H.5.2 Collection and Transportation of Municipal SW

In accordance with the Organic Constitutional Law of Municipalities (Ley Orgánica Constitucional de Municipalidades) and according to the relevant stipulations of the Sanitary Code (Código Sanitario), municipalities are responsible for everything related to the cleaning of the comunas and specifically for the activities of collection, transportation and final disposal of garbage, domestic waste and others that have similar characteristics.

For that end, each municipality has a Cleaning and Embellishment Department in charge of administering and carrying out the activities related to the comuna's cleanliness.

In the Metropolitan Region, up to the year 1985, the greatest part of the collection and transportation of domestic waste (66%) was carried out by private companies, sub-contracted by the municipalities, which was a result of a privatizing process begun between 1981 and 1982.

Currently, approximately 90% of the waste is collected by private companies and only the remaining 10% is collected directly by the municipal system. The municipal service is carried out directly by the Cleaning and Embellishment Department of the respective municipality.

For the service of third parties, the municipality establishes a contract with the company that provides the service. In the collection and transportation contract the type of service that will be provided by the contracted company is clearly established, such as the frequency, coverage, type of waste to be collected, volumes, sanctions for non-fulfilment of agreements, etc.. The contracts are carried out by one or several companies. There are different kinds of contracts and experiences have been varied. Some of them are indicated below:

- In the Municipality of Providencia, up until December 31, 1991, the waste collection service was municipal. As of January 2, 1992, the comuna's collection and transportation service was given out, on a very small scale, to a private company which mainly serviced hospitals, television channels and building complexes. In 1994, another authorization was given out for the purposes of carrying out collection services in certain areas.
- In the Municipality of Santiago, a mixed collection and transportation service is offered. This case is special because it is in the center of the city, where apart from the permanent residents there is a floating

population of more than 2,400,000 inhabitants. The cleaning area is subdivided into 5 parts; cleaning is carried out by municipal personnel, supported by a fleet of 36 collecting trucks, and 6 cistern trucks for street washing. The sweeping of streets in the central perimeter of the capital is in the hands of a private company, with 70 workers.

- In the Municipality of San Miguel, collection and transportation is entirely carried out by one private company. The municipality also has municipal trucks that perform cleaning operations within the comuna, especially the removal of pruning waste, debris, clandestine waste and the cleaning of public thoroughfares.

In this way, contracts have three different forms according to the function that needs to be fulfilled: collection of domestic solid waste contracts; road sweeping contracts and contracts for cleaning places occupied by street markets.

In turn, the domestic solid waste collection and transportation contracts have three basic forms, which can be combined with each other. In the first place there is garbage with transportation to the final disposal site. Secondly, the contract includes collection, transportation and final disposal administered by the same company. Thirdly, the contract can be wider in scope and may include waste collection, the sweeping of streets, and transportation to the final disposal site.

The number of days in the week in which the collection service is carried out (to be established in a contract) depends on the weather, as well as the rate of waste generation, and the socio-economic sector (residential, commercial, industrial) to be cleaned. According to these conditions different frequency systems are established (daily, even weekly). The cost of the system is obviously dependent on the periodicity established in the contract, on the population density, on the type of sector and on other factors.

One of the most relevant aspects for the design of a collection system is the sectorization of the area and collection routes. An adequate design allows for an efficient system which significantly decreases dead time, that is time not used for collection, which minimizes costs.

For the Metropolitan Region the collection frequencies are generally 2 to 3 times a week, an amount that increases in special sectors of greater density, which is the case of the center of the comunas where collection frequencies are sometimes daily.

The trucks that carry out collection are compactors, with a capacity of 10 to 15 m^3. A driver and three labourers that carry out the collection travel in them. Generally

each truck makes between two and three trips daily, and the time of the cycle between the gravity center of the comuna and the sanitary landfill goes from 165 to 330 minutes.

The collection and transportation costs represent the greatest incidence in the total costs of domestic waste management in the Metropolitan Region. In average the costs go from 15 to 25 US$/ton and in many contracts an additional rate for ton/km has been considered, contemplating a possible change in the location of the final disposal site given that the capacities of the current landfills are reaching their limits.

H.5.3 Street Sweeping and Public Areas Cleansing

Just as the municipality is responsible for the collection, transportation and final disposal of domestic waste, it is also responsible for the sweeping and cleaning of public areas, without the participation of any other authority.

The main problem with cleaning public thoroughfares lies in low efficiency, which makes service costly. Currently many municipalities include, as part of the collection and transportation contract, sweeping and public area cleaning. This aims at giving attention to the main roads of each comuna, specially to the centric sectors.

In the municipalities with high socio-economic levels, sweeping is mechanized and includes a high percentage of the public thoroughfare. Services decrease in quality with lower socio-economic levels, and that is why, in the municipalities with the lowest incomes, sweeping is generally manual and coverage is minimal.

Another way to carry out the cleaning of public areas is through operations that take place once a month, generally carried out directly by the municipality (utilizing equipment, vehicles and its own personnel) and which aim at cleaning specific areas, gardens or others, specially in what pertains to the removal of debris. These operations include those that correspond to the removal of rubbish left behind by pruning, maintenance of gardens, public squares, green areas, etc..

H.5.4 Treatment and Final Disposal

a. General

Once municipal waste is collected, it is taken directly to the places of final disposal, without any type of intermediate treatment.

In Chile since the 1980s sanitary landfills are in operation. This system had been recommended by various international organizations, especially the World Health Organization, because it involved smaller investments and because it is a system used with good results in developed as well as developing countries. The first and most important evaluations on the topic were carried out by the University of Chile and confirmed the relevance of implementing the technique, given the conditions of the Chilean case. This tendency continues today.

The sanitary landfill consists basically of depositing the garbage in layers, distributing and compacting it with heavy equipment and covering it with a layer of soil at the end of the working day. These soils must fulfill technical specifications that ensure that the migration of gases is avoided, that minimize the entrance of rainwater and avoid the proliferation of sanitary vectors. Before placing the waste it is necessary to carry out a series of works to keep the waste confined and to stop it, or the subproducts that are generated as a result of decomposition, from contaminating the environment or causing problems in nearby communities.

Among these works are included waterproofing and drainages for the bottom of the landfill to stop leachate from migrating and possibly contaminating subterranean watercourses. In many cases, given the great quantity of organic matter and humidity that our wastes possess, and as a result of the anaerobic decomposition of waste, gases with a high content of methane (CH_4) and carbon dioxide (CO_2) are generated inside the landfill. These gases must be ventilated and their accumulation within the mass of the waste must be impeded. This must be done because of the high risks that are involved (methane is combustible and explosive) and to avoid migration towards neighboring areas, where contamination of soils or others could be produced. This ventilation is carried out by means of the construction of vertical drainages that cover all the depth of the waste and maintain their continuity from the base of the landfill. The percolated liquids that get out of the garbage cells are taken to accumulation deposits from where they are introduced again to the mass of waste, which allows the production of biogas to be increased and maintains liquids inside the landfill. Surface water and/or precipitation water is intercepted before it enters the landfill, thus stopping it from coming into contact with waste or with percolated liquids. To avoid

the entry of people alien to disposal activities and of animals, the whole perimeter of the site must be closed, in addition to the construction of access and interior roads that allow waste collecting vehicles to circulate. With the purpose of verifying the efficiency of control measures, wells and/or monitoring points are constructed which allow the quality of waters, soils and the air to be known as well as if these natural resources have been affected by the landfill's activity.

Once the landfill reaches its final quota it is necessary to construct a covering layer that protects the garbage cells from different erosion processes; it is also recommended that the renewal of the vegetation cover that existed before the project begun is considered.

Regardless that final disposal in the country is carried out by means of sanitary landfills, it must be made clear that not all have the same level of operation and many are only controlled rubbish dumps. A series of problems have been caused as a result of the inadequate implementation and bad management of final disposal sites. Among these problems is the contamination of superficial and/or subterranean watercourses because of their coming in contact with waste or leachate; the proliferation of sanitary vectors, because of inadequate covering of waste, which transmit diseases to neighboring populations; contamination of the air because of spontaneous combustion of waste or the migration of biogas; generation of foul smells because of inadequate operation of the landfills; recuperation of goods contained in the waste without any type of control which transforms people that work in this activity into sanitary vectors; destruction of the landscape and devaluation of land adjacent to landfills.

With regard to the situation in Greater Santiago, 100% of the waste generated is deposited in three sanitary landfills, which have the authorization of the Health Service (Servicio de Salud) to operate. These correspond to:

b. Lepanto Sanitary Landfill

LEPANTO SANITARY LANDFILL: Located to the southwest of Greater Santiago, in the comuna of San Bernardo, close to the Locality of Nos, near the road known as Los Morros, to the East of Cerro Negro.

It has been operating since the year 1979 and it currently receives the waste that is generated in the comunas of San Bernardo, Puente Alto, Buin, Pirque, Paine, Calera de Tango and part of the waste of the El Bosque and La Pintana municipalities. All this amounts to 16,000 tons of waste per month.

Some waste supplied by private individuals and which can be assimilated with urban

waste are disposed of together with municipal waste. Waste coming from industries is also received and it is deposited in other areas without any kind of conditioning or protection, without the keeping of records, statistics or backgrounds with regard to their entry and origin.

This landfill is located above an old sand extraction pit which was privately owned. The waste is deposited directly on the natural terrain which is made up primarily of permeable soils. There are no superficial water courses and subterranean water is located approximately 80 meters below the landfills's foundations.

Waste is deposited and compacted by means of machinery, and it is usually covered at the end of the working day. The gases that are generated are collected and commercialized for industrial use. There exists no treatment or adequate management of the leachate that is generated, which causes strong smells in the sector and increases the possibilities of soils or watercourses being contaminated.

At present, there is not a monitoring program for water, soil, air, biogas migration, etc. and a recovery program for the area once the project is concluded has not been considered. This is why an increase in the production of liquids, foul smells, uncovered garbage, etc. can be expected, as erosive processes continue to affect the covering of the waste cells, because they lack a protection cover.

Within the site where the landfill is located, there are sectors that are being operated for the extraction of sand. This has been generating huge perforations which in future could eventually be used for the disposal of urban waste or construction waste. That is, only if engineering projects are designed which ensure that no environmental damage will be produced.

The plots adjacent to the Lepanto terrain are primarily for agricultural use together with some small ones for development.

As far as the operational aspect, the Lepanto landfill has a deficient management, which is why it could be considered simply as a controlled garbage-dump.

The landfill is administered directly by a private individual (owner of the land), who offers the service to the municipalities and establishes a rate per ton of deposited waste.

The activity does not undergo through any type of control by the municipalities that use the site, and a system to control the weight of the waste that enters the landfill is also missing.

c. *Cerros de Renca Sanitary Landfill*

CERROS DE RENCA SANITARY LANDFILL: Located in the northwest sector of Greater Santiago, in the comuna of Quilicura, adjacent to Av. Americo Vespucio. This landfill began operating in April 1978, and it takes in 30% of the waste produced in Greater Santiago. Currently it receives the totality of the waste produced in the municipalities of Las Condes, Lo Barnechea, Vitacura, Conchali, Huechuraba, Quinta Normal, Renca, Quilicura, Colina, Lampa, Pudahuel, Lo Prado, Cerro Navia and part of the waste generated in the comunas of Santiago, Independencia and Recoleta. The total waste that enters monthly amounts to approximately 56,000 tons.

Waste from collections made directly to generating groups by private companies also enter the landfill. Among them there are wastes that can be assimilated with urban wastes, and which signify a monthly inflow of around 9,000 tons.

This sanitary landfill is the only one authorized to receive hazardous industrial waste because it is located in an area of approximately 1 ha. This area does not have any kind of conditioning and the wastes are deposited directly on the ground. At the site, large pools that contain a variety of industrial products can be seen but their characteristics are unknown. The most worrisome situation is the mixing of wastes of different nature, which causes an additional management problem and a risk, because there exist great volumes of final wastes with a variety of highly toxic components. This area set aside for industrial wastes is generally used by the Environmental Health Service to send wastes that have been abandoned in public thoroughfares by generators or for wastes that are generated in special circumstances.

This landfill was built between hills, which has allowed the activity within the site to be partly hidden. Wastes are deposited directly onto the natural soil, which is formed by a mixture of clayey and loamy soils. Because it is found between hills, during the rainfall season the area of the landfill receives all the waters that run down the slopes, which considerably increases the amount of water on the surface. This situation is produced because there are no works that allow water to be intercepted and led outside the area of the site. Bad management of the landfill, together with the inflow of rainwater and inadequate covering of the waste cells, have allowed great quantities of leachate to be generated in different parts of the landfill, contaminating the covering layer. For the storage of liquids there are great deposits, for the most part uncovered, which produce strong odours. This situation has meant the rejection of the project on the part of the community.

The type of landfill that has been developed is the one known as AREA, where wastes are deposited above the terrain, distributed in layers and compacted with heavy

machinery, generally D-8 bulldozers. The wastes are covered at the end of the working day, with soils extracted from the same site. For the ventilation of gases vertical drainages were built, known as chimneys and located at a distance of 25 meters between each other. At a first stage, the gas is aired out into the atmosphere or burnt and later it is extracted and sold. This biogas forms part of the gas that is sold in Santiago as pipeline gas. The volume of biogas extracted monthly is of around 1,500,000 m^3, which means a total of 5900 x 10^6 Kcal.

The liquids that are generated in the landfill do not undergo any kind of treatment and are only kept in accumulation deposits.

Just as in the case of the Lepanto landfill, Cerros de Renca does not have any monitoring program which would allow the performance of the landfill to be checked and to find out if contamination of the environment exists.

The sectors of the landfill that have reached their final quotas do not have any type of protection or vegetation cover to impede the deterioration of the waste cells. To date there is no closure program that permits the control of waste disposal effects in said sectors.

The areas adjoining the landfill correspond to plots of land used for agricultural or industrial activities. When the activities of the sanitary landfill began, the site was totally removed from households or settlements, but due to an inadequate protection policy for the facility, the construction of households very close to the limits of the site was permitted. The new inhabitants complained about the construction of the landfill, which has forced proposals to close the site even though it has enough terrain to continue working.

In the future the latter will mean a strong increase in the cost of managing the solid waste of municipalities which currently deposit waste in Cerros de Renca. The reason for this is that the next landfill will be located 60 km away from the present one (Montenegro sector), and it will have to operate with transfer stations. It is estimated that the future operation will mean an increase of about US$ 8 per ton.

In general, the landfill has had operational defects, especially with regard to the management of leachate. In addition, in the last couple of years there has been an increase in the number of people who reclaim objects found in the garbage, even though it is an activity which is totally forbidden by the sanitary authorities.

This landfill is administered by a Council of Mayors, which subcontract the operation of the landfill to a private company. To verify the correct construction of the landfill

and the fulfillment of sanitary norms, the council subcontracts another private company to carry out technical inspection activities of the facility.

d. Lo Errazuriz Sanitary Landfill

LO ERRAZURIZ SANITARY LANDFILL: Located in the western sector of Greater Santiago, in the comuna of Estación Central, at one side of the Zanjón de la Aguada.

It has been operating since September 1984 and currently receives the waste generated in the municipalities of San Joaquín, Isla de Maipo, Pedro Aguirre Cerda, Lo Espejo, Cerrillos, San Miguel, Ñuñoa, La Cisterna, Providencia, Maipú, La Granja, La Reina, La Florida, San Ramón, Macul, Peñalolen, Estación Central, Talagante, Peñaflor, and also part of the waste from the comunas of Santiago, El Bosque, La Pintana, Independencia and Recoleta. The total amount of waste that it receives monthly is approximately 90,000 tons.

Just like the other landfills, it too receives waste collected by private companies which can be assimilated with urban waste in a monthly total of 17,000 tons. It is strictly forbidden by the sanitary authority to receive hazardous wastes given its nearness to households, but it is nonetheless impossible to be sure that such wastes do not enter together with other wastes.

This landfill was constructed in an old sand extraction pit, and it is the first sanitary landfill that began operation with an engineering project that took the waterproofing of the bottom and of the walls into consideration, in order to avoid the migration of contaminating elements.

However, and in spite of the security measures adopted since the beginning of the landfill's operation, the earthquake of March 1985 produced an accident in the construction of waterproofing for the walls, specifically the failure of the waterproof geomembrane, a fact which in turn caused a series of problems in which both inhabitants and authorities were involved. The breaking of the waterproofing plate caused a lateral migration of gas towards the houses near the North wall of the pit. This situation was controlled by perforating a barrier of 10 deep wells, which allowed the leak to be intercepted and the problem to be controlled.

Due to the situation described above, the Lo Errázuriz sanitary landfill project was revised and re-designed. The new project was approved in September 1986 by the Ministry of Health and the Metropolitan *Intendencia*.

The new design of the sanitary landfill established a special waterproofing system for the North wall of the pit as a way to prevent any possibility of accidents in the future. At that time, a wall of 1.0 meter wide gabions was placed above the polyethylene plate that rests on the wall. The gabions, which are of uniform size and filled with round stones, were covered on the inside with a 5 cm thick layer of mortar (water and cement). On top of the gabions and resting on the layer of mortar, a second plate of polyethylene was placed. Tubes with slits were left inside the gabions, these having the thickness of the whole waste deposit, so that continuous monitoring could be carried out and biogas migration could be detected.

