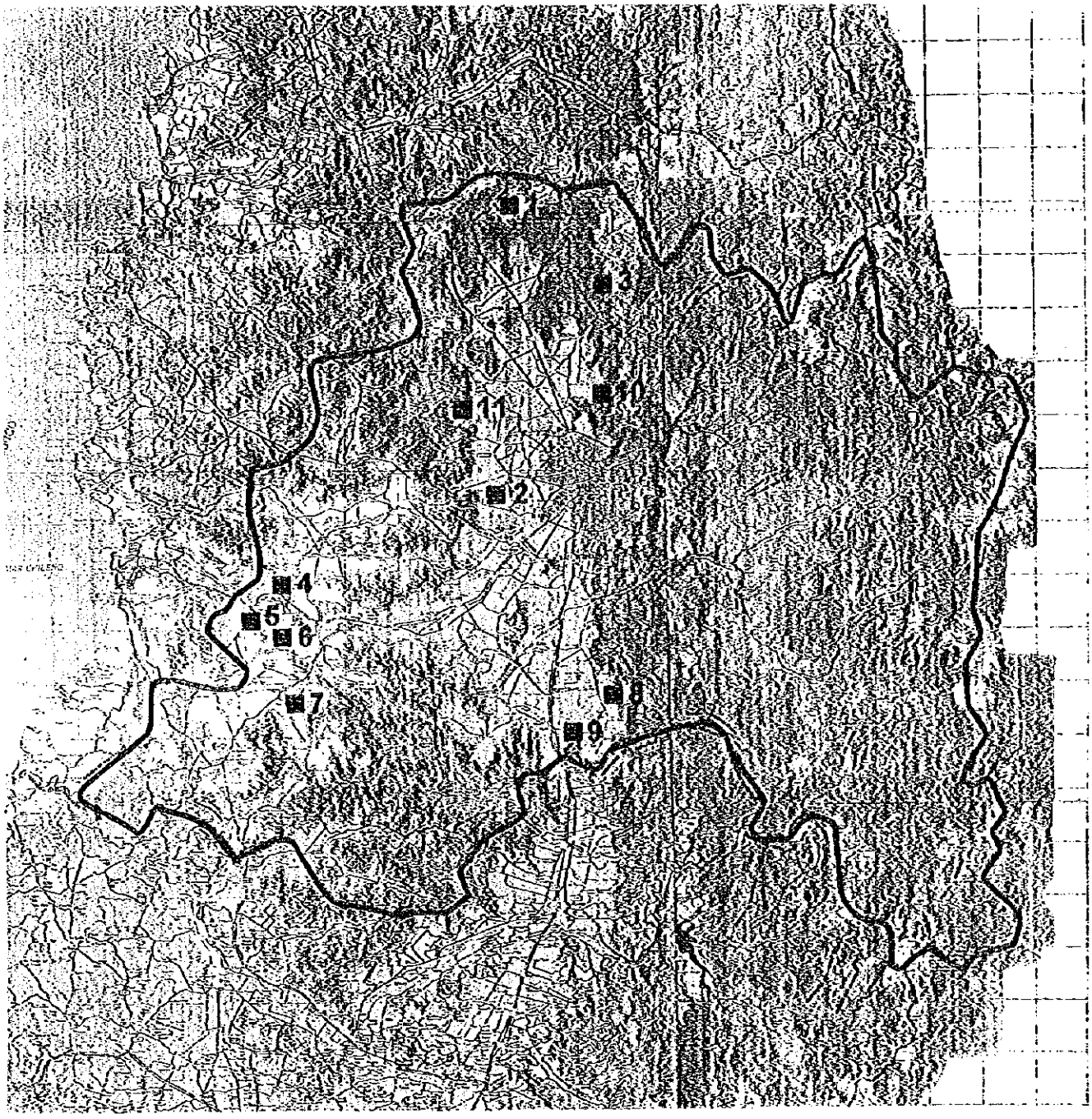


Figure 7.3.1a Location map of Candidate Sites

7.3.2 Investigation and Comparative Environmental Evaluation of Candidate Sites

a. Information sources and data compilation

Information regarding the candidate landfill sites was compiled through field visits to all sites and from a wide range of sources. The information mainly come from open sources such as yearbooks and contemporary literature, etc.. The main sources of information have been the National Service for Geology and Mining (SERNAGEOMIN), the Metropolitan Sanitary Works Company (EMOS), Department of Farming and Grazing Service of the Ministry of Agriculture and the Natural Resources Information Center (CIREN).

On top of the work, the Study Team has outlined a suitable landfill configuration at each of the sites and on the basis of this, made an estimate of landfill area and volume. For the Montenegro site, the data compilation has greatly benefitted from the KIASA study.

The technical/environmental data for each of the sites can be found in Annex J.2.2 of this report. The description of each site ends with a conclusive evaluation of the site's suitability as a hazardous waste landfill. In Annex J.2.3 the data are compiled in short form in a data sheet with "quality characters", resulting in a qualitative ranking of the sites. Finally, a recommendation is made as to the sites most suitable for construction of a hazardous waste landfill.

This information is summarized in the following.

b. Conclusive Evaluation of Each Site

1. Montenegro

The location is well fit for a landfill site for hazardous waste, especially if a municipal waste landfill is established nearby. This is due to the small and well-protected ground water interests and the low precipitation and high evaporation as well as the good access by road and train.

2. Cerro Carneros

The location is well fit for a landfill site for hazardous waste, due to the well-protected ground water, the low precipitation and medium evaporation, the short distance from Santiago, and the good road access.

3. Quilapilún (Tres Orejas)

The location is well fit for a landfill site for hazardous waste. The main advantages is the small and probably well-protected ground water resource, the low precipitation and high evaporation, and the very large volume available (if this is needed). Some practical problems in relation to access road and public services can, however, be foreseen.

4. Estación Puangue

The location is not too well fit for a landfill site because the volume is relatively small and the quebradas and the relatively high precipitation in the area may create problems. The access by road and train is, however, good, and the natural ground water protection seems good.

5. San Diego

The location is well fit for a landfill site for hazardous waste, although the relatively high precipitation may create some problems. The probably good natural ground water protection will partly compensate for this, and it is an advantage that there are no watercourses crossing the area and that the road access is good.

6. Santa Amelia

The location is not fit for a landfill site for hazardous waste because of the problems related to the access road and the dwellings along this road. The large amount of private landowners in the area is also likely to create problems.

7. Mandinga

The location is relatively well fit for a landfill site for hazardous waste, because the ground water resource is probably small and well-protected, which to some extent remedies the high precipitation and medium evaporation. It is also an advantage that the access road is very good, although this site is the one of all locations farthest off from Santiago. The unknown ownership may prove a disadvantage.

8. Escorial Norte

The location might be used for a landfill site for hazardous waste, but there is severe doubt about ground water protection and watercourses, and the relatively high precipitation in the region may create problems.

9. Rincón los Rulos

The location is deemed to be unfit for a landfill site for hazardous waste, mainly due to the poor ground water protection, the water coming from the hillsides and the relatively high precipitation in the region.

10. Las Canteras

The location is deemed unfit for a landfill site for hazardous waste because the area is classified as agricultural soil of good quality. The problems with the last stretch of the access road and the vicinity of cultivated farmland is also deemed to be severe obstacles.

11. El Convento

The location is deemed unfit for a landfill site for hazardous waste, mainly due to the small area which makes landfill construction irrelevant, but also due to poor access road and other activities, and poor ground water protection.

c. Comparative Evaluation of the Potential Landfill Sites

For a comparative evaluation the main issues from each of the 11 sites are summarized in a table 7.3.2a below. An advantage or disadvantage is illustrated by characters ranging from "++" (best) to "- -" (poorest). For some issues - such as distance to central Santiago - the exact value is specified.

The total evaluation for each of the sites is made on the background of a "weighed average" of the single issues. Some issues may be negative to a degree that outweighs otherwise positive issues, such as is for example the case for the poor access to site number 6.

Table 7.3.2a Comparative evaluation table for landfill sites

Evaluation issue / Site number	1	2	3	4	5	6	7	8	9	10	11
Land use and land use quality	+	++	++	+	+	++	++	+	+	- -	++
Land ownership	+	+	+	+	+	-	0	+	+	+	+
Physical planning	++	+	++	++	++	++	++	++	++	+	0
Ground water / ground water protection	++	++	+	++	++	+	+	+	- -	+	- -
Precipitation / evapotranspiration	+	+	+	0	0	0	0	-	-	+	+
Watercourses	0	+	+	0	++	+	++	-	-	-	-
Sensitive activities	+	++	+	0	++	0	++	+	+	-	-
Distance from Santiago (km)	70	22	50	70	70	70	78	45	50	20	32
Access road	++	++	+	++	++	- -	++	0	0	0	-
Access train	+	- -	- -	++	0	- -	- -	0	0	- -	- -
Landfill volume (million m³)	13	20	30	6	15	17	15	12	17	8	?
Public service	-	0	-	-	-	-	+	0	-	+	+
Total evaluation	++	++	++	0	+	-	+	-	-	-	- -
Suggested priority	2	1	3	6	5	-	4	-	-	-	-

It is worth mentioning that the evaluation undertaken is relative and not absolute. That is, the evaluation is intended to select those sites which are most suitable for a landfill localization from a technical/environmental point of view and exclude those which are less fit or unfit. **The evaluation made in this report is thus only for a preliminary site selection and cannot substitute an in-depth assessment as this is done in an Environmental Impact Assessment.**

d. Advantages and Disadvantages of Locating a Landfill for HW in the same Area of a Municipal Landfill

A municipal landfill for the MR is being constructed at Montenegro next to one of the candidate sites for HW landfill. In general, there are following "advantages" and "disadvantages" of locating a landfill for HW and a municipal landfill in the same area:

da. Advantages

i. Economic advantages

- Survey data (geological profile, boring, underground water, topographic maps, environmental conditions, etc.) could be of common use.
- Various facilities (access road, utilities such as water and electricity, buffer zones, etc.) could be of common use.

ii. Compatibility with regional development plans (land use conformity)

- Zoning of the area for sanitary infrastructure can be made.
- Monitoring and control of public aversion calling facilities can be concentrated.

iii. Relative easiness of land acquisition

db. Disadvantages

i. The people nearby the site may feel that they are socially excluded and marginalized due to the concentration of **NIMBY** facilities. This may cause stronger opposition against landfills.

ii. There are some possibilities of intentional and/or unintentional misplacement of HW at the municipal landfill due to the vicinity of two sites.

e. Recommendation

The suggested priority for the candidate sites for localization of a industrial hazardous waste landfill is indicated in table 7.3.2a.