This waterproofing was joined to the one already designed for the bottom (a highly compacted 60 cm layer of clay with a permeability of $k=10^{-6}$ cm/sec.), and the one for the South wall (a 1.5 mm thick high density polyethylene plate).

Once the 1985 gas migration was overcome, and after the waterproofing was modified, there have been no new biogas migrations, a fact which is demonstrated by the monitorings that take place daily both inside the landfill and in adjoining areas. The project also foresees the monitoring of underground water, through water samples taken in 10 deep wells located downstream and upstream of the landfill. These samples are subject to physical-chemical and bacteriological analyses. The results of these analyses are compared to standard data obtained when waters were characterized before waste was deposited. To date there are no records of aquifer contamination.

The wastes are deposited on top of the bottom waterproofing, distributed in compacted layers and covered with natural soils at the end of the working day. The covering material is extracted from outside sources. The leachate is stored in an accumulation deposit from where it is recirculated to older parts of the landfill to increase the production of methane and to stop them from leaving the landfill.

At a first stage, when the gas that is generated has a low content of methane, it is ventilated through vertical drainages, located some 25 m from each other, or burnt. Once the quality of the biogas improves, it is captured and sent to a cooling plant from where it is taken to accumulation tanks and later mixed with fossil fuels and sold as pipeline gas for domestic use. Currently, some 4,000,000 m^3 of biogas are extracted monthly which have a calorific power superior to 4,700 kcal/m^3 and a methane content of about 54%.

The total surface of the sanitary landfill project is of 40 ha, of which 11 ha have already been finished, and above the final covering, green areas have been built. This forms part of the recovery program of the sector which considers the construction of a park.

The lands adjoining the landfill on the North side are completely inhabited. The ones located on the South and West sectors are occupied by illegal waste dumps, where a large amount of waste of industrial origin is currently deposited.

Initially this sanitary landfill was administered by a Council of Mayors, but due to operational problems on the part of the private company in charge of building the landfill during 1985, the Council of Mayors formed an enterprise of limited responsibility, whose objectives were the study, development, administration and operation of the appropriate systems for solid waste disposal of the 15 municipalities that formed part of the society.

This company currently undertakes the construction of the sanitary landfill, and subcontracts specific equipment and services to contractor companies.

Given the different works that this project involves, the rate is higher in comparison with the other two landfills of the Metropolitan Region, and reaches today a cost of US$ 5 per ton.

The end of the useful life of this landfill was estimated for December 31, 1994. However, due to various problems in decision-making with regard to future final disposal sites, the closure date has had to be postponed. This situation has created negative conditions for the project because in order to receive a greater volume of waste it was necessary to increase the height of the landfill. This has caused an increase in the incidence of leachate with the subsequent problem of foul odours and contamination risks. There has also been a delay in the execution of the final covering, which has increased the migration of gases to the atmosphere, and therefore damages to the environment. This increase in height has also meant greater inconveniences for the management of rainwater.

Up until now, because of lack of another landfill where municipalities, especially those located in the South sector, could dispose of their waste, an emergency solution has been considered which consists in moving over 50% of the wastes that are disposed in Lo Errázuriz to the Lepanto sanitary landfill. This situation will create severe inconveniences to the final disposal system because the Lepanto landfill is not prepared to receive greater volumes of waste, especially because of its awful level of operation, the lack of appropriate access routes, the lack of protections to avoid contamination, or of any engineering project to carry out constructions or to monitor the works.

On the other hand, the wastes originating from the comunas located in the North sector, will be taken to the sanitary landfill which is projected for Montenegro and which in turn will receive the wastes of the municipalities that deposit in Cerros de

Renca. In this case, the wastes will first need to be taken to a transfer station and from there to the landfill, given that the distance to the final disposal site will increase in more than 70 km.

For this last case, it is expected that the rate for final disposal will be above US$ 12 per ton, including transfer costs.

H.5.5 Recycling in the Metropolitan Region

a. General

According to what is established in the Organic Constitutional Law of Municipalities and in the Sanitary Code, any activity that takes place during the management of solid urban waste is of exclusive responsibility of the Municipalities and it is their duty to authorize, administer and operate, directly or through third parties, any recycling process.

To date, some comunas have carried out pilot experiences in the field of recycling. None have truly prospered, especially due to an unstable market for recovered products, which makes it necessary to subsidize the system.

The prevailing conception of the operation of a sanitary landfill makes it incompatible with recycling in the site, which leaves open two alternatives: either recycling is organized from a first selection and classification in the home, before transportation begins, or separation centers are created in the sanitary landfill facilities themselves.

On the other hand, one of the main reasons for the existence of recycling in Chile is the level of poverty in which some sectors of the population live. People living in poverty and who barely have education necessarily see in waste collection a means of income. This activity has been sponsored by different entities and they have been successful in making recycling a viable way to make a living for these people.

From the above we can infer that, up until now, there exists a level of recycling which is not controlled; that is to say, it takes place without any kind of organization. This kind of recycling is really an illegal activity which is carried out by different people known as *cartoneros* or *cachureros* (scavengers) who take away different elements from garbage bags at the doors of households, before they are removed by the municipal collection service.

The majority of scavengers are men (80%), with an average age of 29 years, and an average schooling of 6th grade. They come from low income comunas, the majority have vehicles to work with (76.7% use tricycles) and they do so preferably alone. In half the cases, they are the only member of the family that is dedicated to the activity and on average have been dedicated to this kind of labour for 9 years.

Cardboard represents 50% of their income and their working day is of approximately 10 hours, preferably working at night because of social rejection towards their work. In an average run of 30 km their average product is 100 kg each day. They have a monthly income of $ 100,000 working 5 days a week.

Among the elements that are recycled are: plastics, paper and cardboard, glass and crystals, ferrous and non-ferrous metals.

b. Plastics

As a way to make recycling easier, ASIPLA, the Association of Plastic Industrialists, has published a codification system for plastic containers, making special references to ensure that recycled plastic materials under no circumstance are re-used or re-processed to manufacture containers that will later contain products for human consumption.

The junk collectors separate polyethylene bags and the larger containers such as bottles, buckets and drums, but not the smaller containers for milk products, margarine, oils and others. The value for re-selling such items is calculated according to cleanliness, quality, humidity, colour and printing.

Currently, recycled plastic products are:

- Low and high density polyethylene (thermoplastic)
- Polypropylene
- Expanded polystyrene (thermoformed)
- Acrylic (thermoformed)

It is estimated that in Chile the installed capacity is approximately 1,000 tons/month in thermoplastics, the recovery productivity is approximately 5.4 tons/person per month and the percentage of waste or losses is 3%, which occurs mainly in the extraction of material.

c. Paper and Cardboard

This material is without a doubt the product most commonly recycled in all the world. It is an element and raw material of great density and consumption because of its global use as a basis for communication, information, packaging, hygienic services, etc.

The main characteristics for its acquisition in Greater Santiago are:

- Cleanliness: free of contaminating substances and foreign substances (plastics, staples, wire, talc, etc.).

- Humidity: a small percentage is accepted, between 10 and 13%. Above this level penalties are applied and above 20% the product is rejected.

- Conservation state: for example, a better price is given for new unread newspapers than for read newspapers.

The total re-processing capacity for papers and cardboard in the country must be near 20,000 tons/month, of which 75% is being re-used, mainly in Greater Santiago. The material is recycled for the production of corrugated paper, toilet paper, egg boxes, fruit boxes, packages, cardboard, tissue, etc..

The most dangerous factor in this activity would be a decrease in the international price of paper.

d. Glass and Crystal

This is another product that is commonly recycled and in which 100% of the collected material is used, the source of which is primarily glass from containers and flat glass.

This material is bought whenever clean of foreign substances, especially resins or chemical residues.

The recycling of glass for containers is a closed circuit because it is used time and again for the same end. The importance of this form of recycling is that for every ton of re-utilized glass, a ton of natural resources is spared. This process also reduces contamination produced in obtaining natural resources by 15%, and 30% less energy is required.

e. Ferrous Metals

It is not possible to estimate the quantity of material that is recycled but it is clear that a very small amount comes from domestic waste. In general the largest percentage is obtained from waste coming from demolitions or constructions.

f. Non-Ferrous Metals

These materials come mainly from industrial wastes and scraps and the theft of electrical and telephone installations. What comes from domestic waste is not very significant and it originates mainly from aerosol containers, knobs and metallic wraps.

g. Present Problems

Even though, at a first glance, recycling may appear attractive, there exists a variable which is not usually considered in the evaluation of projects of this nature. It pertains to the fact that the work conditions of the people that obtain the products constitute a serious social problem. In fact, one of the gravest problems that the local authorities face today is related to the so-called *cartoneros*. In the Metropolitan Region their number is estimated at 30,000 people, coming from the poorest sectors of the city, who are dedicated to this activity as a source of income. One of the ways to face this social problem is through the creation of FOSIS projects to form micro-enterprises of associated workers, thus incorporating them to the labour system. One of these projects was carried out in the comuna of Estación Central, with the aim of partly eliminating the problem of the junk collectors that illegally entered into the Lo Errázuriz sanitary landfill to recover objects from the garbage. This project, however, did not prosper especially because of the increase in costs that operating the system in an organized and sanitary manner entailed (one that does not represent dangers to human health). The permanence of these projects in time generally requires subsidies because they are not profitable on their own. In view of this, and before developing any recycling project, it is necessary to establish the amount of recycled resources that municipalities want to have recovered so that this sector is incorporated into the workforce with certain minimal conditions of any paid work.

In summary, recycling can only be viable under certain market conditions which generally are hard to maintain in developing countries, which is why it does not appear to be a clear policy to be recommended in all cases.

H.5.6 Administration and Organization

According to Law No. 18,695 of the Organic Constitutional Law of Municipalities (1988), article 3, letter d), and according to the Sanitary Code, article 11, letter d), municipalities have the attribution and sanitary obligation to collect, transport and eliminate all garbage, waste and refuse that is deposited or produced in urban areas.

In turn, the ability to charge for the extraction of domestic waste is established by this same Organic Constitutional Law in article 5, letter d), which states that municipalities may charge rights for the services they offer. The specifications for charging are contained in Law of Municipal Revenues No. 3063, of 1979, and the corresponding Regulation for fixing how much to charge for the extraction service is set in Supreme Decree No. 261 of the Ministry of the Interior (D.O. 25.03.80).

Law No. 19,388, published in the Official Bulletin (Diario Oficial) of Tuesday May 30, 1995, introduces alterations to Law No. 18,695, Organic Constitutional Law of Municipalities, specifically in article 12 related to the Common Municipal Fund, increasing its resources and thus enabling better financing for Municipalities of lower incomes.

It also introduces alterations to Law Decree No. 3063, Law of Municipal Revenues, among which it allows the charging of differentiated rates, and establishes that rates, just like the necessary conditions for their total or partial exemption, will be fixed in the respective municipal decrees. It also establishes an exemption that operates automatically, without the express need for the respective municipal decree because it is fixed by the Law itself, which favours homes or living units with a valuation equal or inferior to 25 tax units monthly (Unidades Tributarias Mensuales). It establishes alterations in that municipalities have to decide with regard to the extraction and transportation of waste coming from factories and workshops. On the other hand, it eliminates the general system of charging cleaning rates together with territorial contributions, and obliges the owner or occupant of any property, whether the person be an usufructuary, tenant or mere keeper, to pay for the service, without detriment of the responsibility that affects the owner.

A summary of the most important Laws and Dispositions in what pertains to the collection, transportation and final disposal of urban wastes is presented below.

FACULTIES	ORGANISM	LEGAL DISPOSITIONS
Essential attribution of establishing rights for the services offered, among them, for the garbage extraction service that the municipality has as exclusive function.	Municipalities	Law No. 18,695 (1988, reformed by Law 19,130, 1992), Organic Constitutional Law of Municipalities, art. 3, letter d), art. 5, letter e), and art. 20, letter b). Reformed by Law No. 19,388, 1995, art. 12.
The function and obligation of collecting, transporting and eliminating, with methods considered adequate by the National Health Service, the garbage that is deposited or produced in urban thoroughfares.	Municipalities	Decree with Strength of Law No. 745 (1968, Ministry of Justice). Sanitary Code art.11, letter b).
Minimal Sanitary norms with regard to the classification, collection, transportation, disposal, exploitation, deposition, and hygienization of garbage.	Municipalities	Supreme Decree No. 4740 (D.O. 09.10.1947) of the Ministry of Health. Regulation that fixes the minimal sanitary norms to protect public health with regard to garbage. Paragraph 1.
Minimal sanitary norms for the operation of garbage dumps, with regard to the requirements of the site, its staff, its operation and legal responsibilities.		Resolution No. 02444 (31.07.1980) of the Ministry of Health which establishes minimal sanitary norms for the operation of garbage dumps.
Payment for the right to clean and extract wastes coming from domestic services, the sweeping of homes, factories or businesses. The rate is established for a volume of 200 liters of daily waste. For the extraction of wastes that exceed said quantity or the extraction of slag or waste from factories or workshops, a differentiated rate may be established. This right is paid together with the contribution for real estate, or by owners of commercial establishments and businesses, along with the commercial patent.	Municipalities	Law No. 3063 (1979, of the Ministry of Interior) of Municipal Revenues art. 6, 7, 8 and 9. Reformed by Law 19,388 of 1995, art. 7, 8 and 9.
Setting of the rate for garbage extraction services, specifying total spending to be considered, methodology for rate calculation and procedure for charging said rates.	Municipalities	Supreme Decree No. 261 (D.O.: 25.3.80 of the Ministry of Interior). Regulation for the charging of municipal cleaning.

To fulfill their responsibilities with regard to the management of domestic solid waste, municipalities have Cleaning and Embellishment Departments, which are in charge of administering and carrying out, directly or through third parties, the activities necessary to ensure a correct collection, transportation and final disposal of solid waste.

The Cleaning Department regulates its activity in this field through the dictation of the Cleaning Decrees. These decrees contain norms relative to the cleaning of public thoroughfares, collection of garbage, evacuation of domestic wastes and sanctions for violators of the decrees.

When analyzing the above-mentioned legal dispositions, a key problem jumps to sight and it is hoped that with the alterations established in Law No. 19,388, it can be overcome. This problem refers to the mechanism chosen for the payment of municipal cleaning, which is to say the relation of the payment with the territorial tax. This mechanism for years has allowed the users of the cleaning service that are exempt from this tax to not pay the rate corresponding to the use of the cleaning service. This has as direct consequence that, on a national level, only 32% of the costs that are disbursed by the municipalities to fulfill their function of domestic cleaning, are collected.

In summary, the present management of solid waste in economic terms is characterized by the following elements:

- A deficient charging system which causes only 30% of the total costs for managing waste at a national level to be covered.
- Service spending for the community, which includes cleaning costs, makes up about 25 to 27% of municipalities' spending in the Metropolitan Area. It should be noted that this cost has increased within the municipal budget from 18% in 1985 to 27% in 1991.
- The generation of solid waste increases annually and it has been found that social segments of fewer resources generate a smaller amount of waste with a larger content of organic matter.
- There is lack of information in the municipalities with regard to the cleaning services that are offered. This reflects weak organization and administration, and also lack of human and financial resources.
- No economic incentives in the cleaning rate policy exist when the real cost of service is spread out evenly among users.
- In view of the above mentioned problem, the rate system for cleaning services does not comply with the principle that "those who contaminate pay."
- There is deficient regulation in relation to industrial waste collection, transportation and final disposal.

Just as it is the responsibility of the municipalities to manage domestic waste, it is the responsibility of the Ministry of Health to inspect and penalize said management.

The current Sanitary Code, established by Ministry of Health Supreme Decree No. 725 of December 11, 1967, and which modified Decree with Strength of Law No. 226 of May 15, 1931, clearly defines the obligations and attributions of the Sanitary Authority.

In the specific field of solid waste, the Sanitary Code establishes in Title II, "Of Hygiene and Environmental Safety", Paragraph III, "Of Refuse and Garbage", Articles 78 to 81, the conditions under which the accumulation, selection, industrialization, commerce or final disposal of solid waste should take place:

ARTICLE 78: The Regulation will set the sanitary and security conditions relative to the accumulation, selection, industrialization, commerce or final disposal of garbage and waste.

ARTICLE 79: Previous to proceeding with the construction, reparation, alteration or enlargement of any waste or garbage treatment plant of any kind, the approval of the project by the National Health Service will be necessary.

ARTICLE 80: It is the National Health Service's duty to authorize the installation and oversee the operation of all places destined for the accumulation, selection, industrialization, commerce or final disposal of garbage or waste of any kind.

When granting this authorization, the National Health Service will determine the sanitary and security conditions that must be fulfilled to avoid inconveniences or dangers to the health of the community or the staff that work in these activities.

ARTICLE 81: Those vehicles and transport systems for material which, to the judgement of the National Health Service, may represent a danger or an inconvenience to the population, as well as all transportation of waste or garbage of any nature, should fulfill the requirements that said Service indicates. This entity will also administer sanitary supervision over them.

In the Metropolitan Area, the entity in charge of directly supervising all the activities related to the management of solid waste is the Metropolitan Environmental Health Service.

Where the operation of the current supervision system is concerned, it cannot prevent illegal disposal of solid waste, due to the low values of the fines (1 to 3 tax units), and to the lack of resources and administrative procedures.

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ANNEX I

INDUSTRIAL AND MEDICAL SW GENERATION

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ANNEX I INDUSTRIAL AND MEDICAL SW GENERATION

I.1 Present ISW Generation

I.1.1 Previous Studies on ISW Generation

a. D&M's RISPEL Study

A study of generation ratios of ISWs was not carried out, therefore the ISW generation amounts of the year 1992 were estimated according to the CIIU Code by using the INVENT model and WHO model. The summary of estimation is shown below.

aa. By INVENT model

The amounts of ISW were estimated according to the type of industry based on the number of employees and the total amount of generation is shown below.

- Total generation amount of ISW: 659,228 ton/month
- HW amount of the total ISW generation: 855 ton/month

ab. By WHO model

The amounts of ISW were estimated according to the type of industry based on the data of their production, however the estimation was failed to be accurate because the substantial data were not obtained

- Total generation amount of ISW: 28,641 ton/month

b. EWI's RINSOR Study

ba. Present discharge amount of ISW

Based on the survey result of 265 factories and the data of the number of employees in the MR, the total discharge amount of ISW (No Aprovechados: Not Recycled Wastes) from the MR in 1994 was estimated as follows.

- Recyclables (Aprovechables): 9,269 ton/month

- Not Recyclables (No Aprovechables): 16,836 ton/month
- Total: 26,105 ton/month

bb. Future generation amount of ISW

The future generation amount of ISW was not estimated by using the INVENT model, the WINVENT model and the WHO model because the report of CEPAL concluded that the future estimation of the ISW amount in the South America region based on the three models were quite different respectively. Therefore, the study of the EWI basically used the data of the number of employees and the growth of GNP for the estimation of the future ISW amount. The following assumptions were set up for the estimation.

- The future technology of production will be no difference from the existing ones.
- The future environmental regulation for air emission and waste water discharge will be the same as the existing ones.
- The future balance of demand and supply of employment will be the same as the present one.

The amount of ISW was assumed to be influenced by the following index.

- The variation of the number of employees according to the CIIU Code.
- The future amount of production and sale will change in accordance with the trend observed between 1983 and 1991.

The discharge amount of ISW (No Approvechados) in the year 2004 estimated based on the above said assumptions are shown below.

- Recyclables (Aprovechables): 19,920 ton/month
- Not Recyclables (No Aprovechables): 35,742 ton/month
- Total: 55,662 ton/month

I.1.2 Classification of ISW

a. Classification of ISW related with the Study

aa. Classification related with the Study

Various investigations in relation with the Study have been carried out and various classifications of ISW, as listed below, were introduced:

- HW classification in the D&M's RISPEL study,
- ISW classification employed in the declaration system,
- ISW classification proposed in the EWI's RISNOR study,
- ISW classification the Team employed for their investigation,
- HW classification drafted by MS, and
- HW classification in the ISWM manual produced jointly by the Ministry of Economy Promotion and Reconstruction, and CONAMA by TESAM S.A..

Among various classifications mentioned above, the classification applied to the CDSI data base is the most relevant for the Study.

ab. Present status and future adjustment to CDSI system

aba. Present database system

In July 1994, the private consultant Dames & Moore presented the Final Report of the Study on "Household and Industrial (Toxic and Hazardous) Solid Waste Management; Design and Implementation of a Hazardous Solid Waste Management Control System in the Metropolitan Region". This report included a "Scheme for the Identification and Classification of Hazardous Solid Waste", which is presented in Figures I.1.2a and I.1.2b. The scheme would enable to both identify hazardous solid waste and determine the degree of harmfulness on the basis of their chemical constituents. However, such classification procedure implies the need to implement chemical analysis and, therefore, the existence of certain analytical capability, not yet attained in Chile. For this reason, the proposal presented by the consultants was not for immediate implementation but rather midterm in nature, that is, in anticipation of the future existence of adequate facilities and infrastructure.

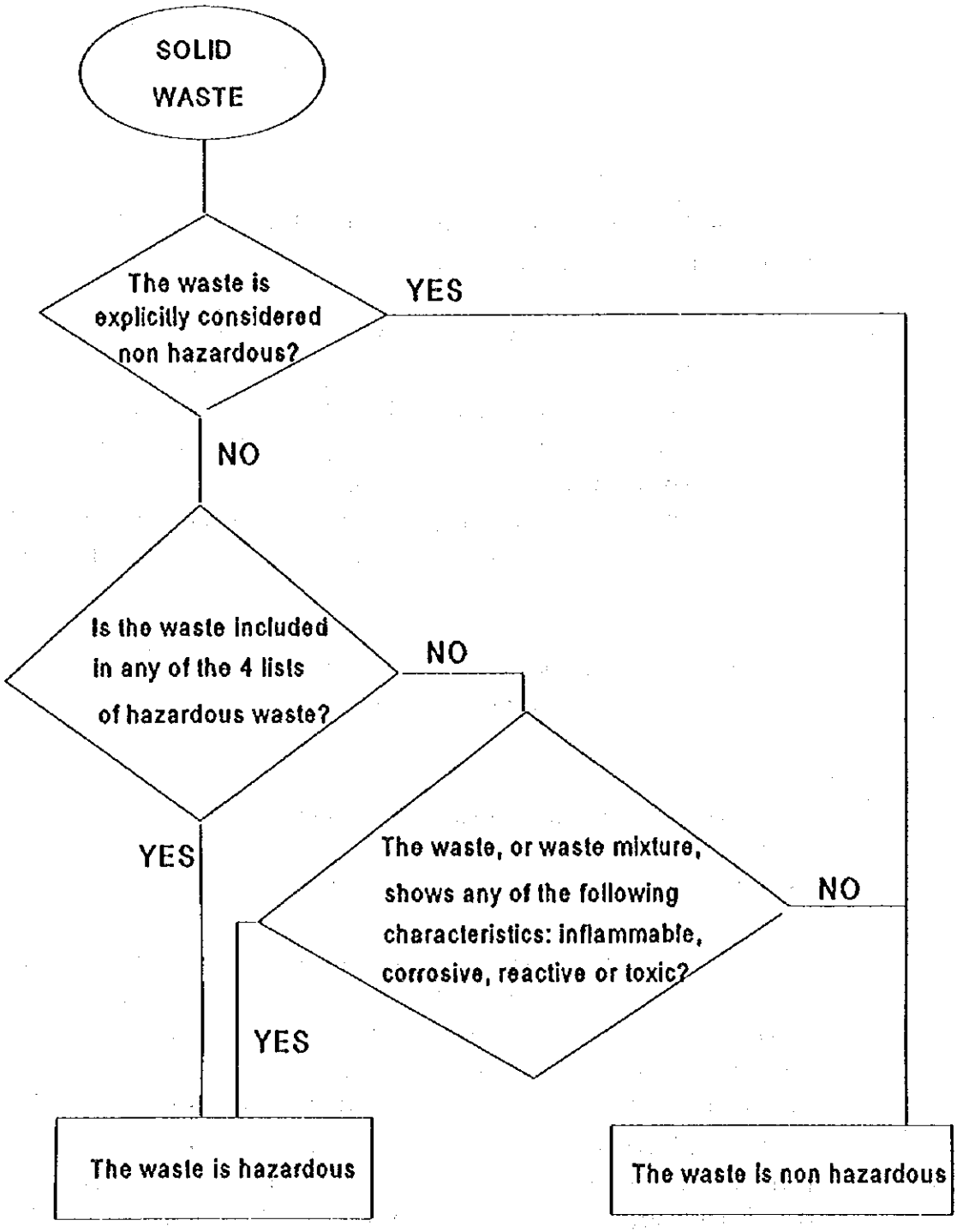

Figure I.1.2a Identification and Classification System for Hazardous Solid Waste (Phase 1)

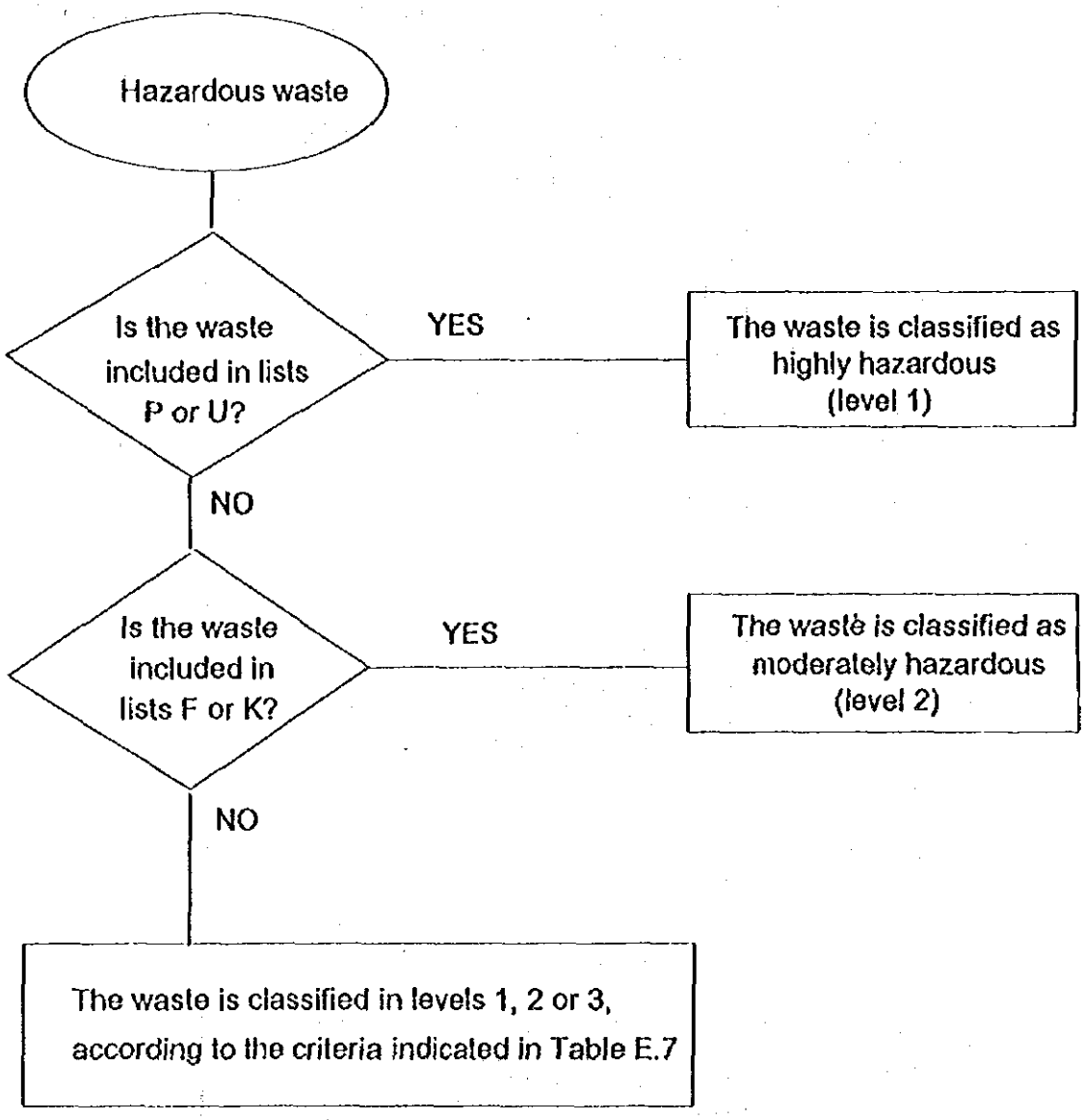

Figure I.1.2b Identification and Classification System for Hazardous Solid Waste (Phase 2)

The short term proposal established by the report was the implementation of a declaration system where both producers and destinations of waste should declare (by means of completing and submitting the declaration documents) the amounts generated and received respectively. One of the main results of the study was the design of the CDSI database (ISW Control System), created to store all the information received from producers and final receivers of waste.

The initial computer system included 25 categories of waste for classifying the different types of residues generated and declared by the industries. The list of the original waste categories is presented in Table I.1.2a below.

Table I.1.2a Original Waste Classification by Dames & Moore

CATEGORY	DESCRIPTION
1.	Adhesives
2.	Glass
3.	Ashes
4.	Dust
5.	Sand and clay
6.	Slag
7.	Stone and rubble
8.	Ceramics
9.	Cement and plaster
10.	Asphalt and tar
11.	Asbestos
12.	Filtering materials
13.	Chemical products in containers
14.	Discarded raw materials
15.	Laboratory waste
16.	Fats and oils
17.	Organic matter
18.	Vegetal material
19.	Paper and cardboard
20.	Plastic and rubber
21.	Wood and saw dust
22.	Leather, fabrics and fibers
23.	Paints, inks and solvents
24.	Metals
25.	Petroleum and by-products

However, during the first 4 months of independent operation by PROCEFF (subordinate to SSMA -Environmental Sanitary Service- responsible for operating the system), the number of categories was increased to 50 on the basis of the new types

of waste that were being declared. The new waste classification is listed in Table I.1.2b below.

Table I.1.2b Present Waste Classification

CODE	DESCRIPTION
0001	Adhesives
0005	Dust
0010	Ashes
0015	Sand and clay
0016	Sand and rubble
0020	Slag
0025	Rubble
0026	Rubble, dust, paper, wood
0030	Asbestos
0035	Asphalt and tar
0040	Ceramics, cement and plaster
0041	Fiber cement waste
0045	Batteries
0050	Iron, steel and bronze scrap
0051	Metal drums
0052	Metal wools
0053	Metal, paper, cardboard and tin plate drums
0055	Tannery spoilage (leather)
0060	Fabrics and fibers
0061	Cotton waste
0065	Discards from chemical/reactive products (expired products)
0070	Empty containers for reactive chemical products
0075	Paint, ink and pigment containers
0076	Solvents
0080	Filters/earth
0085	Trisodium Phosphate
0090	Gum and rubber
0095	Plastics (Polyethylene, PVC)
0096	Plastics/paper/cardboard/wood/fabrics
0097	Plastic drums
0098	Plastic wool (foam)
0100	Sludge
0101	Contaminated pastes
0105	Wood and saw dust (impregnated with chemical products)
0110	Organic matter in general
0111	Fats and oils
0112	Offal
0115	Paper and cardboard

0116	Paper/glass/plastic
0117	Paper/plastic/scrap/cardboard
0120	Petroleum and by-products
0125	Glass
0130	Domestic waste
0131	Domestic waste and unclassified waste
0135	Production waste
0140	Unclassified
0150	Metal dust

At present, the computer system is still operating under the mentioned conditions, which result in the following shortcomings:

- The number of categories is deficient to provide a realistic description of the wastes generated. For instance, groupings such as those under categories 0116 or 0117 imply a significant loss in accuracy, both in quantitative and qualitative terms.
- If different wastes generated by the same industry are to be input separately, the system requires individual records, which means loss of efficiency for the typist (PROCEFF is understaffed).
- Since there is no scheduled list of residues, inconsistency is found regarding waste description by the industries. Such an ambiguous system also leads to incompetent recording of data.

abb. Improvement plan

EWI's Study on "Diagnosis and Identification of Technologies and Strategies for Non Hazardous Solid Waste", Final Report (March 1995), proposed an improvement plan for the declaration system and the CDSI database. It must be noted that the proposal did not arise from judging the deficiency in view of computer system operation, but from the need to adjust to the inherent situation and to the wastes that were being declared. The plan can be summarized as follows:

- A new scheduled list of residues with 333 categories was compiled to be used in the CDSI system. Each waste was assigned a code which will be used at the time of completing the documents and recording the data in the computer system. Therefore, the system will gain efficiency in spite of the dramatic increase in the number of waste categories.
- This general list of residues was used to compile a specific list titled "Types of Waste for Industrial Sector", where each industrial activity (ISIC code) was associated with all the different types of waste it is predisposed to generate.

- Both of these lists will be sent to the industries and will become the new guideline for filling out the declaration documents and also for recording the information in the database.
- The computer system will generate a specific list corresponding to each industry for each individual company in order to individualize the monitoring activities.
- Finally, the data base will retain the capability of upgrading both lists if new information is received (e.g. adding new waste to the general list, assigning an existing waste a new ISIC code, etc.).

It is expected that these adjustments will provide a more accurate control over the industries, as well as a quantitative diagnosis regarding the need for treatment/disposal facilities. It is PROCEFF's intention to begin implementing the new system by January 1996.

b. ISW classification employed in the Team's Investigation

Categorization methods vary in the context of ISW classification and HW classification. Each country adopts their own classification of ISW and/or HW with varying circumstances. In other words there is no internationally accepted or recognized ISW or HW classification. Therefore, it is necessary for the related Chilean authorities to confer when contemplating other countries' and international organizations' trends in waste classification to consider Chilean intrinsic situation and conditions prior to establishing the most suited waste classifications to be adopted in Chile.