It will be seen that for several of the potential sites no priority is indicated. This is because these sites are not deemed appropriate for the localization of a hazardous waste landfill in any case.

For the remaining ones, which are situated either north or immediately west of Santiago (site 1, 2 and 3) or west of Santiago in the Melipilla-region (site 4, 5 and 7), a suggested priority is indicated.

The order of priority thus suggests that the sites numbers 1, 2 and 3 are the ones most suitable for the establishment of an industrial hazardous waste landfill in the Metropolitan Region, with site no. 2, Cerro Carneros, receiving the first priority.

It should be emphasized that the ranking is to some extent conditional. Although there is no doubt that site no 2, Cerro Carneros, should on the basis of the information presently available receive the top priority, there might be some doubt whether site no. 1, Montenegro, or no. 3, Quilapilún, should be second priority. The fact that the municipal landfill at Montenegro will be constructed is for example much in favour of an industrial waste landfill on the same locality, as these two landfills could thereby benefit from the same facilities and one more landfill would not contribute to general inconveniences.

It should also be emphasized that information provided during an EIA may change the priority suggested for these three sites.

7.3.3 IEE of Recommended Sites for Hazardous Waste Disposal

On the basis of the conclusions it is deemed reasonable to consider the potential landfill localities of Cerro Carneros, Montenegro and Quilapilún the top priority sites for the establishment of a hazardous waste landfill site. For these three sites an Initial Environmental Evaluation along the lines suggested by JICA in the "Environmental Guidelines for Infrastructure Projects VI, Solid Waste Management, September 1992" should therefore be conducted.

There is, however, no doubt that for a landfill intended for infinite or long-time storage

of HW for the whole Metropolitan Region, a full Environmental Impact Assessment (EIA) must be conducted. The IEE is therefore not intended as a discussion of whether EIAs should be conducted, but merely as the introduction to the main topics in these EIAs.

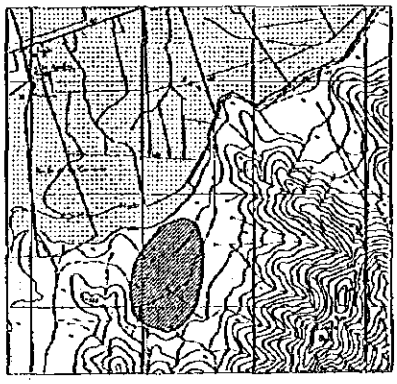
Following aspects were considered in the IEE: location, potential landfill (downscale map segment), potential area (m^2), potential volume (m^3), resettlement, land acquisition, traffic, public facilities, cultural property, water rights, rights of common, public health, wastes, underground water, hydrological conditions, coastal zone, flora and fauna, landscape, air pollution/odor, water pollution, soil contamination. noise and vibrations, general issues. All these aspects were evaluated. It was indicated in the case where information was absent.

Furthermore, an EIA has been made for the potential site of Montenegro, as this is also the site for a potential domestic waste landfill, and this landfill is finally approved and is expected to be in full operation in March 1996. As this is the case, it is deemed inappropriate to conduct an IEE for this site. The IEEs therefore only cover the sites of Cerro Carneros and Quilapilún.

The full IEE for these two sites can be found in Annex J.3, Initial Environmental Evaluation of the Potential Landfill Localities Cerro Carneros and Quilapilún, of this report.

The IEEs and some supplementary information from Annex J.2.2 and Table 7.3.2a previously are summarized in Table 7.3.3a overleaf.

Table 7.3.3a Summarized IEE for the candidate landfill sites Cerro Carneros and Quilapilún

Site / Topic	Cerro Carneros	Quilapilún
Localization	At the slope and foot of Cerro Carneros, 22 km west of Santiago.	At the foot (and slope) of Loma del Pequén Quillay, 50 km north of Santiago.
Potential landfill (downscaled map segment)		
Potential area (m^2)	500,000	750,000 - 1,100,000
Potential volume (m^3)	20 million	30 - 100 million
Resettlement	Not needed - no housing nearby.	Probably necessary to resettle inhabitants (and owners of farmland) close to site. Options and legal background must be carefully assessed.
Land acquisition	Will be needed as area is privately owned. Legal basis must be assessed.	Will be needed as area is privately owned. Probably also irrigated farmland between site and highway due to pollution risks. Legal basis must be assessed.
Traffic	Present access road insufficient. Alternatives must be assessed, including access from highway.	Present access road highly insufficient and past housing. Alternatives must be identified and assessed.
Public facilities	Not identified. Must be identified and assessed.	Water supply possible, but will probably compete with present use. Other facilities not identified. Must be assessed.
Cultural property	None known - assess on the basis of historical/archaeological archives.	None known - assess on the basis of historical/archaeological archives.
Water rights	None identified. Should be identified and decided upon.	Water rights may be related to farm water supply and irrigation. Must be made up and decided upon.
Rights of common	None identified at present. Planning has identified the area for future recreational purposes. Compliance with these plans should be assessed.	None identified and none likely.
Public health	No risks likely to arise. Should be assessed for Public Relation reasons.	No risks likely to arise. Should be assessed for Public Relation reasons, unless resettlement of nearby dwellers take place.
Waste	On-site disposal needs for specific waste types (e.g. special lot for infectious waste, etc.) should be assessed and incorporated in environmental permit.	On-site disposal needs for specific waste types (e.g. special lot for infectious waste, etc.) should be assessed and incorporated in environmental permit.

Site / Topic	Cerro Carneros	Quillaplún
Ground water	Ground water/geological/water pollution situation must be carefully investigated and assessed.	Ground water/geological/water pollution situation must be carefully investigated and assessed.
Hydrological conditions	Gullies (quebradas) from the slopes and suitable measures to prevent flooding should be identified.	Gullies (quebradas) from the slopes and suitable measures to prevent flooding should be identified.
Coastal zone	Not relevant.	Not relevant.
Flora and fauna	Flora and fauna vulnerable to landfill construction and operation should be identified and relevant measures suggested.	Flora and fauna vulnerable to landfill construction and operation should be identified and relevant measures suggested.
Landscape	Closed landfill's compatibility with planned activities crucial. Should be carefully assessed and acceptable solutions prescribed. Proper requirements for coverage should be incorporated in permit.	Landscape problems unlikely in this desolated area. Proper requirements for coverage should be incorporated in permit.
Air pollution/ odours	Due to distance to inhabited areas not critical. Should be evaluated with regard to planned waste types.	Air pollution probably not critical. Odour problems may arise and be critical if houses nearby still inhabited, depending on waste types received. Should be assessed on these backgrounds.
Water pollution	Crucial point, cf. "ground water" above. Water balance must be established and solutions as to leachate detainment and handling suggested and assessed.	Crucial point, cf. "ground water" above. Water balance must be established and solutions as to leachate detainment and handling suggested and assessed.
Soil contamination	Soil not assumed vulnerable. On-site waste handling in relation to waste types should be specified.	Irrigated farmland west of site may be vulnerable. On-site waste handling in relation to waste types should be specified and assessed in relation to vulnerability.
Noise and vibrations	Noise levels at nearest houses due to traffic on access road should be assessed. Noise emissions from the landfill proper deemed unimportant.	Will be critical if nearby houses still inhabited. Must be assessed if this is the case.
General issues	The EIA and the environmental permit should specify control and supervision both during construction and operation and after closing.	The EIA and the environmental permit should specify control and supervision both during construction and operation and after closing. **It is obvious from the above, that the future existence of housing and farming in the vicinity of the site is crucial. The political and legal options for acquisition of the houses and the land by expropriation should therefore be carefully assessed before a full EIA is launched.**

CHAPTER 8

EXAMINATION OF ORGANIZATIONAL AND INSTITUTIONAL SYSTEM

CHAPTER 8 EXAMINATION OF ORGANIZATIONAL AND INSTITUTIONAL SYSTEM

8.1 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 industrialists.

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

This premise and the two directives should fundament 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.

Less simple actions will attempt to reduce the generation of pollutants at the source 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 the critical difficulties. Tax legislation and long-term financing (10 years for example) should make a quick development feasible in that sense. A cooperative program will be established which has as priority, the minimization of highly toxic waste generation.

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

Incidentally, Chile should pay close attention to norms ISO-9000 and ISO-14000 -- the first of which is already in full effect, and the second 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 environmentally critical products, such as mining products, fish and fruits, Chile could suffer from the increased demands of the North American, European and Asian markets, including penalization by violent price reductions. Producers will need certificates 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 the penalties for non-compliance.

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 MR 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;
- the availability of establishments that are qualified, or that can be made to be qualified, to process waste (to utilize it);
- business interests in the processing of waste;
- the effects of waste on the environment and on health;
- the financial investments involved.

As an example, the economical processing of waste oils and solvents can be cited, which should become mandatory, but that 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 be used, becomes 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, different workshops, scattered all over the city, which should give their waste to specialized third parties.

The minimization of waste, with such conceptual amplitude, needs 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, to evaluate proposals, to manage financial funds, and to transfer technologies, expanding the results.

c. Legislation for Proper Waste Disposal

ca. Principal Exposition

Industrial waste may have its final destination (disposal) buried in the ground, or it can be treated by means of biodegradation in the superficial soil. In both cases, the risk of ground contamination must be minimized -- which means the contamination of the soil and of its subterranean and superficial waters.

Industrial waste can be processed thermally, be it by incineration or pyrolysis, which gives off into the atmosphere the products of oxidation and of thermal decomposition. To minimize the contamination of the air, those products must be treated, before their emission. The residues of this treatment, in addition to the ashes and slag, constitute toxic waste.

The treatment and destination of waste can be executed inside 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 the acceptable parameters and limits for discharge on the ground, water and air.

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.

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 decharacterized (physically and chemically), but the responsibility remains for any effluents, products or subproducts 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 for that.

The owner of a 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 subterranean and superficial waters, in addition to being responsible for any contamination originating from that site. The Legislation should settle the obligation of monitoring the site (air, soil and waters) and the limit concentrations of admissible contaminating substances in the limits of the property. When a limit-concentration is exceeded, the owner should immediately interrupt the contaminating flow, decontaminate external areas and then, their own terrain. 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 his venture, 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 them. In any case, technical norms and legal restrictions for the use of the soil will help him choose a site and reduce the risks of their venture.

Even though it is a universal orientation that the owner be responsible for keeping their property and the 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, to establish extremely strict demands and technical norms, aiming to minimize risks but without providing, ordinarily, resources to guarantee the responsibility of the owner or of the person in charge of disposal.

Finally, another common way of not facing the problem is regulating it in very general terms establishing "obligations" instead of "legal responsibilities", leaving eventual problems for future discussion.

In this text, it is proposed 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. Coherently 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 not be more strict 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-liquids (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 in solids, any waste classified as reactive, corrosive, or acutely toxic; likewise, organic wastes will not be admitted in a landfill designed for inorganics, and 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 manufactured) 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 real natural 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 well fixed, 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.

Clayish 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 injections of hazardous waste into deep ground 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 hypothesis, 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 in that process. 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-solid and solid waste resulting from the treatments and the process itself. It will also define the need to provide auto-stoppage 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 most likely 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 theses 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, by convention, 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 give distinction to and make feasible such entrepreneurial activities, while establishing the necessary and strict rules for their existence and operation. The IWCs will only be feasible when (and only when) the State establishes and demands the fulfillment of the legislation that is here proposed, or its equivalent.

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 give adequate disposal to all packages of agricultural and home toxic products at no extra 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 cited 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 matter, very complex, will be complemented by executive level norms.

The Legislation will define the concepts of "generator" (which may include all waste transfers to processors), of "transporter", and of "receiver", of "owner of a site that receives waste", and of "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 about "Civil Responsibility - CR".

To make feasible the above mentioned responsibilities, <u>we recommend</u>:

- stimulate the offer, in the market, of civil responsibility insurance for "gradual" sinisters, in addition to the usual "sudden" sinisters, applicable to environmental damage;
- create a Provisional Fund for the Remediation of Contaminated Soil -- whose constitution and application would have as model the North American "Superfund" and other similar initiatives.

The Legislation will settle the obligation of each Comuna of choosing and preserving, in its Urban Development Plan, one or more 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: "those who generate are responsible", 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 communas 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 incentivate 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.

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 of that Ministry, be it at national or regional level, and that the issues of multi-ministerial competency should be regulated by 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) before the Competent Authority (CA) and of it before 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. 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 the ground 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 an Accident or Soil Contamination Provision Fund of the IWC, to guarantee the responsibility of the owner.

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 superficial 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 8.1.1a), 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 8.1a) 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 not published; and
- Technical instructions are instituted by resolutions or administrative acts of the executive regional competent authority (SESMA).

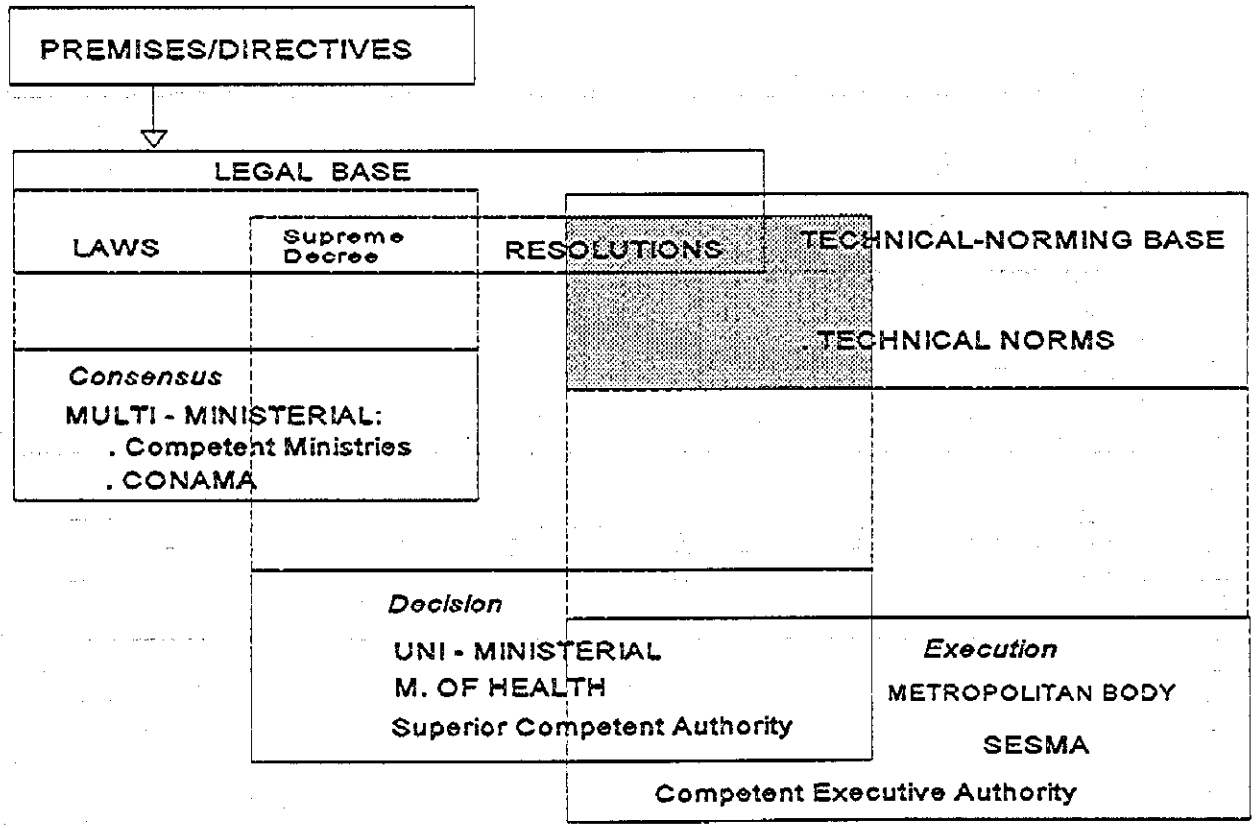


Figure 8.1a Distribution of Competencies

g. Scenario for Legal System Development

ga. Scenario

A scenario for legal system development is drafted for the discussion with the relevant organizations concerned and tabulated in Table 8.1a.

Table 8.1a Scenario for Legal System Development

Item-letter	Phase 1 (- 1997)	Phase 2 (- 2000)	Phase 3 (- 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	
LA-MC-10	D/T	L	
LA-MC-11	L	D	
LA-MC-12		D/L	
LA-MC-13	L/D/T		
LA-MC-14	L/D		
LA-CA-1	T/D		
LA-CA-2	T/D	D	
LA-CA-3	T/D		
LA-CA-4	D		
LA-CA-5		D	
LA-CA-6	T/D		
TA-CA-1			T
TA-CA-2			T
TA-CA-3			T
Section 8.2.2 Organizational Development	D		
Procedure for Classification of ISW	T		
Improvement of System for Installation of Waste Water Treatment	L/D/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 8.1a

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; of the 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 ("gradual 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 for 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 from customers contaminated packages and give them 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-3, -4, -5, -6, -7, -10, -11 and -12 should be detailed through Supreme Decree or Resolution; so should the following:

LA-CA-1: Disposal on the soil or superficial soil biotreatment.

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

LA-CA-3: Creation of a Central Storehouse 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 consequent responsibilities.

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-4, -6, -7 and -10, and LA-CA-1, -2, -3, and -6 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 waste during industrial operations and internal transportation.

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

gb. Development in Phase 1 (- 1997)

The Competent Authority is empowered to evaluate proposals from the services' market, which is already aware of its possibilities.

The CA (SESMA) should be sufficiently organized at the executive level (LA-MC-14 and LA-MC-7).

The obligations of owners and users of facilities, Generator/Receiver/Transporter, as well as the basic concepts will be established (LA-MC-2), while the legislation that fixes the legal responsibilities will be gradually improved until the year 2000.

Certain Resolutions will establish restrictions of land use for treatment and disposal activities, as well as for incineration at industrial waste specialized plants and for co-treatment at industrial thermic plants.

Storage and integrated management centers for ISW will also be regulated through Resolutions.

By means its own legal act it will be defined that SESMA will be the CA for the evaluation, approval and inspection of industrial liquid effluents treatment plants, and all necessary guidance to the projects and operation of such plants will be complemented by technical norms.

Technical norms will be established for soil disposal and incineration activities of ISW.

The procedures for classifying and changing the category of ISW will be established. Also, the basic contents and guidance for the preparation of EIA/DIA concerning ISW management plants will be established.

The CA will establish the rules for meeting the supply of private services to the market,

and the municipalities will cooperate to make feasible the use of an appropriate lot for the siting of SW treatment and disposal plants (LA-MC-11).

The following activities will be regulated through acts of adequate level:

- control and storage of machinery oil containing PCBs;
- recycling of solvents and lubricants by clean processes;
- prohibition of acceptance of HW at sanitary landfills;
- storage, processing, treatment, and/or disposal of ISW at the generator's or at specialized establishments;
- those industries defined as priority by SESMA will submit the following in accordance with the scales determined by the CA:
    - their projects and schedules for installation of liquid effluents' treatment;
    - their plans for the implementation of the hazardous ISW management system.

Finally, the technical instructions for the above mentioned activities will be established.

gc. Development in Phase 2 (1998 - 2000)

The CA will improve and complete the legislation and regulations based on the experience and results obtained during the initial years.

The legal responsibilities will be fully defined through legal acts and will be made feasible by means of the provisional fund for the remediation of contaminated soil for hazardous ISW disposal or during transportation, as well as by the civil liability insurance for gradual environmental damage.