As mentioned above, several similar studies for ISWM were conducted prior to the Study and several ISW classification were examined and proposed. Among those ISW classifications proposed, it may be judged that the "333 classification" proposed in the EWI's RISNOR study and the one which SESMA-PROCEFF plans to adopt officially for their ISW monitoring and management (i.e. CDSI system) should be currently most suited to the present state of industries in the region.

As proved in the EWI's RISNOR study, the 333 classification is most suited for management of the declaration (and is advantageous especially in view that both waste generator and authority could identify ISW), however, diversity in the 333 classification is of great disadvantage and imposes a huge restraint when estimating total waste generation amount in the MR and for planning treatment/disposal plans based upon the estimated value. Therefore, for the formulation of the Master Plan as the Study requires, it is indispensable that the 333 classification should be divided into

categories of wastes, similar in nature. Consequently, the Team proposed 24 ISW classification, as shown in Table I.1.2c, to be used for the Study that is compatible with and is a calibrated version of the 333 classification. The Team produced the matrix-table, as shown in Table I.1.2d in order to maintain compatibility of 24 classification and 333 classification. The matrix-table is determined for the Study in order to estimate ISW generation amount and formulate ISW treatment/disposal plans, finally after full and detailed examination of its compatibility by both the Team and the counterpart.

Table I.1.2c Proposed 24 ISW Classification

Code	Type of Waste
C-1	Ash including from incinerator
C-2	Dust and APC products
C-3	Inorganic sludge
C-4	Organic sludge
C-5	Asbestos
C-6	Acids
C-7	Alkalis
C-8	Solvents
C-9	Oily waste
C-10	Inorganic chemical residues
C-11	Organic chemical residues
C-12	Other liquid waste
C-13	Waste from food production
C-14	Glass and ceramics
C-15	Metal and scrap
C-16	Paper and cardboard
C-17	Plastics
C-18	Rubber
C-19	Textile and leather
C-20	Waste similar to domestic waste
C-21	Wood
C-22	Slag from melting
C-23	Construction waste
C-24	Other solid waste

Table I.1.2d Matrix-table of Team's 24 Categories of ISW and 333 Categories being applied to CDSI System

Categories of Waste		*Non-hazardous Waste*		*Hazardous Waste*		*Liquid Waste*	
Code	Type	P-code	Name	P-code	Name	P-code	Name
C- 1	Ash including from incinerator	49 153	Coal Ash Residues from Calcining Kiln	138 209 266	Residues from incinerator Ash with Zinc Contents Ashes		
C- 2	Dust and APC products	101 125 126	Lamp Soot Grind Dust Tinning Dust	264	Dust & Ashes from Combustion Control Equipment		
C- 3	Inorganic sludge	82 84 87 95 97 189	Clay Sludge Grinding Sludge Granite a/o Marble Sludge Sludge after Water Treatment Spinning Sludge Waste Sludge from Fibro-cement	86 88 89 93 94 141 221 222 224 227 228 250 254 262 263 269	Flocculation Sludge Neutralization sludge Flocculated Sludge Soldering Sludge Dye Sludge Paint Residues Squeezed Sludge of Filter Press Toxic Drained Sludge Textile Galvanization Sludge Sludge from Galvanizing Process Sludge from Phis/Chem. Sewage Treatment Sludge with Mercury Sludge with Chlorides Sludge with Solvents Sludge from Gas Treatment Sludge with Lead		
C- 4	Organic sludge	76 81 85 90 91 92 95 100 129	Alcohol-Sludge Mix Sludge from Natural Dyeing Sludge from Alcohol Filtering Pickling Sludge Sludge of Sponification Plant Sludge of Vegetal Oil Processing Sludge after Water Treatment Cultivation Media Water Storage Precipitate	83 86 94 141 158 202 219 221 222 223 225 226 250 262 263	Depolymerization Sludge Flocculation Sludge Dye Sludge Paint Residues Solid Residue of Ink Sludge Contaminated with Trichloroethylene Sludge with Perchloroethylene Squeezed Sludge of Filter Press Toxic Drained Sludge Sludge Contaminated with Benomyl Lodo de Keltano (Sp.) Sludge from Resin Processing Sludge with Mercury Sludge with Solvents Sludge from Gas Treatment		
C- 5	Asbestos			205	Asbestos		

Categories of Waste		*Non-hazardous Waste*		*Hazardous Waste*		*Liquid Waste*	
Code	Type	P-code	Name	P-code	Name	P-code	Name
C- 6	Acids			206	Used Batteries	175	Sulfonated Acryl Acid
				211	Copper of Etching Acid Bath	308	Hydrochloric Acid
				229	Acid Sludge	309	Chromium Acid
				267	Copper of Etching Acid Bath	310	Furamic Acid (Acido Furamico (Sp.))
				270	Dried Acid Residues	311	Nitric Acid
						312	Sulfuric Acid
						313	Used Acids
						316	Oxygenated Water
						373	Copper Acid Solution
						392	Etching Solution
C- 7	Alkalis					371	Soda Solution
						374	Strong Alkaline Solution
						385	Developer Solution
						386	Scouring Solution
C- 8	Solvents			201	Phthalic Anhydride	52	Enamel
				213	Dioctilftalato (Sp.)	305	Acetones
						326	Methylene Chloride / Di-, Trichloroethane
						352	Penetration Liquid
						353	Methylacetate
						356	Perchloroethylene
						358	Liquefied Paints
						367	Resins Contaminated with Solvents
						386	Scouring Solution
						401	Solvents
						402	Chlorinated Solvents
						403	Fluorinated Solvents
						407	Inks
						408	Toluene
						409	Trichloromethane
						410	Trichloroethylene
C- 9	Oily waste			67	Lubricating Grease	301	Flax Oil
				244	Residues of Petroleum Distillation	302	Insulation Oil
						303	Diesel Oil
						304	Used Oil
						329	Diesel
						334	Oil Emulsion
						354	Kerosene
						357	Petroleum
						362	Petrochemical Products
						415	Oily Sludge

Categories of Waste		*Non-hazardous Waste*		*Hazardous Waste*		*Liquid Waste*	
Code	Type	P-code	Name	P-code	Name	P-code	Name
C- 10	Inorganic chemical residues	17	Sodium Carbonate	3	Full Spray Cans	343	Phosphate Solution
		18	Silicon Carbide	34	Dyestuffs, Pigment	371	Soda Solution
		32	Sodium Chlorate	70	Used Hyposulfite	375	Solution with Copper Content
		59	Calcium Fluoride	105	Zinc Oxide	376	Solution Contaminated with Zinc
		103	Aluminum Oxide	106	Copper Oxide	377	Ammoniac Solution
		104	Cerium Oxide	109	Lead Oxide	378	Bisulfite Solution
		107	Iron Oxide	173	Tin Oxide	379	Ammonium Carbonate Solution
		108	Manganese Oxide	206	Used Batteries	380	Solution of Calcium Carbonate/Ferric Chloride
		135	Cosmetic Residues	208	Used Catalyst	381	Carbonate & Silicate Solution
		136	Wastes from Crystallization	214	Ferrocyanides	382	Cyanide Solution
		159	Concentrated Salts	215	Phosphate of Lead	383	Chromate Solution
		160	Silicon	238	Expired Pharmaceutical Products	384	Cuprammonium Solution
		187	Sodium Meta Aluminate	249	Chromium Salts	387	Phosphate Solution
				253	Residues of Pharmaceutical Products	388	Sodium Phosphate Solution
				255	Fungicides	389	Ferrous Phosphate Solution
				256	Weed-killers	390	Phosphate & silicate Solution
				257	Insecticides	391	Solution of Galvanizing Processes
				261	Powdered Phytodrugs	392	Etching Solution
				272	Lead Residuum	393	Ammonium Nitrate Solution
						394	Potassium Nitrate Solution
						395	Potassium Solution
						396	Sodium Solution
						397	Ammoniac Sulfate Solution
						398	Copper Sulfate Solution
						399	Zinc Sulfate Solution
						400	Ammoniac Tartrate Solution
						416	Fixing Solution

Categories of Waste		*Non-hazardous Waste*		*Hazardous Waste*		*Liquid Waste*	
Code	Type	P-code	Name	P-code	Name	P-code	Name
C- 11	Organic chemical residues	15	Coal	2	Adhesive	306	Acetonitrile
		25	Wax	3	Full Spray Cans	314	Different Alcohols
		38	Coke	34	Dyestuffs, Pigment	315	Acrylonitrile
		40	Vinyl Adhesive Residues	167	Solidified Organic Dye	318	Ethyl Alcohol
		56	Carbon Fiber	204	Items Containing PCB (Polychlorinated biphenyls)	319	Different Alcohols
		65	Graphite	207	Capacitors Containing Polychlorinated biphenyls	320	Alchelobenzene
		135	Cosmetic Residues	230	Material Contaminated with Aromatic Amines	321	Antifreezer
		146	Carbonaceous Residues	231	Bisodic Arsenite Methyl	322	Antioxider
		174	Hydroxiethylbutyn	233	Isoftalic Nitrile	324	Methylene Bromide/Methyl Isobutylcetone
		176	Ester	235	Hydrated Oxides of Ethylene	325	Methylene Chloride
				236	Paper Soaked with Phenols	328	Liquid Detergent
				238	Expired Pharmaceutical Products	330	Diphenyl Solution
				239	Resin contaminated with Dimethylformamide	331	Dimethylaniline Solution
				240	Resin contaminated with Ethylacetate	332	Dimethylcetone
				242	Phenolic Resins	333	Dimethylformamide
				243	Residues of Freon Distillation	336	Ethyl Acetate
				245	Residues of Polyethylene Distillation	337	Ethylbenzene
				246	Residues of Resin Distillation	338	Ethylenglycol
				252	Transformer Containing PCB	339	Phenol
				253	Residues of Pharmaceutical Products	341	Formaldehyde
				255	Fungicides	342	Formaldehyde Solution
				256	Weed-killers	344	Freon
				257	Insecticides	345	Ftalates
				258	Benzyl of Dicophol	348	Glycerine
				259	Isocyanates	349	Hydrocarbons
				261	Powdered Phytodrugs	359	Pyridine
				268	Chlorofluorated Compouds	361	Ethylenglycol Polymer
						363	Propyleneglycerol
						364	Propyleneglycol
						365	Melamine Resin Solution
						366	Epoxy Resin Solution
						369	Silicone Solution
						404	Tetrachloroethylene
						405	Carbon Tetrachloride
						406	Tetrahydroburane
						411	Trioethyleneglycol
						412	Polychlorobiphenyls
						413	Dichloropropane
						414	Shampoo Residues
C- 12	Other liquid waste					340	Tank Bottoms (Specify)
						351	Liquid Refrigerant
						417	Anti-skidding Compound

Categories of Waste		*Non-hazardous Waste*		*Hazardous Waste*		*Liquid Waste*	
Code	Type	P-code	Name	P-code	Name	P-code	Name
C- 13	Waste from food production	39	Used Fungus Compounds (Maculas)			317	Water & Blood
		41	Meat Residues				
		53	Animal Excretions				
		63	Gelatin				
		66	Animal Fat				
		99	Vegetal Material				
		132	Complexed Proteins				
		139	Raw & Cooked Seafood Wastes				
		140	Pasta & Food Product Wastes				
		147	Animal Residues				
		150	Residues from Fermentation				
		151	Fruit Residues				
		156	Wheat Residues				
		184	Bristles				
		186	Sugar				
C- 14	Glass and ceramics	9	Sand from Melting Plants				
		43	Ceramic Residues				
		57	Glass Fiber				
		117	Photographic Plates				
		148	Smelting Crucible Waste				
		155	Residues from Foundry Floor				
		166	Used Washing Sand				
		170	Glass				
		197	Silicon Containers				
C- 15	Metal and scrap	5	Wire				
		12	Electric Wire				
		26	Stainless Steel Scrap				
		27	Aluminum Scrap				
		28	Brass Scrap				
		29	Copper Scrap				
		30	Iron Scrap				
		71	Aluminum Foil				
		143	Soldering Residues				
		161	Cans with Oil				
		171	Metallic Chip				
		193	Metallic Containers				
		198	Aluminum Paper				
C- 16	Paper and cardboard	19	Cardboard				
		22	Cellulose				
		112	Paper				
		113	Sand Paper				
		114	Melamine-Coated Paper				

Categories of Waste		*Non-hazardous Waste*		*Hazardous Waste*		*Liquid Waste*	
Code	Type	P-code	Name	P-code	Name	P-code	Name
C- 17	Plastics	116	Used Film				
		118	Plastic				
		119	Non-Polymerized Plastic				
		120	Polyester				
		121	Polyethylene				
		122	Polymer				
		123	Acrylic Polymer				
		124	Polyurethane				
		145	Resin				
		154	PVC Residues				
		164	Plastic Containers				
		165	Thermoplastics				
		191	Polypropylene				
		192	Polyamide				
C- 18	Rubber	64	Rubber				
		102	Worn Tires				
C- 19	Textile and leather	1	Acetate				
		6	Cotton				
		45	Thread Residues				
		74	Wool				
		134	Textile Scrap				
		149	Leather Residues				
		168	Dirty Cloths				
		195	Cloth Sacks				
C- 20	Waste similar to domestic waste	42	Cafeteria Residues				
		44	Non-tradeable Cigarette Residues				
		127	Dust & Waste from Office Cleaning				
C- 21	Wood	10	Saw Dust				
		98	Wood				
		133	Wood Scrap				
		178	Wood Chips				
		179	Podicel (troc)				
C- 22	Slag from melting	152	Residues from Foundry	50	Slag from Electric Furnace		
		177	Soldering Flux	51	Slag from Smelter		
				271	Lead Slag		

Categories of Waste		*Non-hazardous Waste*		*Hazardous Waste*		*Liquid Waste*	
Code	Type	P-code	Name	P-code	Name	P-code	Name
C- 23	Construction waste	11	Asphalt				
		14	Kaolin				
		23	Cement				
		48	Debris				
		68	Construction Gravel				
		73	Broken Refractory Bricks				
		111	Plastified Panels				
		169	Pieces of Reinforced Concrete				
		172	Plaster				
		182	Sand				
		190	Pieces of Fibro-cement				
		194	Clay Powder				
		196	Puddle Powder				
C- 24	Other solid waste	13	Used Limestone	16	Worn-out Activated Carbon		
		31	Pressed circuits	203	Tannery Sand		
		35	Electric Components	241	Resin contaminated with Solvents		
		47	Grinder Disk	247	Residues of Solvent Distillation		
		54	Kaolin Feldspar	248	Residues of Distillation of Chlorinated Solvents		
		110	Filter Panels	260	Cans/Bins with Lead		
		115	Cellulose Film				
		180	Paint Containers				
		181	Cellulose Filters				
		183	Polishing Paste				
		185	Mineral Wool				
		188	Sand Paper Powder				

c. Proposed Classification of Hazardous Waste

The classification of HW drafted by the MS in the document is basically corresponding to that sanctioned by the Bazel Convention. It is fairly understandable that a developing country employs it for his administration of HW. The concept of the classification of HW adopted by the Bazel Convention is basically:
HW are defined as those:

i. which are identified in specific "waste streams" (Y2 - Y18), and/or
ii. waste "having as constituents", and
iii. which indicate "hazardous characteristics".

Therefore, in order to identify and control HW, establishment of "analysis methods and permissible limits" for HW and consolidation of analytical capability in industries are essential.

At present, consolidation of laboratory analysis (nationally) is deemed poor and authorities face problems of lacking analytical capacity as well as having limitations in cost recruitment. Therefore for the time being, it may be practical to assume that waste produced by industries without proof of their safety is hazardous, and should be treated as HW. Hence industries (waste generators) shall bear the burden of proving that their waste generated (HW or liquid waste defined by the SESMA-PROCEFF waste classification) are within the permissible limits: e.g. industries themselves shall, at their own cost, carry out laboratory analyses (which MS defines) verifying that their waste is non-hazardous. In this context, problems may not arise even though 2 different classification of HW(i.e. SESMA-PROCEFF and MS) exist. Periodical reviews and revisions of the PROCEFF waste classification are necessary in reflecting the outcome continuously compiled through these laboratory analysis. It is indispensable for the formulation of an efficacious HWM plan to make the SESMA-PROCEFF classification and MS classification compatible.

It is necessary to spend quite a long time for the formulation of the compatibility between two classifications since it requires practical analysis works. This issue will be explained in detail in the following section.

d. 24 classification proposed by the Team and 44 classification drafted by MS

Responding to the request of the Chilean side to the Study Team that the waste classification being applied to the Study shall be compatible with the one which the MS is going to adopt for hazardous wastes, expressed at the Discussion Meeting on the Progress Report held from 10th to 14th March 1995, the Team summarizes their opinions and proposals as below. For better understanding of the opinions and proposals, those are illustrated in Figure I.1.2c.