The obligation of the manufacturer/importer of toxic products for agricultural and domestic use will be fixed with regard to receiving non usable products and contaminated packaging from clients so as to provide an adequate destination.

The obligations of the authorities will be defined with regard to planning the response to emergency situations in the main roads concerning hazardous substances.

gd. Development in Phase 3 (2001 - 2005)

The plants for storage, treatment, processing and disposal of ISW will be implemented, and the CA (MS/SESMA) will be qualified for fulfilling its attributions.

The Sub-Program for Waste Minimization (solid, liquid, emissions) will be developed and established my means of a legal act as part of a Government program for Cleaner Production. The Sub-Program will be supplied with technical instructions, targets and loans to allow Generators to implement their approved programs.

8.2 Institutional and Organizational Development

8.2.1 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 of its exclusive competence 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 dominant objective of the issue is not industrial waste -- hypothesis where 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 competences 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 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 the Regional CONAMA and attending to 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 Superintendence of Sanitary Service (SISS), in accordance with the Law N°3.133/16 and the regulation D.S. MOP N°351/92.

8.2.2 Organizational Development

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

a. 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 nearer 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) subprogram 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.

b. Structural Alterations of SESMA - Proposal

The structural adaptation of SESMA is relatively simple, for the reasons presented previously. A modern criteria is proposed for the management of waste, appraising clean industrial production as much as clean disposal of waste. In this way, the possibility to select or manage hazardous substances will be considered, and intervention in manufacturing methods and processes made possible, before those substances become waste -- be they liquid, solid or gas. To minimize waste, and dispose of what is inevitably produced with the least environmental impact, are the ruling directives.

The management will take place through the "Management Program for Industrial Waste - PROGRESI", divided into four subprograms:

i. Subprogram for promotion of Waste Minimization, comprising:
   - technical information;
   - training;
   - evaluation of projects (regarding clean production) and their performances;
   - transfer of technology.

ii. Three subprograms in relation to the control of industrial waste, comprising:
   - origin-disposal flow;
   - permits and inspection;
   - technical instructions (norms);
   - monitoring by self-control (effluents and waste);
   - monitoring of soils and natural waters;
   - control of the transportation of hazardous products.

The first subprogram will provide technical information about substances, their toxicology, restrictions in the environment, etc. to professionals and companies at a very low cost. It will also provide courses and seminaries 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 conventions and international centers of information, which operate through instant computerized systems.

Operating as technical support for the financial fund that was proposed in section 8.1.1.1b, this subprogram would evaluate the financing proposals, as well as the results of those approved, and would promote the transfer to other industries of technologies or simple procedures with the purpose of reducing the generation or hazardousness of waste.

The other subprograms would control (qualitatively and quantitatively) the generated waste, its destination and transportation, as well as the receiving establishments (that process, treat or dispose of waste), which they would inspect and grant permits to.

It would establish and divulge the technical-normative acts on waste, their management and disposal. It would have the competence to set programs of self-control of effluents and industrial waste for industries, evaluate their data and make pertinent demands. It would have the competence to evaluate and carry out the monitoring of soil and water that may be affected by industrial activity or by the disposal of waste, evaluating the results and making the pertinent demands.

It would also be in charge of controlling the transportation of hazardous products, potential generator of waste and of soil and water contamination.

The "Management Program for Industrial Waste" would be very integrated with PROCEFF, the programs for Occupational Health and of Basic Sanitation, and capable of assuming some of their activities.

The alteration of SESMA recommended for the short term is presented in the following diagram.

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.