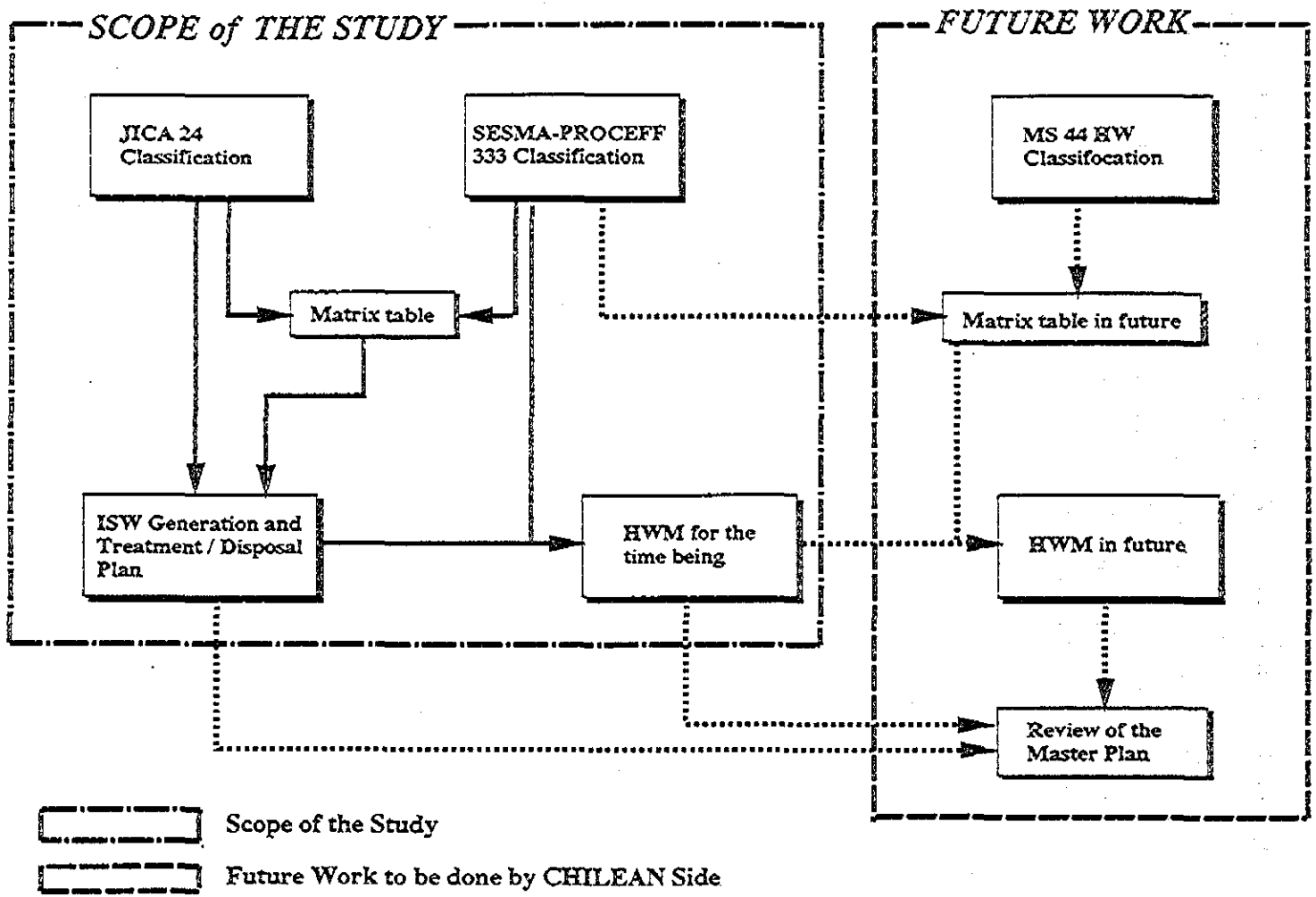

Figure I.1.2c Relationship of three ISW classification

i. Matrix-table between 24 classification and MS classification

Waste in each of the 24 classification proposed by the Team may falls into multiple sections of the MS's 44 classifications, that is, "one-to-one correspondence between generated waste and the classification (e.g. 24 classification of the Team and 333 classification of EWI's RISNOR study, although some exceptions remain)" can not be followed in this 44 classification. Therefore, the Team shall not produce a matrix-table (as the one produced between the 24 classification and 333 classification).

ii. Estimation of ISW generation and treatment/disposal planning

As EWI's RISNOR study proved that "estimation of ISW generation amount" and "planning of treatment/disposal based upon the generation estimation" in relation to the 333 classification are hardly possible in view of the "time allowed" and "available computer capacity" at present, in this regard, the Team proposed the 24 classification in order that ISW can be identifiable visually and the compatibility of waste classification with 333 classification can be maintained. Therefore, it is necessary for "estimation of ISW generation amount" and "planning of treatment/disposal based upon it" to adopt the 24 classification that the Team proposed.

iii. SESMA-PROCEFF 333 classification and MS 44 classification

While the HW classification MS proposed is for the purpose of identifying and controlling HW, it is indispensable to provide standard analysis methods for identification and to facilitate specialized analysis for HW. Under the present situation where analytical abilities are not gained, it is very difficult for industries to declare their waste through the declaration system according to the classification that MS proposed. On the contrary, the 333 classification of ISW has the list for HW identification and thus may be deemed as an effective tool to be employed for the declaration system and the management of HW, under the present situation of lacking provisions of standard analysis methods and specialized analysis facilities for HW. Therefore, as the Team's conclusion of ISW classifications, both classifications of SESMA-PROCEFF being adopted and MS drafted should co-exist.

iv. Coordination of two classifications

In order to formulate an efficacious HWM plan in Chile, coordination of both classification of SESMA-PROCEFF and MS (drafted) is indispensable.

However, formulation (coordination) requires empirical support of analysis works, which shall take some time.

v. Coordination work required

In order to formulate a compatible system between the 333 classification (being adopted for the declaration system) and the classification MS drafted, the Team proposes the following steps to be adopted by the Chilean side:

- For the time being, for those industries which are deemed to generate (hazardous and liquid state) waste listed in the PROCEFF classification, (control system) unless the factory proves their waste is non-hazardous, the waste shall be deemed hazardous (i.e. the industry carries out the required analytical tests of their generated waste based upon the criteria of MS specified in the draft regulations.)
- At the same time, data of HW and LW should be continuously collected and compiled in accordance with the 333 classifications of PROCEFF as well as the 44 categories of MS.
- Factory inspections should be carried out in conjunction with laboratory analyses for processing the compiled data to make it more accurate and reliable.
- Along with the data compilation, the risk of ISW in accordance with the definition by MS should be easily identified by the data given in the declaration system.

vi. Estimation of HW quantity

Based on the matrix table between the PROCEFF's 333 and the JICA's 24 classifications, the hazardousness of ISW can be identified to the extent as described below:

- The waste categorized as C-5 (Asbestos) is hazardous,
- The wastes categorized as C-13, -14, -15, -16, -17, -18, -19, -20, -21, -23, are all non-hazardous,
- Some portions (some between 0 and 100%) of the wastes categorized as C-1, -2, -3, -4, -6, -7, -8, -9, -10, -11, -12, -22, -24 may be hazardous.

In addition, based on the comparison of the available waste generation data by the 333 classifications, from the EWI's RISNOR Study, with the results of the

factory survey by the Study Team, the portion of hazardous and liquid wastes for each of C-1, -2, -3, -4, -6, -7, -8, -9, -10, -11, -12, -22, -24 can be assumed because "one-to-one correspondence" (with a few exceptions) are maintained between the 24 classification and 333 classification.

Accordingly, the ISW treatment/disposal master plan is to be proposed based on the estimation of HW/LW generation with the method mentioned above. However, the Chilean experts may also refer and review the ISW based on the amount of HW generation in accordance with the 44 classification of MS as its compatibility with the PROCEFF's 333 classification is known to the Chilean side.

vii. Priority in HWM

Main HWM issues for the time being are: monitoring and controlling of "Highly Potential Industries" which may be liable to produce LW and HW for the ISW List (namely the 333 classification of PROCEFF). Factories are classified with their (high, medium, or low) liability of generating HW as shown in the Table I.1.2e on the next page. Monitoring and controlling by regulation should be first reinforced and practiced toward those "high potential industries".

Table I.1.2e Classification of factories in accordance with the potential of generating hazardous wastes

Potential	CHU Code		Industrial Category	* Type of Industry				
				1	2	3	4	5
Highly Potential Industries	351	3511	Organic and inorganic industrial chemicals		x			
		3512	Fertilizers, Insecticides and the likes			x		
		3513	Resins, plastics, and chemical fibres		x			
		3514	Mnufactured chemical products		x			x
	352	3521	Paints, Varnishes, lacquers, enamels, and the likes			x		
		3522	Medicines (Pharmaceutical products)		x			x
		3523	Soaps, detergents, shampoos, cosmetics, and the likes		x			
		3529	Other non-classified chemical products		x	x		x
	354	3540	Oil and coal products			x		
	356	3560	Other non-classified plastic products		x			x
	371	3710	Iron and steel industries	x				
	372	3721	Basic copper industry	x				
		3722	Copper products and alloys	x				
		3729	Basic non-ferrous metal industries (exc. copper)	x				
	381	3811	Metal cutlery, hand tools and other general hardware				x	
		3812	Metal furniture and fixture				x	
		3813	Metal structures, tanks, shanties, doors and windows				x	
		3814	Metal packages, tools, and household utensils				x	
		3815	Wires, non-isolated cables and by-products				x	
		3819	Other metal products				x	
			Highly Potential Total					
Potential Industries	3211	3211	Textile processing and materials manufacturing					
	3231	3231	Leather tanning and finishing					
	3232	3232	Fur dressing, dyeing and other fur and skin articles					
	3319	3319	Other non-classified wooden products					
	341	3411	Paper and pulp					
		3412	Paper containers and boxes					
		3419	Other paper and pulp products					
	3420	3420	Printing, photoengraving, publishing and the likes					
	355	3551	Tires, tubes, rims and the likes					
		3559	Other non-classified rubber products					
	362	3620	Glass and glass products					
	3699	3699	Other non-metallic mineral products					
	382	3822	Agricultural machinery					
		3823	Wood and metal working machinery					
		3824	Other industrial machinery					
		3825	Office machinery and equipment (inc.computers)					
		3829	Other non-classified machinery					
	383	3831	Motors, generators, transformers and the likes					
		3832	Radio, TV, X-ray related machinery and equipment					
		3833	Electric heating machinery and equipment					
		3839	Other electric machinery					
	384	3841	Ship and boatyards, marine engines and their parts					
		3842	Railroad machinery and equipment					
		3843	Vehicle parts and engines					
		3844	Motorcycles and bicycles					
		3845	Airplanes and their components					
		3849	Other transport equipment					
	385	3851	Measurement, controlling and medical machinery					
		3852	Optical and photochemical machinery (inc.lens)					
	390	3901	Jewellery and silverware					
		3902	Musical instruments					
		3903	Sporting, athletic and camping goods					
		3909	Other non-classified manufacturing industries					
	625	6253	Gasoline filling station					
	952	9520	Laundries and dry cleaners					
			Potential Hazardous Total					
			Hazardous Total					

	CIIU Code		Industrial Category	* Type of Industry				
				1	2	3	4	5
Less Potential Industries	311	3111	Livestock slaughtering and meat production					
		3112	Dairy products					
		3113	Fruits, vegetables, and their products					
		3114	Fish and other marine foods					
		3115	Animal and vegetable oils					
		3116	Cereal foods					
		3117	Bakery, biscuits, cakes, pastas and the likes					
		3119	Cocoa and Chocolate powder and sugar confectioneries					
	312	3121	Other non-classified food manufacturing					
		3122	Animal feeds					
	313	3131	Alcoholic distiling					
		3132	Wine, ciders and other fermented beverages					
		3133	Malt, beer and malt liquors					
		3134	Non-alcoholic beverages					
	314	3140	Cigarettes, cigars and tobacco					
	3212 - 3219	3212	Cloth manufacturing and related processing					
		3213	Socks, stocking and knit products					
		3214	Carpets and rugs					
		3215	Ropes, cables, cordage, nets and the likes					
		3219	Other non-classified textile industries					
	322	3220	Garment industries					
	3233	3233	Leather products (exc.footwears)					
	324	3240	Leather footwears					
	3311 - 3315	3311	Wood processing and wooden products manufacturing					
		3312	Wooden and cane containers manufacturing					
	332	3320	Furniture, fixture and the likes					
	361	3610	Potteries and ceramic products					
	3691 - 3696	3691	Bricks, Lettices, walls and refractory materials					
		3692	Cements, lime, and plasters					
		3693	Cement building materials					
		3695	Fibre cement products					
		3696	Plaster building materials					
	410	4101	Generation, transmission and distribution of electric energy					
			Less Potential Total					
			Total					

NOTE : *Type of Industry
1. primary metal industry, 2.organic chemical industry
3. pesticides and explosives industry, 4. electroplating and surface finishing industry
5. inorganic chemical industry

I.1.3 Present ISW Generation

a. Calculation of Generation-Ratio

Estimation of the present ISW generation amount is carried out by referring to the outcome of the Team's factory survey (189 factories due to 10 factories among 199 did not reply their number of employees) plus the data from the EWI's RISNOR study (265 factories) converted to the 24 waste classifications proposed by the Team. Generation-Ratio (GR) is calculated from the following formula.

$$GR = (TA(J) + TA(E) - OA) / (NE - NE(OA))$$
$$GA = (GR \times NE(INE)) / 1{,}000$$

GR	:	Generation-Ratio (kg/employee/year)
GA	:	Waste Generation Amount (ton/year)
TA(J)	:	Total Amount of Generation obtained by the Team's survey
TA(E)	:	Total Amount of Generation obtained by the EWI's RISNOR study
OA	:	Overlap Amount of generation between Team's survey and EWI's RISNOR study
NE	:	Number of Employees in total for all factories surveyed by the Team and EWI's RISNOR study
NE(OA)	:	Number of employees overlapped in the two studies
NE(INE)	:	Total number of employees in the Metropolitan Region from INE data

b. Numbers of Factories and Employees in the Metropolitan Region

Statistics available with regard to the industries and their employees are the data compiled by INE (Instituto Nacional de Estadisticas). The INE data regarding the industries in the MR shows only ranges of number of employees for respective industries as shown in Table I.1.3a. The following assumptions are, therefore, made for the calculation of Industrial SW generation:

i. Data (numbers of factories and employees) of industries with less than 10 employees are not included in this estimation, since relevant data was not available and its overall contribution towards the total number of employees in the industries within the MR is marginal.

ii. Number of employees referred in the calculation of GR is the total employees including employees in indirect/administrative sections.

iii. Number of employees (in industries with 10 or more employees) used in the calculation of the ISW amount generated are shown in the table below.

Table I.1.3a Assumption for the Estimation of Waste Generation from Factories with 10 or more Employees

Range of Employees Number	Assumed Employees Number
10 -19	15
20 -49	35
50 - 99	75
100 - 199	150
200 - 499	350
500 - 999	750
> 1,000	1,500

c. Present industrial SW generation amount

A comparison table of EWI's RISNOR study and the JICA Team's survey is prepared as shown in Tables I.3.b and I.1.3c. As clearly presented in the table, there is very little difference between generation ratio of EWI's RISNOR (4,254.49 kg/annual/employee) and that of the JICA survey (3,473.71 kg/annual/employee). However, the generation ratio as well as amount of HW and LW in the JICA survey was much higher than in EWI's RISNOR study, because the JICA survey targeted to investigate industries which may generate more HW and LW than those industries targeted by EWI's RISNOR study. It is found by the tables that the two studies covers 84,380 employees in total which is equivalent to 30% of total employees of targeted industries in the MR. JICA study selected much larger industries than EWI's. (Average number of employees for JICA is 340 while that of the EWI's is 76.)

Present ISW generation amount in the MR is estimated in relation to 36 industrial group-wise classification and the 24 ISW classification. The outcome is summarized as shown in Tables I.1.3d and I.1.3e below. As for the mining industries (CIIU code 21001 to 29090), there are several in the MR and they produce considerable amount of ISW. However, all of the generated ISW in the mining industries are disposed of at

their own landfills at present and in future (i.e. closed system). Therefore, ISW generated in mining industries are excluded from this table to avoid confusion due to the huge amount of slag from the industry. ISW Generation amount (in 1995) in total is about 939 thousand tons per year. The largest generation (amounts) of ISW and industry are C-13 Waste from Food Production (219,911 ton/year) and CIIU Code 311 Food Manufacturing (154,850 ton/year) respectively. Detailed outcomes are presented in Tables I.1.3f, I.1.3g and I.1.3h.

As for the ISW generation by the waste categories of non-HW, HW and LW, ISW generation amount in 1995 is calculated based on the EWI's RISNOR Study and JICA's Survey and summarized in Table I.1.3i. Detailed outcome is presented in Table I.1.3j. As clearly shown in the table present generations of HW and LW are very few due to mainly limited generation of sludge (C-3 and C-4) and dust (C-2).