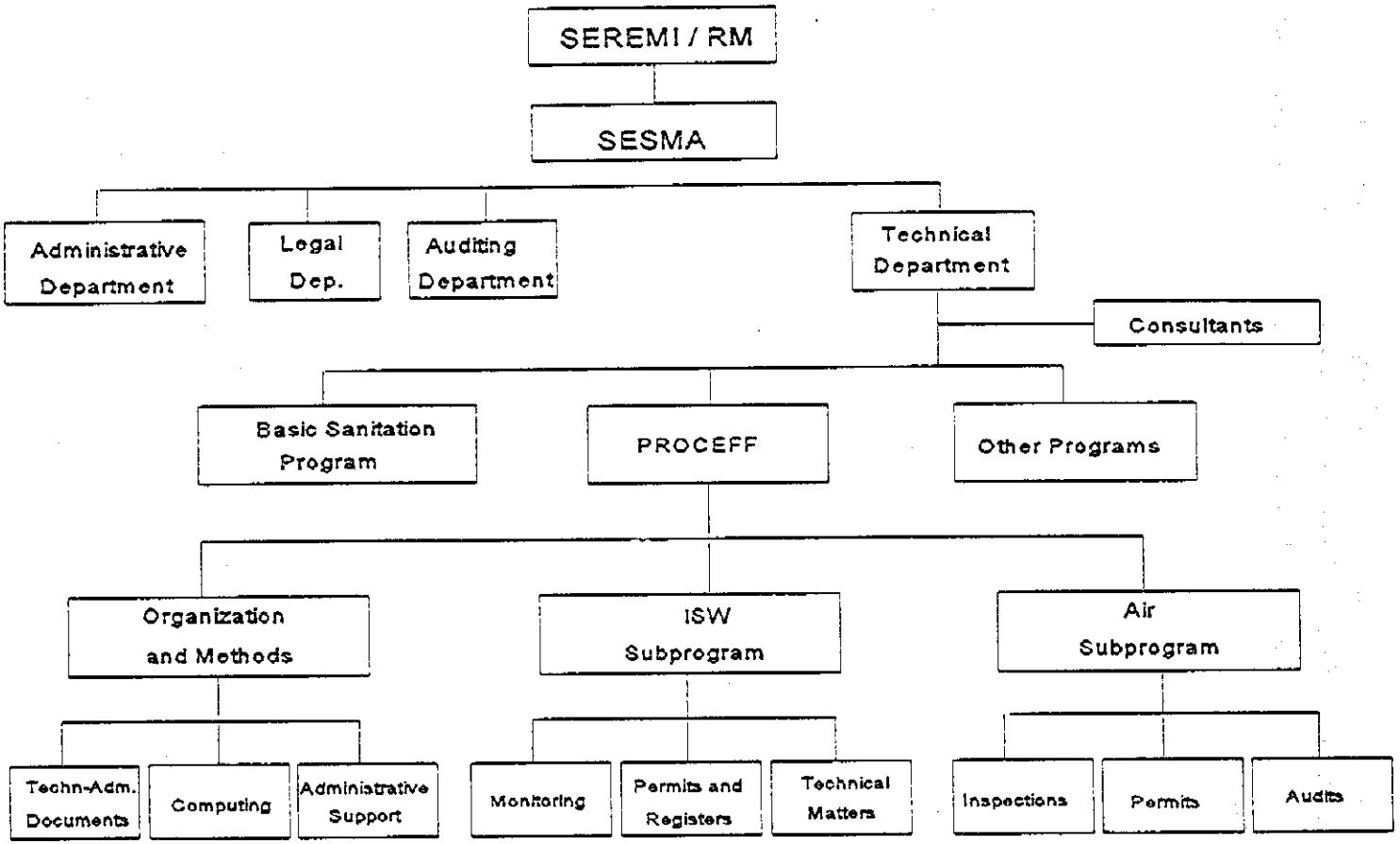


Figure 8.2.2a Present Organizational Chart of SESMA

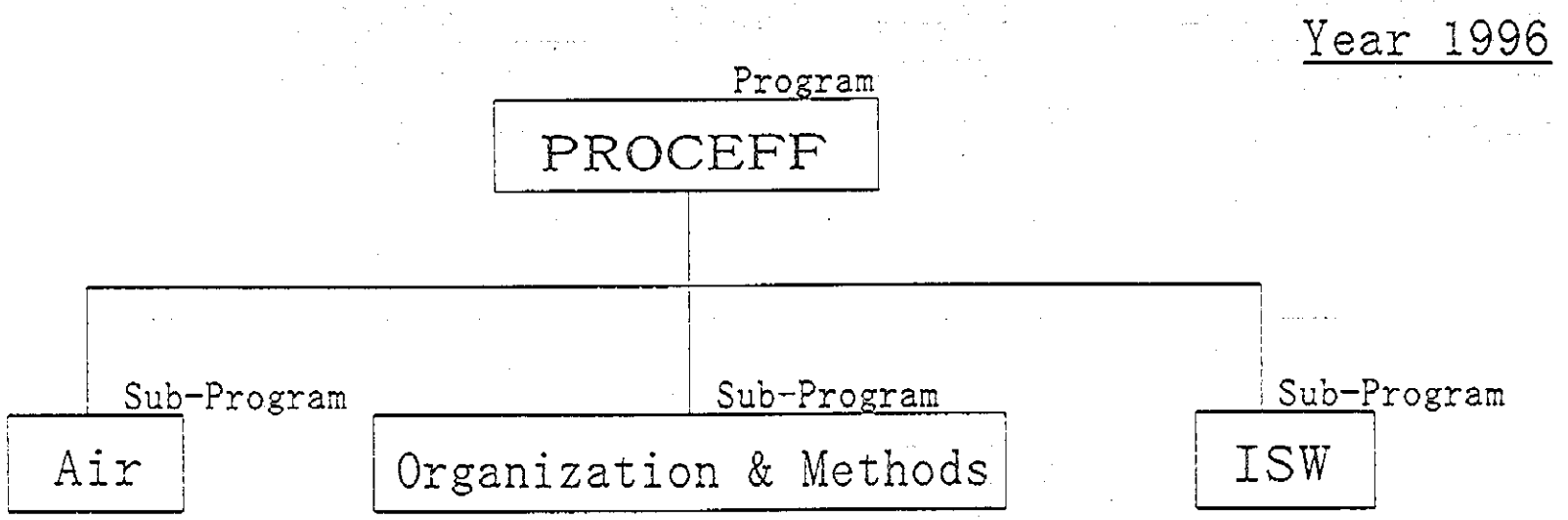


Figure 8.2.2b Proposed Organizational Chart of PROCEFF

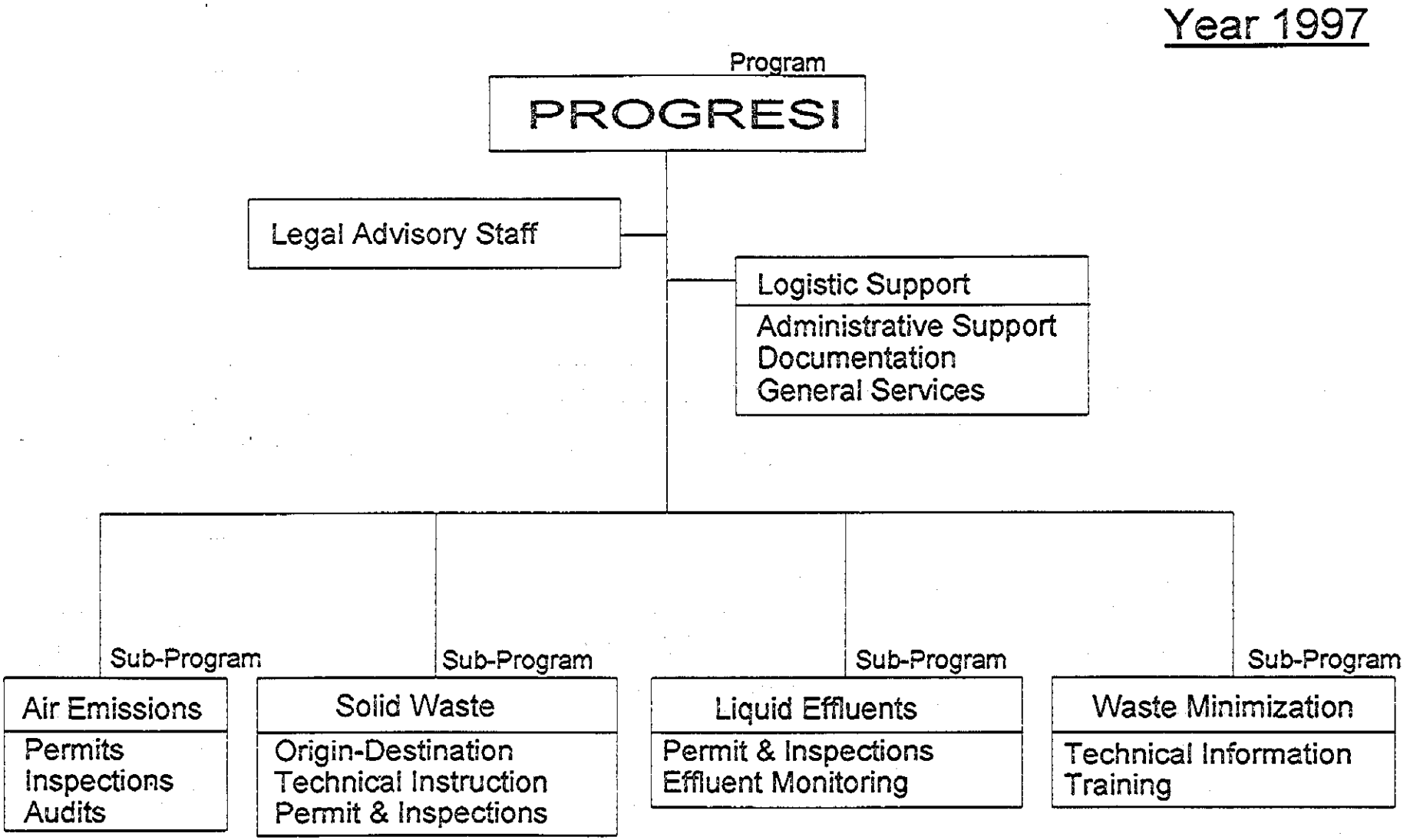


Figure 8.2.2c Proposed Organizational Chart of PROGRESI (Year 1997)

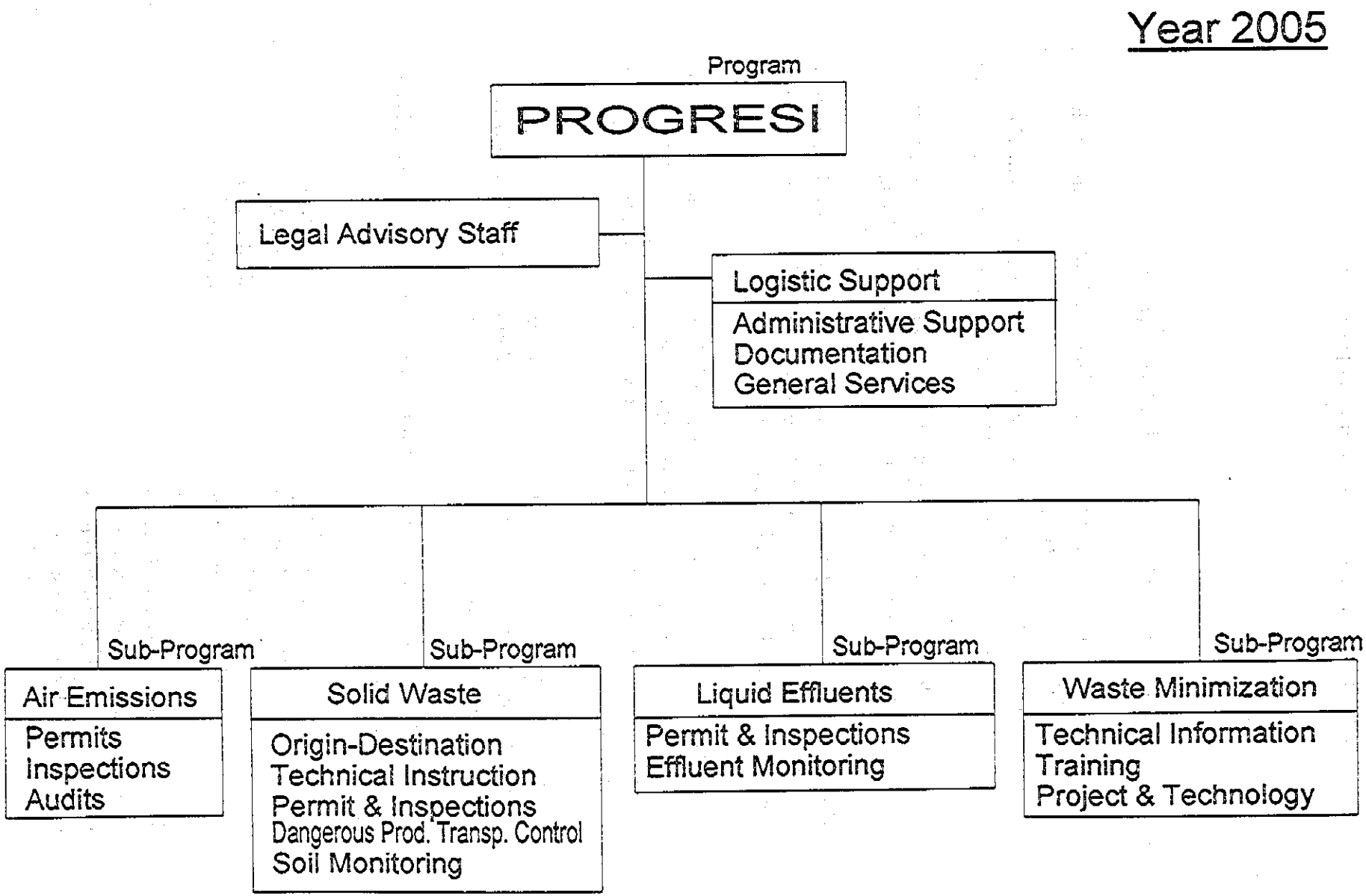


Figure 8.2.2d Proposed Organizational Chart of PROGRESI (Year 2005)

8.3 Strategy for the Short Term Administration of ISW

8.3.1 General Strategy

Three facts constitute the basis of the strategy here 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 8.1.1f, we choose as priority issues in the short term, the following:

- as a regulatory basis (to be selected from existing acts, complemented and consolidated): LA-MC-2, LA-MC-7 together with LA-CA-1, LA-MC-10 together with 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" (presented in the next section 8.3.2) 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 soon 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 about "responsibility" -- even though this critical issue requires broader legal support, in the future.

8.3.2 Procedure for the Classification of Industrial Waste

A procedure for the classification of ISW is presented as shown in Figure 8.3.2a.

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

p-2 Reference I should be periodically revised by SESMA, based on the better 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 end.

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/no 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, humidity, scientific weight, 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 (NHW) 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 the contrary 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.

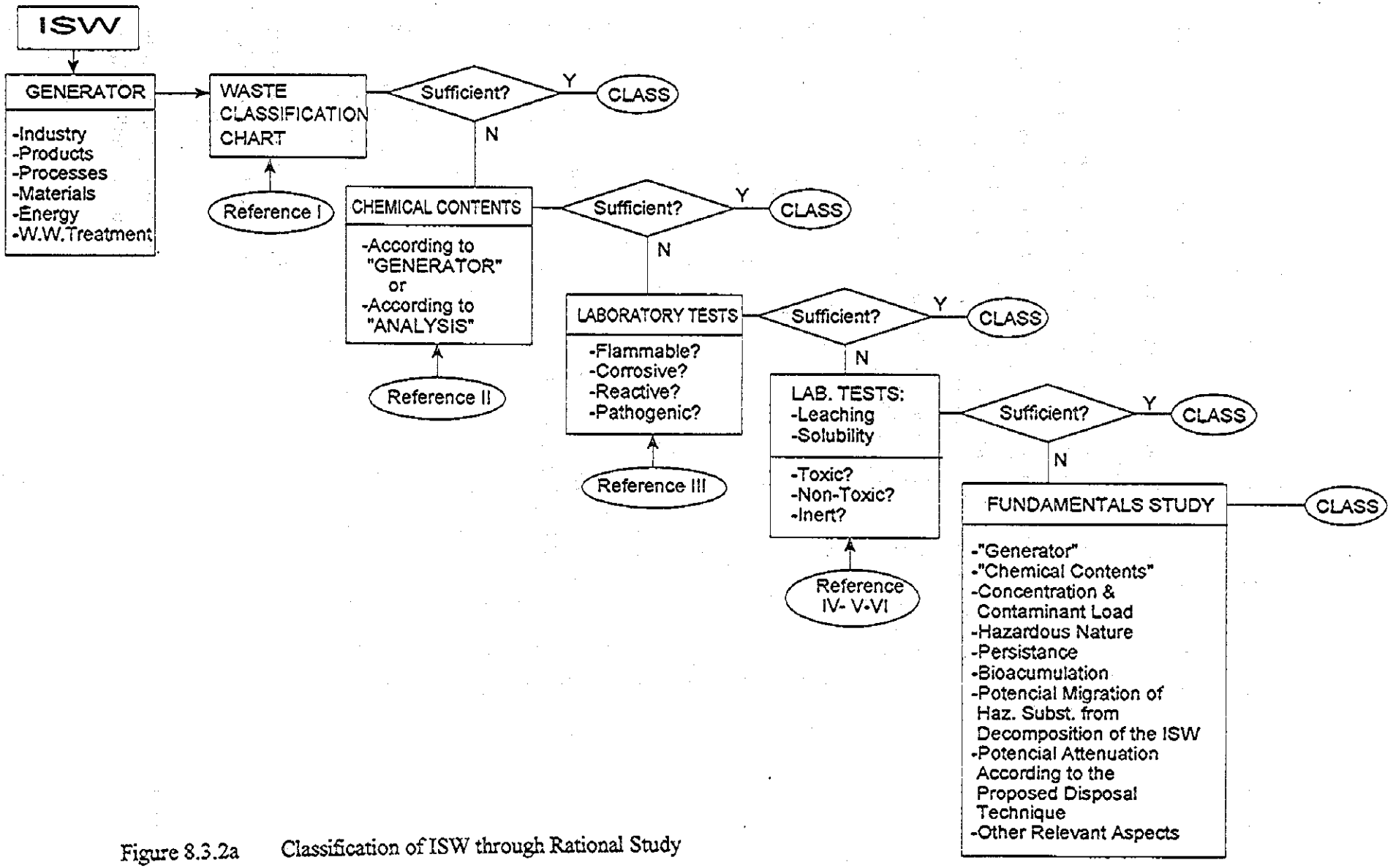


Figure 8.3.2a Classification of ISW through Rational Study

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 Laeching 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 (USA).
(see L.3 of Annex L)

Reference VI: Characteristics of Drinking Water
(see L.3 of Annex L)

8.3.3 Treatment of Industrial Liquid Wastes

The treatment of liquid effluents gives origin to sludge, which is usually a hazardous waste, 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).

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).

The following is recommended:

i. Review 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/DIA, since the purpose is to reduce the environmental impact according to previously established technical standards; and
   - by requiring that the projects be in compliance with its technical standards, so they can be accepted for the assessment procedure and so they can be approved.

ii. Establish the necessary technical norms for the following items:
   - submittance of the project to the assessment procedure;
   - content of the project, including data regarding sludge; and
   - characterization parameters for effluents, treated water and sludge, as well as the standards for discharging water into public collection systems and into natural water flows.

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.

8.4 Development of Human Resources

8.4.1 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 training:
- chemical engineering (processes);
- civil engineering (soils/geotechnics);
- geology (prospection/hydro geology);
- law (civil/public); and
- chemistry (analytic).

ii. Specialized training:
- environmental engineering;
- sanitary engineering;
- subterranean waters;
- environmental law; and
- organic and inorganic laboratory analysis.

iii. Complementary training:
- 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 superficial soil;
- operation of landfills for industrial waste;
- design and monitoring operation of soil and subterranean 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 a factory;
- sampling of industrial waste in a factory;
- characterization (chemical, physical, biological) of industrial waste;
- classification of industrial waste;
- sampling of soil and subterranean 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 training:
- 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 subterranean water monitors;
   - soil boring survey;
   - the Technical Information System;
   - maintenance of a specialized library;
   - the Declaration System for industrial waste.

iii. Practical training:
   - laboratory analyses;
   - 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.

Table 8.4.1a 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

8.4.2 National Center for the Environment - CENMA

The Government of Chile decided to found CENMA and it counts on 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.

The Basic Project presents, as initial objectives of the Center, the following:

- to establish an automatic monitoring network of the meteorological conditions, quality of the air, quality of the Mapocho river water, including the already existing monitoring system;
- to establish laboratories for studies on air, water, solids, microbiology, and fuels;
- to train professionals and scientists;
- to establish a model plant for waste water treatment, for the Center itself, with a module for physical-chemical treatment ($15m^3$/day), and another for biological treatment ($8m^3$/day), as well as a landfill to receive dried sludge and a shelter for drums with hazardous wastes generated in the laboratories.

The intention is not for CENMA to compete with private laboratories but to act as a "reference laboratory" for them, a place to refer works to and calibrate equipment.

It is recommended that CENMA participate in the development of the Administration of Industrial Waste in the short term by:

- Implementing a laboratory for analysis and tests of waste and hazardous substances, whether it is with appropriate equipment, methods and standards or qualified laboratory technicians; the laboratory would serve the PROGRESI/SESMA needs and would serve as a training and reference base. It would also grant certificates and control the quality of other chemical analysis and test laboratories working in the characterization and study of industrial waste.
- Offering to the entire professional market, courses on chemical

characterization of waste, with training in its laboratories and in the liquid effluent treatment plant.

In the medium term, the Center could become qualified to support private studies about processing and treating hazardous industrial waste, providing analyses and tests not offered on the market, and grant certificates for developed processes.

8.5 Examination of Executing Bodies

8.5.1 Executing Bodies

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
- Minimization of residues activities
- 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 CPTDP
- Transportation of ISW
- Emergency response (accidents in roads, streets and factories)
- Soil decontamination
- Underground storage tank monitoring, installation, substitution.

8.5.2 Cost Recovery Method

The price for the ISW handling services consists of:

Price = Cost + Profit + Provisional Fund Rate

Provisional fund destination: (only to remedy effects of contamination, destruction or accidents), is as follows:

i. Storage, processing, treatment, disposal services:
   - Soil remediation (includes groundwater)
   - Reparations of soil and water basins or streams due to effects of accidents
   - Reconstruction of facilities or grounds due to "gradual sinisters".

ii. Transportation services:
   - Soil remediation (includes groundwater)
   - Reparations of soil and water basins or streams due to effects of accidents
   - Reconstruction of facilities or grounds due to "gradual sinisters"
   - 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 sinisters".

8.6 Procedure to obtain Neighborhood Consensus

a. Background

The Basic Environmental Law (enacted in 1994) establishes that all projects related to the storage, treatment or disposal of ISW must clear the EIA system. The assessment should be completed by CONAMA-RM upon the submission of the EIA/DIA by the promoting sector. The project is also made available to the municipality whose territory will be affected and to the general public by means of a newspaper notice which includes some general details on the project, the environmental impact and mitigation measures.

"The citizens' organizations with legal entity and the persons directly affected" by the project (article 28, law 19.300) may review the content of the study and present the appropriate observations to CONAMA-RM or, in case such observations are disregarded, may submit an appeal to a superior authority.

There is an established system of "public participation" in the Republic (although the Law was enacted recently). In principle, a procedure for "neighborhood consensus" should be formulated along with the established system.

However, recent municipal SW landfill projects in the MR faced many difficulties including neighbors' objections in the appraisal stages. Namely the system of "public participation" does not function in reality for the moment.

b. POS and the follow-up research of the POS

In view of the present situation, a POS was carried out to find any keys for solution and/or suggestion that the existing procedure for "neighborhood consensus" to be transformed operational and substantial or be revised.

It is found as an outcome of the POS that majority of interviewees who live near candidate sites and present sites of municipal landfills showed "objection without exception and/or strong objection" against construction of SW treatment/disposal facilities in their community.

In response to the outcome of the POS, a follow-up research of the POS was carried out. It was found through the follow-up research that the main objections expressed by the people in the follow-up research can be categorized into two in general, i.e., "objection related to the communication procedures" and "objection related to the adverse impacts (of landfill projects)".

c. Conclusions

Given the observation in the follow-up research of POS (i.e., people's resentment towards poor communication, fears and anxieties over adverse impacts of projects, further doubts whether promises are kept), it is suggested, in order to facilitate existing procedure for neighborhood consensus realistic, that **improvement of communication, and sufficient environmental protection** should be, at first, realized in private sectors preparing a project.

d. Recommendation to substantiate the Procedure

In view of outcome of POS and the follow-up research of the POS, the Team judges that if the existing EIA is transformed operational and functional, a sound procedure

for "neighborhood consensus" could and should be realized. The following is proposed to amplify the existing EIA system regarding ISWM projects.

da. Agreement to be exchanged by promoting sector and neighbor

Although sufficient environmental protection measures are presented in the planning stage by a promoting sector, neighbors are doubtful and worried whether actual ISWM facilities to be constructed fully comply with what was proposed at the planning stage and whether proposed protection measures will actually take place or not. Neighborhood consensus can not be realized without removing neighbors' doubt and worries. For that purpose, as preconditions of ISWM facilities' siting and/or operation, a promoting sector should be obligated to make an agreement with neighbors regarding environmental protection measures promised by them.

db. Fulfillment of the agreement to be secured by authorities

With regard to the above, the authority should establish a system to ensure that the promoting sector complies with environmental protection measures proposed. Namely, the followings examples are recommended to authorities to establish such framework of the administrative measures, e.g.:

i. The authority should guide the sectors so that the project be presented to public in an honest manner and the sector explain the operation, maintenance and monitoring plans, as well as the potential environmental impacts, the prevention measures and the measures prepared for contingencies of accidents.

ii.. The technical suitability of the project as well as the financial soundness of the promoters must be presented by the sector and be verified by the authorities.

iii. In order to secure the agreement, the authority needs to strengthen its day-to-day monitoring and administrative guidance capability including on-site inspections;

vi. The precautions required by the regulations and the authorities for such type of project must be disclosed. The following must be obligated to the promoting sector by authorities administrative measures:

- maintenance (including effluents' treatment and monitoring) to be implemented after the closure of the landfill;

- an environmental risk insurance to be obligated for contingencies of restoration from accidents; and
- a Contingency Fund for Pollution to be constituted by an additional surcharge over the price of the services, and which will be destined for mitigation that could occur in the future (even when the company fails or disappears).