Table I.1.3b ISW Generation Amounts (for Non-HW, HW and LW) obtained by EWI's RISNOR Study and JICA's Survey

Unit: ton/month

Industrial Category	CIIU Code	EWI'S RISNOR					JICA					Nos. Empl. Grand Total	Tn/month Grand Total
		Nos. Empl.	Non HW	HW	LW	Total EWI	Nos. Empl.	Non HW	HW	LW	Total JICA		
Highly Potential Industries	351	117	29.90	0.80	-	30.70	676	12.12	-	108.78	120.90	793	151.60
	352	437	58.68	32.02	0.00	90.71	6,815	172.85	0.83	459.82	633.49	7,252	724.20
	354	-	-	-	-	-	285	13.33	-	-	13.33	285	13.33
	356	829	22.36	-	-	22.36	2,891	124.40	0.61	0.49	125.50	3,720	147.86
	371	1,194	357.86	47.31	0.24	405.41	1,547	970.88	312.00	-	1,282.88	2,741	1,688.29
	372	23	29.93	0.68	-	30.61	1,597	42.50	70.00	2.00	114.50	1,620	145.11
	381	1,784	156.39	4.74	0.25	161.37	7,370	1,349.32	59.30	489.41	1,898.03	9,154	2,059.40
Total Highly Potential Industries		4,384	655.12	85.56	0.48	741.16	21,181	2,685.40	442.74	1,060.50	4,188.63	25,565	4,929.79
Potential Industries	3211	1,130	225.58	0.26	-	225.84	5,915	100.77	1.20	3.78	105.75	7,045	331.59
	3231	297	202.14	0.20	-	202.34	690	187.00	12.00	-	199.00	987	401.34
	3319	63	44.06	-	-	44.06	120	50.75	-	-	50.75	183	94.81
	341	1,063	737.16	80.64	0.04	817.84	4,538	2,135.40	331.00	1.23	2,467.63	5,601	3,285.46
	3420	551	68.95	0.29	0.01	69.25	3,793	1,425.55	-	4.79	1,430.34	4,344	1,499.59
	355	345	46.62	0.02	0.01	46.65	722	259.00	-	-	259.00	1,067	305.65
	362	34	1.10	-	-	1.10	1,030	544.30	45.00	0.50	589.80	1,064	590.90
	3699	397	11.04	-	-	11.04	348	5.55	15.00	-	20.55	745	31.59
	382	36	0.80	-	-	0.80	3,201	129.83	14.12	1.50	145.45	3,237	146.25
	383	-	-	-	-	-	2,265	731.45	0.50	3.72	735.67	2,265	735.67
	384	84	9.54	0.02	-	9.56	2,177	62.29	-	0.01	62.30	2,261	71.86
	385	-	-	-	-	-	276	1,058.68	-	0.20	1,058.88	276	1,058.88
	390	157	4.62	0.12	0.00	4.74	126	4.60	-	-	4.60	283	9.34
	625	-	-	-	-	-	39	0.20	-	1.75	1.95	39	1.95
	952	-	-	-	-	-	193	6.46	24.00	0.07	30.53	193	30.53
Total Potential Industries		4,157	1,351.61	81.54	0.06	1,433.21	25,433	6,701.83	442.82	17.55	7,162.20	29,590	8,595.41
Less Potential Industries	311	5,524	1,927.19	6.64	149.53	2,083.36	6,762	1,748.24	-	1.87	1,750.11	12,286	3,833.47
	312	555	63.66	0.40	1.84	65.90	-	-	-	-	-	555	65.90
	313	740	136.50	-	-	136.50	2,663	4,514.52	-	21.20	4,535.72	3,403	4,672.22
	3212 - 3219	313	13.03	-	0.02	13.06	730	-	-	-	-	1,043	13.06
	322	1,031	15.55	0.01	-	15.56	4,251	95.89	-	7.42	103.31	5,282	118.87
	324	648	5.91	-	-	5.91	2,701	46.10	-	-	46.10	3,349	52.01
	3311 - 3315	1,619	1,805.51	0.05	-	1,805.56	-	-	-	-	-	1,619	1,805.56
	332	298	41.11	0.02	-	41.13	-	-	-	-	-	298	41.13
	361	280	685.40	-	-	685.40	-	-	-	-	-	280	685.40
	3691 - 3696	467	69.75	-	-	69.75	548	808.25	-	-	808.25	1,015	878.00
	410	-	-	-	-	-	95	25.00	12.50	-	37.50	95	37.50
Total Less Potential Industries		11,475	4,763.61	7.13	151.38	4,922.12	17,750	7,238.00	12.50	30.49	7,280.99	29,225	12,203.11
Grand Total		20,016	6,770.34	174.23	151.92	7,096.49	64,364	16,625.23	898.06	1,108.53	18,631.82	84,380	25,728.30

Table I.1.3c ISW Generation Ratio (for Non-HW, HW and LW) in 1995 based on EWI's RISNOR Study and JICA's Survey

Unit: kg/year/employee

Industrial Category	CIIU A	Generation Ratio by EWI'S RISNOR				Generation Ratio by JICA				Grand Total
		Non HW	HW	LW	Total EWI	Non HW	HW	LW	Total JICA	
Highly Potential Industries	351	3,066.67	82.05	-	3,148.72	215.15	-	1,931.01	2,146.15	2,294.07
	352	1,611.46	879.35	0.03	2,490.84	304.36	1.45	809.66	1,115.47	1,198.35
	354	-	-	-	-	561.26	-	-	561.26	561.26
	356	323.67	-	-	323.67	516.36	2.53	2.03	520.93	476.97
	371	3,596.60	475.51	2.38	4,074.49	7,531.07	2,420.17	-	9,951.23	7,391.28
	372	15,615.65	354.26	-	15,969.91	319.35	525.99	15.03	860.36	1,074.88
	381	1,051.94	31.88	1.65	1,085.47	2,196.99	96.55	796.87	3,090.41	2,699.67
Total Highly Potential Industries		1,793.22	234.18	1.32	2,028.73	1,521.40	250.83	600.82	2,373.05	2,314.00
Potential Industries	3211	2,395.51	2.76	-	2,398.27	204.44	2.43	7.67	214.54	564.81
	3231	8,167.27	8.08	-	8,175.35	3,252.14	208.70	-	3,460.83	4,879.49
	3319	8,392.76	-	-	8,392.76	5,075.00	-	-	5,075.00	6,217.18
	341	8,321.64	910.30	0.45	9,232.39	5,646.72	875.28	3.24	6,525.23	7,039.02
	3420	1,501.72	6.29	0.17	1,508.19	4,510.04	-	15.15	4,525.20	4,142.52
	355	1,621.50	0.70	0.28	1,622.47	4,304.71	-	-	4,304.71	3,437.44
	362	388.24	-	-	388.24	6,341.36	524.27	5.83	6,871.46	6,664.29
	3699	333.55	-	-	333.55	191.38	517.24	-	708.62	508.75
	382	267.33	-	-	267.33	486.71	52.94	5.62	545.27	542.18
	383	-	-	-	-	3,875.23	2.65	19.73	3,897.61	3,897.61
	384	1,362.86	2.86	-	1,365.71	343.35	-	0.06	343.41	381.39
	385	-	-	-	-	46,029.57	-	8.70	46,038.26	46,038.26
	390	353.04	8.87	0.08	361.99	438.10	-	-	438.10	395.87
	625	-	-	-	-	61.54	-	538.46	600.00	600.00
	952	-	-	-	-	401.66	1,492.23	4.35	1,898.24	1,898.24
Total Potential Industries		3,901.68	235.39	0.16	4,137.23	3,162.11	208.94	8.28	3,379.33	3,485.80
Less Potential Industries	311	4,186.52	14.43	324.82	4,525.77	3,102.47	-	3.31	3,105.78	3,744.23
	312	1,376.50	8.65	39.68	1,424.82	-	-	-	-	1,424.82
	313	2,213.51	-	-	2,213.51	20,343.31	-	95.53	20,438.84	16,475.65
	3212 - 3219	499.67	-	0.88	500.55	-	-	-	-	150.21
	322	180.93	0.13	-	181.06	270.68	-	20.95	291.63	270.05
	324	109.41	-	-	109.41	204.81	-	-	204.81	186.35
	3311 - 3315	13,382.42	0.37	-	13,382.79	-	-	-	-	13,382.79
	332	1,655.40	0.97	-	1,656.36	-	-	-	-	1,656.36
	361	29,374.16	-	-	29,374.16	-	-	-	-	29,374.16
	3691 - 3696	1,792.24	-	-	1,792.24	17,698.91	-	-	17,698.91	10,380.27
	410	-	-	-	-	3,157.89	1,578.95	-	4,736.84	4,736.84
Total Less Potential Industries		4,981.55	7.45	158.31	5,147.32	4,893.30	8.45	20.61	4,922.36	5,010.69
Grand Total		4,058.96	104.45	91.08	4,254.49	3,099.60	167.43	206.67	3,473.71	3,658.92

Table I.1.3d Summary of ISW Generation Amount in 1995 by 24 ISW Categories

Unit: ton/year

Code	Type of Waste	ISW Generation
C-1	Ash including from incinerator	10,973
C-2	Dust and APC products	5,078
C-3	Inorganic sludge	47,035
C-4	Organic sludge	43,518
C-5	Asbestos	299
C-6	Acids	16,911
C-7	Alkalis	2,435
C-8	Solvents	485
C-9	Oily waste	3,824
C-10	Inorganic chemical residues	24,479
C-11	Organic chemical residues	7,927
C-12	Other liquid waste	4,044
C-13	Waste from food production	219,911
C-14	Glass and ceramics	129,240
C-15	Metal and scrap	55,028
C-16	Paper and cardboard	90,602
C-17	Plastics	24,858
C-18	Rubber	14,306
C-19	Textile and leather	10,158
C-20	Waste similar to domestic waste	47,984
C-21	Wood	117,359
C-22	Slag from melting	10,898
C-23	Construction waste	6,577
C-24	Other solid waste	45,209
Total		939,138

Table I.1.3e Summary of ISW Generation Amount in 1995 by 36 Industrial Groups

Unit: ton/year

Potential	CIIU Code		Industrial Category	Nos. of Employee	TOTAL
Highly Potential Industries	351		Manufacture of industrial chemical products	1,962	4,500.97
	352		Manufacture of other chemical products	18,512	22,183.80
	354	3540	Oil and coal products	1,360	763.32
	356	3560	Other non-classified plastic products	15,931	7,598.57
	371	3710	Iron and steel industries	4,106	30,348.60
	372		Basic metal industries	2,355	2,531.35
	381		Manufacture of metal products except machinery & equipment	26,602	71,816.61
Potential Industries	3211	3211	Textile processing and materials manufacturing	19,717	11,136.32
	3231	3231	Leather tanning and finishing	1,868	9,114.89
	3232	3232	Fur dressing, dyeing and other fur and skin articles	14	68.31
	3319	3319	Other non-classified wooden products	770	4,787.23
	341		Paper, printing and publishing industries	9,655	67,961.71
	3420	3420	Printing, photoengraving, publishing and the likes	11,734	48,608.29
	355		Manufacture of rubber products	4,751	16,331.29
	362	3620	Glass and glass products	2,163	14,414.85
	3699	3699	Other non-metallic mineral products	1,211	616.10
	382		Manufacture of machinery except electrical	10,477	5,680.46
	383		Manufacture of electrical machinery	4,829	18,821.57
	384		Manufacture of transport equipment	7,402	2,823.04
	385		Manufacture of science, measuring, controlling equipment(inc.lens)	1,094	50,365.86
	390		Other manufacturing industries	2,598	1,028.48
	625	6253	Gasoline filling station	5,115	3,069.00
	952	9520	Laundries and dry cleaners	2,535	4,812.03
Less Potential Industries	311		Food manufacturing	41,357	154,850.18
	312		Other food manufacturing	4,595	6,547.06
	313		Beverage industries	7,696	126,796.61
	314	3140	Cigarettes, cigars and tobacco	167	1,494.69
	3212-3219		Textile industries	13,221	1,985.96
	322	3220	Garment industries	25,525	6,892.97
	3233	3233	Leather products (exc.footwears)	1,158	312.72
	324	3240	Leather footwears	14,785	2,755.23
	3311-3315		Wood and cork industry	3,745	50,118.56
	332	3320	Furniture, fixture and the likes	5,975	9,896.77
	361	3610	Potteries and ceramic products	3,591	105,482.60
	3691-3696		Manufacture of non-metallic mineral products	6,962	72,267.45
	410	4101	Generation, transmission and distribution of electric energy	75	355.26
			Total	285,613	939,138.70

Table I.1.3f ISW Generation Amount (for 24 ISW Category) obtained by EWI's RISNOR Study and JICA's Survey

Unit: ton/month

Industrial Category		No. of Employees	Waste Category																								
			C-1	C-2	C-3	C-4	C-5	C-6	C-7	C-8	C-9	C-10	C-11	C-12	C-13	C-14	C-15	C-16	C-17	C-18	C-19	C-20	C-21	C-22	C-23	C-24	Grand Total
Highly Potential Industries	351	793	-	0.02	-	-	-	10.80	10.08	-	0.70	-	-	88.00	-	-	6.25	4.49	12.43	-	0.47	5.37	-	-	13.00	-	151.60
	352	7,252	-	0.30	1.08	19.39	-	351.06	49.02	5.54	0.89	0.02	7.50	46.60	-	1.27	28.12	60.63	38.47	-	1.30	69.47	12.93	30.00	0.62	-	724.20
	354	285	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.50	10.00	-	-	0.33	2.20	0.30	-	-	-	13.33
	356	3,720	-	-	0.01	-	-	0.02	-	0.06	1.01	-	-	-	-	-	23.26	28.53	57.58	-	0.36	35.78	1.25	-	-	0.01	147.84
	371	2,741	-	11.92	0.38	2.63	-	-	-	-	0.24	180.00	0.00	-	0.80	670.81	114.28	3.32	0.40	-	2.60	337.01	2.70	355.10	5.24	0.67	1,688.29
	372	1,620	0.80	10.00	-	-	-	1.80	-	-	0.20	0.18	-	-	-	28.14	1.64	1.82	21.86	-	-	6.67	2.00	70.00	-	-	145.11
	381	9,154	8.20	11.29	144.95	12.26	0.15	78.52	4.11	3.60	14.16	411.48	2.08	-	-	121.10	969.30	33.53	79.69	-	1.71	108.33	18.86	35.50	0.05	0.56	2,059.40
Total Highly Potential Industries		25,565	9.00	33.53	146.61	34.28	0.15	442.20	63.21	9.20	17.19	591.67	9.58	134.68	0.80	821.32	1,143.34	142.31	210.43	-	6.76	564.83	38.04	490.60	18.91	1.24	4,929.79
Potential Industries	3211	7,045	212.00	0.24	0.18	2.03	-	0.96	-	-	2.82	-	3.00	-	0.25	-	3.15	6.90	2.53	-	54.89	42.62	-	-	-	0.02	331.59
	3231	987	-	0.20	2.06	9.48	-	-	-	-	-	-	12.00	-	120.35	2.00	43.99	0.33	0.27	-	205.75	4.89	-	-	-	0.02	401.34
	3319	183	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.28	-	-	-	0.01	1.02	93.37	-	0.10	0.05	94.81
	341	5,601	42.60	38.00	81.00	1,130.03	-	-	-	0.02	1.25	-	60.01	-	-	-	35.00	1,274.39	189.76	0.50	0.16	331.25	100.50	-	1.00	-	3,285.46
	3420	4,344	-	-	-	3.26	-	0.07	0.00	4.71	0.05	-	-	-	1.30	-	11.27	1,380.35	52.61	7.60	0.12	37.71	0.40	-	-	0.15	1,499.59
	355	1,067	-	-	-	-	-	-	-	-	0.01	-	-	-	-	-	3.08	14.22	1.01	254.95	0.00	32.06	0.30	-	-	0.02	305.65
	362	1,064	0.70	90.00	137.50	-	-	-	-	-	0.50	-	-	-	-	124.00	28.00	42.10	56.70	-	0.02	4.38	35.00	45.00	27.00	-	590.90
	3699	745	-	0.55	-	-	15.00	-	-	-	-	-	-	-	-	-	0.02	7.01	-	-	-	4.02	-	-	-	5.00	31.59
	382	3,237	3.00	7.30	-	13.70	0.01	-	-	0.50	1.00	0.11	-	-	-	15.90	66.94	2.10	5.21	-	-	12.16	17.12	1.00	-	-	146.25
	383	2,265	-	-	-	0.50	-	3.00	0.30	-	0.42	-	-	-	-	372.10	290.50	10.80	4.45	-	-	49.00	4.60	-	-	-	735.67
	384	2,261	-	0.20	0.00	-	-	-	-	-	0.01	-	-	-	-	-	56.29	0.42	0.03	0.06	0.01	10.00	4.83	-	-	0.02	71.86
	385	276	-	-	-	-	-	-	-	-	0.20	-	-	-	-	32.15	5.50	5.10	6.20	-	-	5.13	1,004.60	-	-	-	1,058.88
	390	283	-	-	0.02	0.10	-	-	-	-	0.00	-	-	-	0.01	-	0.01	2.27	0.04	0.00	0.03	0.66	6.16	0.00	-	0.04	9.34
	625	39	-	-	-	0.20	-	-	-	-	1.75	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.95
	952	393	-	4.00	-	24.00	-	-	-	0.07	-	-	-	-	-	-	-	1.60	0.80	-	-	0.06	-	-	-	-	30.53
Total Potential Industries		29,590	258.30	140.69	220.76	1,183.30	15.01	4.03	0.30	5.30	8.06	0.11	75.01	-	121.91	546.35	544.01	2,747.58	319.61	263.11	260.98	534.95	1,266.87	46.00	28.10	5.32	8,595.41
Low Potential Industries	311	12,286	55.98	5.76	4.03	291.48	-	62.02	-	0.08	1.77	-	-	-	2,802.69	40.50	16.83	140.97	82.23	-	3.91	313.90	11.32	-	-	-	3,833.47
	312	555	0.40	-	-	-	-	-	-	-	1.00	-	0.80	0.04	44.27	-	0.05	1.93	1.24	-	1.09	14.55	0.55	-	-	-	65.90
	313	3,403	-	-	-	45.20	-	-	17.60	-	3.60	246.50	216.00	-	3,623.42	132.30	12.30	88.30	134.10	-	4.30	109.80	38.80	-	-	-	4,672.22
	3212 - 3219	1,043	-	-	-	-	-	-	-	-	0.02	0.81	-	-	0.00	-	-	0.36	10.39	-	0.62	0.85	-	-	-	-	13.06
	322	5,282	-	-	20.01	16.64	0.01	7.42	-	-	-	-	-	-	-	-	-	28.74	2.74	-	28.04	14.97	0.30	-	-	-	118.87
	324	3,349	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.50	8.00	7.00	8.00	22.50	5.91	0.10	-	-	-	52.01
	3311 - 3315	1,619	-	-	-	-	-	-	-	-	-	-	0.05	-	-	-	3.00	0.04	0.20	-	-	9.58	1,792.33	-	-	0.36	1,805.56
	332	298	-	-	0.00	0.02	-	-	-	-	-	-	0.00	-	-	-	0.03	0.06	0.00	-	0.11	1.20	31.71	-	-	8.00	41.13
	361	280	-	-	75.00	-	-	-	-	-	-	-	-	-	-	600.03	-	1.21	0.05	-	-	2.11	-	-	7.00	-	685.40
	3691 - 3696	1,815	-	-	290.76	0.04	-	-	-	-	-	-	-	-	-	1.00	2.00	2.32	0.30	-	-	4.57	0.60	-	52.41	524.09	878.00
	410	95	25.00	12.50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	37.50
Total Low Potential Industries		29,225	81.38	18.26	389.80	353.38	0.01	69.44	17.60	0.08	6.39	247.31	216.85	0.04	6,470.38	773.83	34.71	271.93	238.25	8.00	60.56	477.43	1,875.70	-	59.41	532.36	12,293.11
Grand Total		84,380	348.68	192.48	757.18	1,570.95	15.17	515.67	81.11	14.57	31.59	839.10	301.44	134.64	6,593.09	2,141.29	1,722.06	3,161.82	768.29	271.11	328.30	1,577.20	3,180.61	536.60	106.42	538.92	25,728.30

Table I.1.3g ISW Generation Ratio in 1995 by CIIU Code and 24 ISW Categories

Unit: kg/year/employee

Industrial Category		Waste Category																							
		C-1	C-2	C-3	C-4	C-5	C-6	C-7	C-8	C-9	C-10	C-11	C-12	C-13	C-14	C-15	C-16	C-17	C-18	C-19	C-20	C-21	C-22	C-23	C-24	Grand Total
Highly Potential Industries	351	-	0.23	-	-	-	163.43	152.53	-	10.59	-	-	1,331.65	-	-	94.58	67.87	188.10	-	7.11	81.26	-	-	196.72	-	2,294.07
	352	-	0.50	1.79	32.08	-	580.91	81.11	9.16	1.46	0.03	12.41	77.11	-	2.11	46.53	100.33	63.66	-	2.15	114.95	21.40	49.64	1.03	-	1,198.35
	354	-	-	-	-	-	-	-	-	-	-	-	-	-	-	21.05	421.05	-	-	13.89	92.63	12.63	-	-	-	561.26
	356	-	-	0.02	-	-	0.06	-	0.19	3.26	-	-	-	-	-	75.03	92.03	185.74	-	1.15	115.42	4.03	-	-	0.03	476.97
	371	-	52.18	2.53	11.53	-	-	-	-	1.04	788.03	0.01	-	3.50	2,936.76	500.30	14.53	1.75	-	11.38	1,475.42	11.87	1,554.62	22.94	2.93	7,391.28
	372	5.93	74.07	-	-	-	13.33	-	-	1.48	1.33	-	-	-	208.44	12.17	13.44	161.92	-	-	49.43	14.81	518.52	-	-	1,074.88
	381	10.75	14.80	190.01	16.07	0.20	102.93	5.39	4.72	18.56	539.40	2.73	-	-	158.75	1,270.65	43.95	104.47	-	2.24	142.01	24.72	46.54	0.06	0.73	2,699.67
Total Highly Potential Industries		4.22	15.74	68.82	16.09	0.07	287.57	29.67	4.32	8.07	277.73	4.50	63.38	0.38	385.52	536.68	66.80	98.77	-	3.17	265.12	17.86	230.28	8.87	0.58	2,316.00
Potential Industries	3211	361.11	0.41	0.31	3.45	-	1.64	-	-	4.80	-	3.11	-	0.43	-	5.37	11.75	4.31	-	93.49	72.60	-	-	-	0.03	564.81
	3231	-	2.43	25.06	115.25	-	-	-	-	-	-	145.90	-	1,463.22	24.32	534.83	4.01	3.26	-	2,501.52	59.45	-	-	-	9.24	4,879.49
	3319	-	-	-	-	-	-	-	-	-	-	-	-	-	-	18.03	-	-	-	0.39	66.75	6,122.30	-	6.56	3.15	6,217.18
	341	91.27	81.41	173.34	2,421.06	-	-	-	0.04	2.67	-	128.57	-	-	-	74.99	2,730.35	406.55	1.07	0.34	709.69	215.32	-	2.14	-	7,039.02
	3420	-	-	-	9.01	-	0.18	0.01	13.00	0.14	-	-	-	3.59	-	31.14	3,813.12	145.32	20.99	0.33	104.17	1.10	-	-	0.41	4,142.52
	355	-	-	-	-	-	-	-	-	0.09	-	-	-	-	-	34.61	159.99	11.36	2,867.28	0.01	360.60	3.37	-	-	0.22	3,437.44
	362	7.89	1,015.04	1,550.75	-	-	-	-	-	5.64	-	-	-	-	1,398.50	315.79	474.81	639.47	-	0.23	49.40	394.74	507.52	304.51	-	6,664.29
	3699	-	8.86	-	-	241.61	-	-	-	-	-	-	-	-	-	0.24	112.83	-	-	-	64.67	-	-	-	80.54	508.75
	382	11.12	27.80	-	50.79	0.04	-	-	1.85	3.71	0.41	-	-	-	58.94	248.16	7.78	19.02	-	-	45.08	63.47	3.71	-	-	542.18
	383	-	-	-	2.65	-	15.91	1.60	-	2.23	-	-	-	-	1,971.39	1,539.07	57.22	23.58	-	-	259.60	24.37	-	-	-	3,897.61
	384	-	1.06	0.01	-	-	-	-	-	0.05	-	-	-	-	-	298.73	2.23	0.18	0.32	0.03	53.07	25.61	-	-	0.11	381.39
	385	-	-	-	-	-	-	-	-	8.70	-	-	-	-	1,397.83	239.13	221.74	269.57	-	-	223.04	43,678.26	-	-	-	46,038.26
	390	-	-	0.89	4.03	-	-	-	-	0.04	-	-	-	0.51	-	0.25	96.23	1.87	0.17	1.19	27.77	261.20	0.08	-	1.61	395.87
	625	-	-	-	61.54	-	-	-	-	538.46	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	600.00
	952	-	248.70	-	1,492.23	-	-	-	4.35	-	-	-	-	-	-	-	99.48	49.74	-	-	3.73	-	-	-	-	1,898.24
Total Potential Industries		104.75	57.06	89.53	479.88	6.09	1.63	0.12	2.15	3.25	0.04	30.42	-	49.44	221.49	220.62	1,114.26	129.62	106.70	105.84	216.95	513.77	18.66	33.40	2.16	3,485.80
Less Potential Industries	311	54.68	5.63	3.94	284.70	-	60.58	-	0.08	1.73	-	-	-	2,737.45	39.56	16.44	137.69	80.31	-	3.81	306.59	11.05	-	-	-	3,744.23
	312	8.65	-	-	-	-	-	-	-	21.62	-	17.30	0.76	957.08	-	0.97	41.73	26.77	-	23.57	314.49	11.89	-	-	-	1,424.82
	313	-	-	-	139.39	-	-	62.06	-	12.69	869.23	761.68	-	12,777.27	466.53	43.37	311.37	472.88	-	15.16	387.19	136.82	-	-	-	16,475.65
	3212 - 3219	-	-	-	-	-	-	-	-	0.23	9.37	-	-	0.03	-	-	4.10	119.56	-	7.16	9.77	-	-	-	-	150.21
	322	-	-	45.46	37.81	0.02	16.86	-	-	-	-	-	-	-	-	-	65.30	6.22	-	63.70	34.00	0.68	-	-	-	270.05
	324	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.79	28.67	25.08	28.67	80.61	21.18	0.36	-	-	-	186.35
	3311 - 3315	-	-	-	-	-	-	-	-	-	-	0.37	-	-	-	22.24	0.26	1.48	-	-	71.04	13,284.71	-	-	2.70	13,382.79
	332	-	-	0.16	0.73	-	-	-	-	-	-	0.08	-	-	-	1.21	2.42	0.12	-	4.43	48.36	1,276.71	-	-	322.15	1,656.36
	361	-	-	3,214.29	-	-	-	-	-	-	-	-	-	-	25,715.36	-	52.03	2.14	-	-	90.34	-	-	300.00	-	29,374.16
	3691 - 3696	-	-	3,437.54	0.48	-	-	-	-	-	-	-	-	-	11.82	23.65	27.43	3.55	-	-	53.97	7.09	-	619.66	6,195.07	10,380.27
	410	3,157.89	1,578.95	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4,736.84
Total Less Potential Industries		33.42	7.50	360.06	145.10	0.00	28.51	7.23	0.03	2.62	101.55	89.04	0.01	2,656.78	317.74	14.25	111.66	57.83	3.28	24.87	196.03	770.18	-	24.40	218.59	5,010.69
Grand Total		49.59	27.37	197.68	223.41	2.16	73.34	11.54	2.07	4.49	119.33	42.87	19.15	937.63	304.52	244.90	449.65	109.26	38.56	46.69	224.30	452.33	76.31	15.13	76.64	3,658.92

Table I.1.3h ISW Generation Amount in 1995 by 24 ISW Categories

Unit: ton/year

Potential	CITU Code		No. of Employees	Waste Category C-1	C-2	C-3	C-4	C-5	C-6	C-7	C-8	C-9	C-10	C-11	C-12	C-13	C-14	C-15	C-16	17	C-18	C-19	C-20	C-21	C-22	C-23	C-24	TOTAL
Slightly	351		1,962	-	0.45	-	-	-	320.65	799.27	-	20.78	-	-	2,612.70	-	-	185.56	133.16	369.04	-	13.95	159.43	-	-	385.97	-	4,900.97
Potential	352		18,512	-	9.19	33.19	593.45	-	10,753.74	1,501.59	169.55	27.11	0.56	229.78	1,677.46	-	38.99	861.37	1,857.25	1,178.42	-	39.82	2,127.89	396.07	918.98	18.99	-	72,185.80
Industries	354	3540	1,368	-	-	-	-	-	-	-	-	-	-	-	-	-	-	28.43	572.43	-	-	18.90	125.98	17.16	-	-	-	762.72
	356	3560	13,931	-	-	0.26	-	-	1.03	-	3.08	53.90	-	-	-	-	-	1,135.34	1,466.17	2,959.05	-	18.29	1,838.69	64.24	-	-	0.51	7,596.57
	371	3710	4,596	-	214.26	10.40	47.56	-	-	-	-	4.26	3,235.87	0.04	-	14.38	12,058.34	2,054.22	59.66	7.19	-	46.74	6,058.07	48.53	6,383.25	94.39	12.04	30,340.60
	372		2,335	13.96	174.44	-	-	-	31.40	-	-	3.69	3.12	-	-	-	490.89	28.66	31.46	381.37	-	-	116.41	34.89	1,221.11	-	-	2,531.35
	381		26,697	285.99	392.75	5,054.61	427.36	5.23	2,758.20	145.33	175.54	497.69	14,349.25	72.57	-	-	4,773.11	33,801.86	1,169.17	2,779.00	-	39.56	3,777.68	657.70	1,737.98	1.57	39.46	71,816.61
Potential	3211	3211	39,737	7,119.95	8.34	6.11	68.12	-	32.24	-	-	94.71	-	100.75	-	8.40	-	105.79	231.63	84.97	-	1,843.40	1,431.45	-	-	-	0.67	11,136.72
Industries	3231	3231	1,848	-	4.54	46.80	235.28	-	-	-	-	-	-	272.53	-	2,733.30	45.42	999.07	7.49	6.09	-	4,872.84	111.06	-	-	-	0.45	9,114.89
	3232	3232	14	-	0.03	0.35	1.61	-	-	-	-	-	-	2.04	-	20.49	0.34	7.49	0.06	0.05	-	35.02	0.83	-	-	-	0.00	68.31
	3319	3319	779	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13.89	-	-	-	0.30	51.40	4,714.37	-	5.05	2.42	4,787.23
	341		9,655	861.19	786.05	1,675.53	23,375.34	-	-	-	0.41	25.75	-	1,241.30	-	-	-	724.00	26,361.51	3,975.28	10.34	3.31	6,852.10	2,078.90	-	20.69	-	67,981.71
	3420	3420	11,734	-	-	-	105.77	-	2.14	0.10	137.51	1.62	-	-	-	42.14	-	345.34	44,743.14	1,705.16	246.35	3.89	1,277.31	12.97	-	-	4.86	48,608.29
	355		4,753	-	-	-	-	-	-	-	-	0.43	-	-	-	-	-	164.41	759.70	53.97	13,622.45	0.05	1,733.19	16.03	-	-	1.07	16,351.29
	362	3620	3,163	17.06	2,195.53	3,254.28	-	-	-	-	-	12.20	-	-	-	-	3,024.95	683.05	1,077.02	1,383.14	-	0.49	106.85	853.82	1,097.76	658.66	-	14,413.83
	3699	3699	1,211	-	10.73	-	-	292.59	-	-	-	-	-	-	-	-	-	0.29	130.64	-	-	-	78.32	-	-	-	97.33	616.10
	382		19,677	116.52	292.30	-	532.10	0.47	-	-	19.42	38.84	4.27	-	-	-	617.55	2,599.93	81.56	207.43	-	-	477.29	664.94	38.84	-	-	5,686.46
	383		4,829	-	-	-	32.79	-	76.82	7.71	-	10.75	-	-	-	-	9,519.83	7,632.18	276.31	113.85	-	-	3,253.62	117.69	-	-	-	18,821.97
	384		7,602	-	7.86	0.04	-	-	-	-	-	0.39	-	-	-	-	-	2,233.13	14.54	1.30	2.36	0.20	392.85	189.35	-	-	0.79	2,823.44
	385		1,994	-	-	-	-	-	-	-	-	9.51	-	-	-	-	1,579.22	261.61	242.58	294.90	-	-	244.01	47,784.02	-	-	-	50,365.86
	390		2,598	-	-	2.30	10.48	-	-	-	-	0.33	-	-	-	1.32	-	0.66	250.07	4.85	0.44	3.08	72.16	678.60	0.22	-	4.19	1,028.48
	625	6253	5,115	-	-	-	314.77	-	-	-	-	2,754.23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3,069.00
	752	9520	2,535	-	630.47	-	3,782.80	-	-	-	11.03	-	-	-	-	-	-	-	727.19	126.09	-	-	9.46	-	-	-	-	4,812.03
Zero	311		41,357	2,261.77	232.79	162.87	11,774.24	-	7,505.25	-	3.25	71.58	-	-	-	133,232.54	1,635.97	679.84	5,694.54	3,321.50	-	157.74	12,679.68	457.14	-	-	-	154,086.18
Potential	312		4,886	39.74	-	-	-	-	-	-	-	99.35	-	79.48	3.48	4,397.79	-	4.47	191.75	123.00	-	108.79	1,445.07	54.84	-	-	-	6,547.96
Industries	313		7,896	-	-	-	1,726.66	-	-	477.64	-	97.70	6,697.62	5,861.90	-	98,333.85	3,590.41	333.80	2,396.32	3,639.26	-	116.70	2,979.80	1,052.97	-	-	-	126,796.61
	314	3140	167	0.72	-	-	13.31	-	-	5.18	-	2.87	72.58	45.04	0.06	1,146.82	34.96	3.70	29.48	42.72	-	3.23	58.59	12.42	-	-	-	1,494.69
	3212-3219		13,221	-	-	-	-	-	-	-	-	3.04	173.82	-	-	0.46	-	-	54.15	1,580.74	-	94.61	129.14	-	-	-	-	1,985.96
	322	3220	75,525	-	-	1,160.31	985.00	0.64	430.28	-	-	-	-	-	-	-	-	-	1,668.85	158.77	-	1,625.85	867.87	17.40	-	-	-	6,892.97
	3233	3233	1,154	-	-	57.64	43.78	0.03	19.52	-	-	-	-	-	-	-	-	-	75.62	7.20	-	73.76	39.37	0.79	-	-	-	312.72
	324	3246	14,785	-	-	-	-	-	-	-	-	-	-	-	-	-	-	26.49	423.82	370.86	423.82	1,397.88	313.09	5.30	-	-	-	2,753.75
	3311-3315		3,745	-	-	-	-	-	-	-	-	-	-	1.39	-	-	-	83.77	0.97	5.55	-	-	266.03	49,751.24	-	-	10.10	50,118.56
	333	3320	5,975	-	-	0.95	4.34	-	-	-	-	-	-	0.48	-	-	-	7.22	14.44	0.72	-	26.47	286.97	7,578.35	-	-	1,924.83	9,854.77
	341	3410	3,391	-	-	11,542.50	-	-	-	-	-	-	-	-	-	-	92,343.85	-	186.83	7.70	-	-	324.42	-	-	1,077.30	-	105,482.60
	3491-3496		5,967	-	-	23,932.19	3.37	-	-	-	-	-	-	-	-	-	82.31	164.62	190.98	24.69	-	-	373.74	49.39	-	4,314.08	43,330.10	72,267.45
	410	4101	75	236.84	118.42	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	355.26
			295,613	10,973.35	5,077.84	47,035.33	43,518.34	298.95	16,911.27	2,434.81	464.78	3,924.31	24,475.90	7,937.31	4,043.70	219,911.47	129,248.15	55,077.95	90,601.89	24,857.43	14,395.73	10,158.37	47,985.42	117,358.92	10,896.13	6,976.90	45,209.04	979,136.70