The private sector should honestly establish agreements with neighbors and related bodies that they shall fulfill the sufficient environmental protection measures. In substantiating the agreement, the authority should, in the framework of its administrative measures, secure the **fulfillment of the agreement exchanged between promoting sector and the neighbors**.

8.7 Appropriate System to Promote Private Sectors Related to ISWM

Private sectors related to ISWM comprise waste generators, ISW handling agents, laboratorial analysis institutions and manufacturers of treatment facilities/equipment. Although authorities are responsible for monitoring and guidance (including inspection) to secure the proper practices of ISWM by private sectors, all collection/treatment/disposal works are to be conducted by private sectors in view of the principle policy of the Government. Therefore, the proper management system of ISW can only be realized when sound activities of private sectors are substantially extended with reliable technological and financial background. In this context, authorities' optimum measures of private sectors' promotion are important ISWM policy issues.

a. Measures for waste generators' improvement

The waste generators need to take the following actions to secure the appropriate ISWM:

i. countermeasures to be incorporated in production and treatment processes in order to reduce waste generation and/or to simplify the treatment of generated waste;
ii. identification and analysis of waste characteristics (at initial stages, which will be a guess or estimate of waste characteristic referring to visual features of waste, raw materials and the production process employed);
iii. determination of appropriate measures for ISW generated (e.g.,

storage/treatment/recycling measures suited for the waste characteristics, choice of in-house treatment or entrusted treatment, etc.);

iv. Proper investment, maintenance and operation of facilities and equipment for storage, treatment, recycling, etc.;

v. selection of proper ISW handling agent and verification of whether the agent properly treats and disposes of the ISW entrusted; and

vi. record keeping and reporting to authorities of his ISW from its generation until its treatment/disposal.

The administrative measures as follows are practiced in Japan to improve waste generators' competencies in ISWM:

i. System for qualification of on-site ISWM engineers

Engineer qualification system regarding ISWM was established by the authority. Allocation of the qualified engineer was obligated to generators and ISW handling agents. In addition, training, seminar and workshop are held to educate engineers.

ii. Technical information provision

The technical information required by waste generators for the above-mentioned actions (i. to iv. above) are compiled for the guidelines and the reference texts to be delivered to waste generators or to be used for training and seminars mentioned in above.

iii. Public laboratory institutions' cooperation

The public laboratory institutions accepted laboratorial analysis of ISW at cheap prices. It helped waste generators to understand the characteristics of their wastes.

iv. Technical consultation

The authorities provide waste generators with the technical consultation service to answer their inquiries and questions.

v. Announcement of qualified ISW handling agents

The license system for ISW handling agents has been established and the list of licensed ISW handling agents has been made public to waste generators.

vi. **Easier manifest**

The data collection system and the report formats were prepared and devised to facilitate collecting data and reporting. In addition, it is also an indirect promotion measure that these works have been enforced by law.

The above mentioned measures should be introduced through sufficient examinations/modifications in view of intrinsic conditions of the Republic, in a step-wise manner to facilitate waste generators' proper ISWM.

b. Measures for ISW Handling Sectors' Improvement

The following measures are to be taken to develop ISW handling sectors.

i. Measures to enhance technical capability of the sectors; and
ii. Measures to promote creation of the market mechanism for appropriate treatment, disposal and recycling of ISW.

As for enhancement of technical capability, the measures similar to those proposed for waste generators may be applied (e.g., **ISWM engineer qualification, technical information provision, public laboratory institutions' cooperation, technical consultation, announcement of qualified handling agents**).

As for creation of market mechanism, it may be the most crucial and effective ones to develop ISW handling agents. Said measures (i.e. creation of market mechanism), to begin with, require eradication of illegal treatment/disposal routes (e.g. illegal dumping). The following actions should be taken for that purpose:

- closure and/or control of all illegal dumping sites;
- procedure of localization/operation permits to be established; and
- proper and qualified ISW handling agents to be announced publicly, etc..

According to the license system of ISWM business in Japan, operation of treatment/disposal facilities is granted to the ISW handling agent only when they complies the requirements e.g., "first to own facilities legally complying with requirements", "to allocate enough qualified ISWM engineers" etc.. Meanwhile, penalties are given to the waste generator when they entrust treatment/disposal of their ISW to a handling agent without a license. Since the manifest system is greatly being developed and devised for the recent years in Japan, local authorities identify and understand the actual ISW flows more correctly and precisely.

However, development of such ISW information system is enabled only when ISW handling sectors have attained appropriate treatment/disposal practices and illegal routes have been eradicated. Therefore, it is the first priority that the authorities take substantial measures to eradicate illegal routes of ISW treatment/disposal and to encourage creation of appropriate "market mechanism" in ISWM.

c. Laboratorial Analyses Sectors

The measures which were recommended for ISW handling agents can be applied for development of laboratorial analyses sectors, i.e.:

i. Measures to enhance technical capability of the sectors; and
ii. Measures to promote creation of the market mechanism of the sector.

As for "enhancement of technical capability", since laboratorial analysis requires specialized skills as well as many advanced facilities and equipment, the opportunity of training in this regard has to be provided. Guidelines of laboratorial analyses and textbooks for training of analyses should be prepared so as to meet needs of laboratorial analysis and environmental pollution prevention in Chile. CENMA project should be fully utilized for providing technical training course to educate analysis technicians.

As for "creation of market mechanism", it is suggested as follows. First is to enforce the regulation for waste water, gas emission and ISW (e.g. including obligation of laboratorial analysis), which consequently promote creation of the market mechanism of the sector. Second is to establish a "qualification system for environmental analysis including ISW analysis engineers" and also a " license system for laboratorial analysis institutions", in order for them to be socially recognized as technically qualified personnel and bodies, which consequently raise their social status. In Japan, the license is officially granted to the institutions which own substantial capacities to conduct analysis, and the data analyzed only by the licensed institutions are officially authorized. (The license is also given to the individual engineer in Japan.)

d. Manufacturers of environmental protection facilities and equipment

The Japanese Government has played the positive role by proceeding the following measures to develop an industry of manufacturing environmental protection facilities including SWM.

i. The central government subsidizes local authorities and provides soft loans in their improving sewerage system and SWM system, and also provide private enterprises with subsidy when they invest in environmental protection facilities and equipment. The demand rose for manufacturing environmental protection measures and facilities.

ii. At the same time, the government has strengthened the regulation/standard gradually, which consequently forced them to introduce environmental protection measures and facilities.

iii. Learning of environmental protection technologies from foreign countries were encouraged. In addition, the Government provided national manufacturers with financial and technical assistant for development of technology.

iv. The government has established a system to examine and approve nationally developed technologies to restrain the spread of problematic technologies. Government examination and approval of technologies worked out for prohibiting the bargaining of inappropriate facilities and equipment and for promoting qualified ones.

The current situation for Chile is quite different from the period of 1960s and 1970s in Japan when the Japanese government took these measures. Various alternative technologies are available these days, therefore, the Team understand that it might be practical for the Chilean authorities take the following measures:

i. The government provides with information concerning overseas' latest technologies and manufacturers of environmental protection facilities and equipment to help local private enterprises to enter the industries;

ii. While the regulation and the standard are being strengthened, measures to urge industries to install related facilities and equipment should be simultaneously taken by authorities; and

iii. The government should formulate a system to examine and approve the appropriate technologies for Chilean industries and introduce the information of these appropriate technologies and facilities widely to Chilean industries.

8.8 Monitoring and Information System

a. Main Issues on Monitoring and Information System

In order to establish a proper ISWM system, another set of important issues are the

formation of an appropriate monitoring system and information system. The monitoring system can work only in a pair with information system, and they, therefore, contribute to establish a proper ISWM system only when both of them have functioned simultaneously.

The main issues on monitoring system and the information control system are summarized in the Table 8.8a.

Table 8.8a Main Issues on Monitoring and Information Control

Monitoring System	Information System
1. **Monitoring on ISWM (on-site)** - to identify characteristics of ISW and to understand their amounts; - to check whether storage and treatment facilities are appropriate; - to check whether residues are well treated/disposed. * Analytical identification of ISW (especially HW) and on-site inspection for storage/ treatment facilities are key issues of monitoring in this regard.	1. **Information on ISWM on-site** - Generation of ISW - Storage/treatment facilities and equipment - Operation and maintenance of facilities/equipment - Treatment, disposal and entrustment of residues - Responsible personnel These information are to be prepared by waste generators for reporting to the authorities. For monitoring of HW, information regarding use of raw materials including hazardous substances, and regarding facilities and processes which may generate hazardous wastes are also important to supplement monitoring.
2. **Monitoring on ISWM outside by the manifest system** * This is an issue on monitoring for the manifest system. This will be useful information to prosecute the improper routes of ISW.	2. **Information by manifest system** Concerning ISW being moved out from the premises of waste generators as a form of entrustment or recycling, the authority has to confirm the information on all the routes that said ISW are transported, recycled, treated and disposed.
3. **Monitoring on operation of treatment/disposal facilities** * This is a monitoring system to understand whether intermediate treatment facilities and final disposal sites are properly operated or not. It mainly focuses on monitoring for environmental pollution by the facilities but also whether it is operated within their capacity or not.	3. ***Information on operation of treatment, recycling and disposal facilities of ISW handling agents, recyclers and waste generators*** The information should cover: - whether operation complies technical standards, - whether treated amount are within the capacities permitted, and - authorities' supervision for those items, - information on illegal dumping.

b. Building a monitoring system

The following measures should be taken to cope with the three issues pointed out in the left column of Table 8.8a.

i. Monitoring on ISWM on-site

This is the first step of monitoring among other, which comprises: identification of characteristics of waste generated on-site, their amounts, on-site storage/treatment facilities, their operation conditions, treatment/disposal of residue, etc., in order to secure the proper management. The following measures are required for the system:

- Identification of generated ISW (especially HW). It is possible to screen major suspected HW generators via information of the raw materials and the production process and facilities they are using.
- On-site inspection: It is necessary to check the ISW storage condition, the operation condition of on-site treatment plants and the quality of waste water, gas emission and ISW generated periodically in order to identify performance of operation.

ii. Monitoring on ISWM outside by the manifest system

This requires establishment of the manifest system by which three parties; "waste generators", "destinations (i.e. recyclers or ISW handling agents)" and "the authority" could and should mutually confirm what ISW are collected, transported, handed to the "destination" and recycled, or treated/disposed. Strict and persistent guidance by the authority is essential to make the manifest system functional because it requires that waste generators and destinations to comply with the proper transaction of data.

In addition, prosecution of illegal routes of ISW, a licensing system for treatment/disposal and recycling enterprises, the report collection from waste generators and ISW handling agents are required.

iii. Monitoring on operation of treatment/disposal facilities

In order to detect and prevent environmental pollution caused by the intermediate treatment plants, final disposal sites, etc. (in case), they have to be monitored. It requires self-monitoring by waste generators/ISW handling agents to check the quality of waste water and gas emissions from their intermediate

treatment and disposal facilities. Periodical and sporadic on-site inspection (including checking of waste water and gas emissions quality) by authority is also required.

At final disposal sites, leakage of leachate and discharge of treated leachate have to be monitored. In Japan, leakage of leachate is monitored at inspection wells which are located near the disposal sites. As for the monitoring of the leachate treated, periodical analysis of effluent or the provision of a fish pond are used.

In addition, it requires to check whether the plant operate within its capacity. Inter-relation of "on-site inspection system by the authorities", "the manifest system" and "report collection" are required in this regard..

Such comprehensive monitoring system can not be attained with ease. To aim at establishment of a very precise system might bring a mess and confusion. In Japan, the following actions have been taken to find out the actual conditions and problems:

- HW generators have been identified by authorities;
- Waste generators have been obligated to submit reports (when ordered) and this practice was gradually established;
- The records and data obtained from the inspections have been accumulated; and
- The ISWM survey is conducted every five years.

The manifest system which presently covers the whole Japan has been introduced recently after implementing the above-mentioned practices for more than 10 years. Nevertheless, the monitoring system has not attained a substantial level yet.

For Santiago MR, eradication of the improper disposal routes of ISW (e.g. recycling at illegal dumps), establishment of license system for ISWM and strengthening of manifest system of PROCEFF should be challenged.

b. Building an information system

It is necessitated that an information system be established in order to achieve the proper management system of ISW from the following reasons:

i. Authorities need to understand correctly the flow of ISW from its generation to final disposal including treatment and recycling, and the actual conditions of control and treatment at each process in order to place

appropriate and optimum guidance for all related sectors.

ii. It is necessitated for authorities to find out problems in the actual situations, and urge waste generators and ISWM enterprises to improve them, and accumulate data for following up.

The information control system has to include the following information and data.

1. Data regarding the conditions of generation, storage, treatment, entrustment, etc. of ISW at waste generators (on-site);
2. Data regarding the conditions of production facilities which generate HW, and facilities of ISW storage/treatment at waste generators (on-site);
3. Data regarding the plans and programs of control and treatment of ISW at waste generators (on-site);
4. Data regarding transportation, storage, treatment, disposal and recycling of ISW outside generations (flow);
5. Data regarding reception, treatment, disposal and recycling by ISW handling agents and recyclers (destination);
6. Data regarding specification, capacity and operation record of treatment, disposal and recycling facilities owned by ISW handling agents and recyclers (destination);
7. Data regarding illegal dumping, violations and improper routes; and
8. Data regarding general information, e.g. global and local trends in ISWM business, new and conventional technologies related.

The information system will play important roles both for private sectors and the administrative authorities with following objectives. Data (from 1. to 8. above) required for respective objectives are list below:

i. Private sectors

- Factories should plan and decide the best option for treatment and disposal of ISW generated (e.g. on-site or entrusted). Information required in this regard are: 1., 2., 3. and 5. above.

- ISW handling agents and recyclers should plan and implement appropriate receiving and handling of ISW in their business. Information required in this regard are: 1., 5. and 6. above.

ii. The administrative authorities

- The authority needs to plan an overall monitoring program, and to

implement related supervision and guidance including inspection. Information required in this regard are: 1. to 7..

- The authority needs to provide technical consultation for waste generators, ISW handling agents and recyclers. Information required in this regard are: 8.

The private sectors require data and information in order to maintain their business sound and lucrative. On the other hand, authorities require data and information in order to monitor, instruct and provide guidance and consultation and consequently promote appropriate ISWM. Therefore, the final objective for the information system is to provide immediately with the data which satisfy these objectives. However, such system can be established by constant and steady accumulation of data. In practice, the following procedure have to be taken for collecting, inputting and renewing data.

- questionnaire surveys to understand the actual conditions for 1. to 6. above;
- report collection from waste generators for 1. to 3.;
- report collection from ISW handling agents and recyclers for 4. to 6.;
- on-site inspection by the authorities for 1. to 7.;
- application and permission procedures of treatment/disposal facilities and their operation for 2. and 6.;
- notices from residents, local authorities and polices for 7.; and
- exchange of information among academics and national/international institutions and organizations for 8..

How and to what extent the data is accumulated in the information system depends on the magnitude of necessity of the data and the costs incurred for collection, accumulation and renewal of data. In view of the present situation of ISWM in the MR, it is recommended that

- the data of "major waste generators", "the actual conditions of ISW handling agents and recyclers" and "the improper/illegal routes" be accumulated mainly from individual questionnaire surveys;
- the overall flow of ISW and related problems be filed and utilized for planning macro policies; and
- the information on the "ISW flow" from manifest data be kept for a certain period as reference materials for inspection, supervision and guidance.

An information system (such as shown in Figure 8.8a below) should be established in a step-wise manner with constant and steady data compilation.

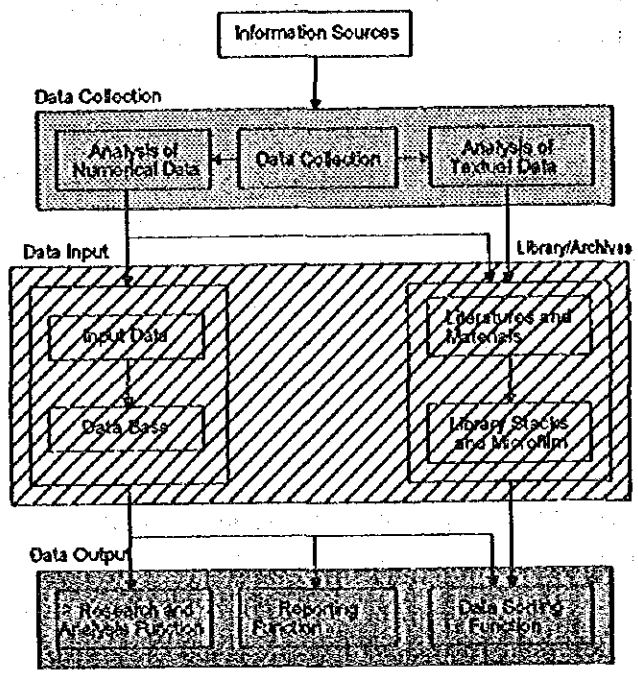


Figure 8.8a Concept of Information System

8.9 Permission Procedures for Localization of ISWM Facilities and License for ISWM Business

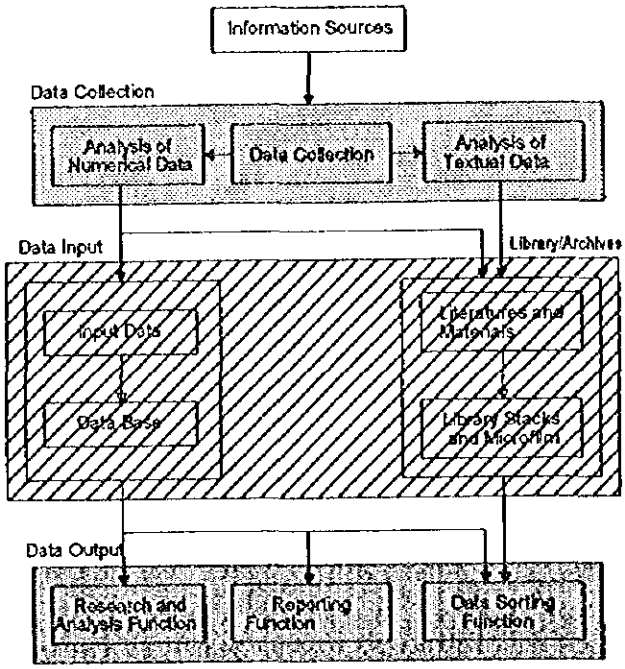
a. Permission procedures for localization of facilities

In order to realize appropriate localization of ISWM facilities and formulation of the ISWM business, permission procedures (especially including procedures for neighborhood consensus) should be established.

In practice, the following measures should be taken by the responsible authorities 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.



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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 promoting sector should have a public hearing to the facility's neighbors and presumably affected people. 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 authority is responsible for the final judgement of a project receiving permits.

v. On the assumption that the above procedures are secured, where the responsible authority faces the situation of having to issue a justifiable 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.

b. License for ISWM Business

In order to practice the ISWM business, it should be necessary to own ISWM facilities and to obtain a license for ISWM business. Permission for operation of facilities and license for the business should be separately issued with following reasons:

i. Even though localization is permitted, it is necessary to verify whether the facilities are constructed as proposed and required functions are equipped. After confirmation, permission for operation of the facilities should be issued.

ii. In addition to fulfillment of structural and functional compliances, it is a precondition in general for licensing ISWM business that "assignment of qualified technical staff", "responsible organizational structure" etc. to be fulfilled in their business practices. Judgement in this regard should be placed apart from facilities evaluation.

iii. ISWM facilities are subject to trading. If owning a facility after purchase allows the business operations, a company without technical competence may carry out the treatment/disposal practices. It consequently will undermine the reliability of the whole ISWM sectors.