Table I.1.3i ISW Generation Amount in 1995 by Non-HW, HW and LW

Unit: ton/year

ISW Category	Generation Amount	Rate (%)
Non- Hazardous Waste	868,000	92.4
Hazardous Waste	26,000	2.8
Liquid Waste	45,000	4.8
Total	939,000	100.0

Table I.1.3j ISW Generation Amount in 1995 by the Classification of Non-HW, HW and LW

Unit: ton/year

	CIIU Code		Industrial Category	Number of Employees	Waste Category			Total
					Non HW	HW	LW	
Highly Potential Industries	351		Manufacture of industrial chemical products	1,962	1,247.6	23.8	3,229.7	4,501.0
	352		Manufacture of other chemical products	18,512	7,092.4	1,006.2	14,085.2	22,183.8
	354	3540	Oil and coal products	1,360	763.3	-	-	763.3
	356	3560	Other non-classified plastic products	15,931	7,542.0	31.3	25.2	7,598.6
	371	3710	Iron and steel industries	4,106	23,885.4	6,459.0	4.3	30,348.6
	372		Basic metal industries	2,355	1,263.5	1,233.0	34.9	2,531.3
	381		Manufacture of metal products except machinery & equipment	26,602	52,507.9	2,233.2	17,075.5	71,816.6
Potential Industries	3211	3211	Textile processing and materials manufacturing	19,717	10,960.3	49.0	127.0	11,136.3
	3231	3231	Leather tanning and finishing	1,868	8,837.8	277.1	-	9,114.9
	3232	3232	Fur dressing, dyeing and other fur and skin articles	14	66.2	2.1	-	68.3
	3319	3319	Other non-classified wooden products	770	4,787.2	-	-	4,787.2
	341		Paper, printing and publishing industries	9,655	59,420.6	8,515.0	26.2	67,961.7
	3420	3420	Printing, photoengraving, publishing and the likes	11,734	48,443.4	9.4	155.5	48,608.3
	355		Manufacture of rubber products	4,751	16,329.8	1.1	0.4	16,331.3
	362	3620	Glass and glass products	2,163	13,304.9	1,097.8	12.2	14,414.9
	3699	3699	Other non-metallic mineral products	1,211	323.5	292.6	-	616.1
	382		Manufacture of machinery except electrical	10,477	5,073.7	548.5	58.3	5,680.5
	383		Manufacture of electrical machinery	4,829	18,713.5	12.8	95.3	18,821.6
	384		Manufacture of transport equipment	7,402	2,821.9	0.8	0.4	2,823.0
	385		Manufacture of science, measuring, controlling equipment(inc.lens)	1,094	50,356.3	-	9.5	50,365.9
	390		Other manufacturing industries	2,598	1,015.6	12.8	0.1	1,028.5
	625	6253	Gasoline filling station	5,115	314.8	-	2,754.2	3,069.0
	952	9520	Laundries and dry cleaners	2,535	1,018.2	3,782.8	11.0	4,812.0
Less Potential Industries	311		Food manufacturing	41,357	148,466.5	268.3	6,115.4	154,850.2
	312		Other food manufacturing	4,595	6,325.0	39.7	182.3	6,547.1
	313		Beverage industries	7,696	126,221.3	-	575.3	126,796.6
	314	3140	Cigarettes, cigars and tobacco	167	1,484.4	0.7	9.6	1,494.7
	3212-3219		Textile industries	13,221	1,982.5	-	3.5	1,986.0
	322	3220	Garment industries	25,525	6,462.0	0.6	430.3	6,893.0
	3233	3233	Leather products (exc.footwears)	1,158	293.2	0.0	19.5	312.7
	324	3240	Leather footwears	14,785	2,755.2	-	-	2,755.2
	3311-3315		Wood and cork industry	3,745	50,117.2	1.4	-	50,118.6
	332	3320	Furniture, fixture and the likes	5,975	9,891.0	5.8	-	9,896.8
	361	3610	Potteries and ceramic products	3,591	105,482.6	-	-	105,482.6
	3691-3696		Manufacture of non-metallic mineral products	6,962	72,267.5	-	-	72,267.5
	410	4101	Generation, transmission and distribution of electric energy	75	236.8	118.4	-	355.3
			Total	285,613	868,075.0	26,023.1	45,040.6	939,138.7

I.1.4 Present ISW Flow

a. Outcome of the Survey Results

aa. Factories' Survey by JICA

The survey by the Team carried out following investigations regarding waste generation, treatment/disposal by respective factories, in order to assume "present ISW flow":

i. Transport and final disposal at municipal landfill by own means of transportation;
ii. Transport and final disposal at municipal landfill by consignment of private contractor;
iii. Final disposal at factory's compound and/or its property land;
iv. Long-time storage at factory's compound awaiting external treatment/disposal;
v. Discharge to sewer or watercourse;
vi. Disposal consigned to private contractor - treatment and disposal is not known;
vii. Reutilization by other parties, e.g. use at other factory as raw materials; and
viii. Others.

The outcome is shown in Table I.1.4a. Destination of 1,282 ton/month, which count for about 7% of the total generation amount (18,632 ton/month), was not known (Others and No Answer in the Table).

ab. EWI's RISNOR Study

Although it is not presented in the report of EWI's RISNOR Study, the study carried out following investigation regarding ISW generation and treatment/disposal at respective factories:

i. Transportation by a third party for sale;
ii. Transportation by a third party for landfill;
iii. Transportation by a third party for fee of charge;
iv. Municipal collection
v. Own transportation for sale;

vi. Own transportation for landfill;
vii. Own transportation free of charge; and
viii. Without transportation.

The Team analyzed the outcome and summarized in Table I.1.4b.

b. Analysis of the Outcome

ba. Summary of Outcome

Although surveyed items of JICA Team and EWI's RISNOR regarding waste generation and treatment/disposal were different, both studies reached the same conclusion that the percentage of "recycling" of ISW is quite high. Bearing this in mind, ISW are classified principally into "recycled" and "not-recycled"and summarized in Table I.1.4c following the manner EWI employed.

bb. Rate of ISW recycled and not-recycled

Proportion of "ISW recycled" and "ISW not-recycled"is given as:

- 56.2% and 43.8% in JICA Team's survey, and
- 54.1% and 45.9% in EWI's RISNOR study.

Outcome of both studies showed approximate values. In this regard, it might be assumed that the values are reliable.

bc. Amount of On-site Intermediate Treatment

Outcome of Team's survey on "on-site intermediate treatment"are shown in Table I.1.4d. According to the table, 1,366 ton/month, which counts for about 7% of the total generation amount of factories surveyed (18,632 ton/month) are internally treated on-site.

On the other hand, values of "others" plus "no answers" in Table I.1.4a reaches 1,282 ton/month and it is approximate to the value 1,366 ton/month. Judging from the questionnaire format employed in the survey, it might be assumed that on-site intermediate treatment are realized in the range of this value (i.e. 7%) in the MR.

Table I.1.4a Disposal Methods in Factory Surveyed by JICA Team

Unit: ton/month

Industrial Category		Disposal Methods									
		1	2	3	4	5	6	7	8	No Answer	Grand Total
Highly Potential Industries	351	0.5	10.5	-	-	0.1	0.1	109.6	0.1	0.1	120.9
	352	0.0	74.4	0.3	0.1	99.4	2.9	425.8	20.0	10.7	633.5
	354	0.3	12.8	-	-	-	-	-	0.2	-	13.3
	356	39.2	43.6	-	-	0.0	1.0	37.2	2.0	2.5	125.5
	371	204.0	713.9	-	40.0	-	301.0	-	-	24.0	1,282.9
	372	-	75.5	-	-	1.8	-	18.2	-	19.0	114.5
	381	21.9	329.8	13.0	15.2	417.6	88.7	655.6	346.4	9.9	1,898.0
Total Highly Potential Industries		265.9	1,260.5	13.2	55.3	518.9	393.6	1,246.4	368.6	66.2	4,188.6
Potential Industries	3211	1.4	53.1	0.7	-	1.0	32.0	14.0	3.4	0.2	105.8
	3231	1.8	148.2	-	-	-	-	49.0	-	-	199.0
	3319	-	-	-	-	-	-	50.8	-	-	50.8
	341	5.1	1,437.2	-	-	-	-	964.3	-	61.0	2,467.6
	3420	-	45.0	-	-	0.3	95.9	1,277.2	1.4	10.6	1,430.3
	355	254.0	0.5	0.5	-	-	-	4.0	-	-	259.0
	362	-	364.4	-	90.0	-	-	40.0	3.7	91.7	589.8
	3699	-	20.0	-	-	-	-	-	-	0.6	20.6
	382	4.0	57.2	-	-	-	-	83.4	-	0.8	145.5
	383	10.0	104.8	-	-	2.4	2.3	308.3	8.0	300.0	735.7
	384	-	9.2	-	-	-	-	53.1	-	-	62.3
	385	-	51.9	-	-	-	-	1,003.0	4.0	-	1,058.9
	390	-	-	-	-	-	-	4.6	-	-	4.6
	625	-	1.0	-	-	-	-	0.8	0.2	-	2.0
	952	0.1	26.4	-	-	4.0	-	-	0.1	-	30.5
Total Potential Industries		276.4	2,318.9	1.2	90.0	7.6	130.2	3,852.4	20.8	464.9	7,162.2
Less Potential Industries	311	2.9	204.4	-	-	0.0	62.4	1,457.1	-	23.3	1,750.1
	313	-	389.0	-	-	292.0	-	3,827.2	19.0	8.5	4,535.7
	322	-	36.6	-	-	7.4	-	59.3	-	-	103.3
	324	-	-	-	-	-	20.0	-	-	26.1	46.1
	3691 - 3696	-	-	524.0	-	-	-	-	284.3	-	808.3
	410	-	-	-	-	-	-	37.5	-	-	37.5
Total Less Potential Industries		2.9	630.0	524.0	-	299.5	82.4	5,381.1	303.3	57.9	7,281.0
Grand Total		545.2	4,209.4	538.4	145.3	826.0	606.1	10,479.8	692.6	589.0	18,631.8

Note:
1. Transport and final disposal at municipal landfill by own means of transprtation.
2. Transport and final disposal at municipal landfill by consignment of private contractor.
3. Final disposal at factory's compound and/or its property land.
4. Long-time storage at factory's compound awaiting external treatment/disposal.
5. Discharge to sewer or watercourse
6. Disposal consigned to private contractor - treatment and disposal is not known.
7. Reutilization by other parties, e.g. use at other factory as raw material.
8. Others.

Table I.1.4b Disposal Methods in Factories Surveyed by EWI's RISNOR Study

Unit: ton/month

Industrial Category	CIIU	Recycled 1	3	4	5	7	8	Total Recycled	Not Recycled 2	3	4	6	8	Total Not Recycled	TOTAL
Highly Potential Industries	351	0.40	-	-	-	-	9.00	9.40	12.80	-	8.30	-	0.20	21.30	30.70
	352	21.44	-	-	-	-	0.13	21.57	80.96	-	3.17	-	-	84.13	105.70
	356	0.05	0.08	-	-	-	3.05	3.18	2.06	0.95	16.18	-	-	19.19	22.36
	371	60.81	0.10	-	-	48.00	302.43	411.34	1,124.38	0.07	13.30	40.52	-	1,178.27	1,589.61
	372	1.05	-	-	-	-	71.00	72.05	-	-	0.20	-	-	0.20	72.25
	381	196.10	0.30	-	3.50	-	29.98	229.87	622.98	0.08	9.57	2.78	8.00	643.41	873.29
Total Highly Potential Industries		**279.85**	**0.48**	**-**	**3.50**	**48.00**	**415.59**	**747.41**	**1,843.18**	**1.10**	**50.71**	**43.30**	**8.20**	**1,946.49**	**2,693.90**
Potential Industries	3211	147.11	3.28	-	-	-	32.00	182.39	205.99	-	4.13	2.17	-	212.29	394.68
	3231	45.59	-	-	-	-	-	45.59	138.54	-	11.20	7.04	-	156.78	202.37
	3319	35.18	-	-	-	-	-	35.18	-	-	0.61	8.28	-	8.89	44.06
	341	89.94	-	-	-	-	487.00	576.94	943.47	-	4.54	-	-	948.01	1,524.94
	3420	30.02	0.20	-	-	-	0.09	30.31	36.72	0.17	2.06	-	-	38.95	69.25
	355	-	-	-	-	-	2.65	2.65	43.13	-	0.87	-	-	44.00	46.65
	362	17.03	-	-	-	-	10.80	27.83	14.77	-	0.20	20.00	-	34.97	62.80
	3699	-	-	-	-	-	-	-	-	-	11.04	-	-	11.04	11.04
	382	0.22	-	-	-	-	0.12	0.34	-	-	0.40	0.06	-	0.46	0.80
	384	19.15	-	-	-	-	0.02	19.17	24.61	-	1.62	-	8.00	34.23	53.40
	385	-	-	-	-	-	-	-	2.10	-	-	-	-	2.10	2.10
	390	1.43	1.60	0.00	-	-	0.17	3.20	-	-	1.31	0.23	-	1.54	4.74
Total Potential Industries		**385.66**	**5.08**	**0.00**	**-**	**-**	**532.85**	**923.59**	**1,409.33**	**0.17**	**37.96**	**37.77**	**8.00**	**1,493.23**	**2,416.82**
Less Potential Industries	311	1,003.68	20.74	-	-	-	269.65	1,294.07	857.93	20.00	39.82	-	0.25	918.00	2,212.06
	312	34.25	-	-	-	-	0.43	34.67	17.01	-	14.22	-	-	31.23	65.90
	313	21.30	-	-	-	-	-	21.30	96.00	-	-	19.20	-	115.20	136.50
	322	9.47	0.27	-	-	-	0.04	9.77	0.35	-	5.44	-	-	5.78	15.56
	324	0.29	-	-	-	-	-	0.29	5.61	-	0.01	-	-	5.62	5.91
	332	2.21	-	-	9.70	-	25.80	37.71	2.63	-	0.80	-	-	3.43	41.13
	361	-	-	-	-	-	682.00	682.00	3.35	-	0.05	-	-	3.40	685.40
	3311 - 3315	1,616.73	14.18	-	-	-	164.75	1,795.65	0.10	-	4.46	0.50	4.85	9.91	1,805.56
	3691 - 3696	9.19	5.30	-	-	-	41.40	55.89	202.55	3.12	30.13	2.58	-	238.37	294.26
	3212 - 3219	0.18	1.30	-	-	-	10.21	11.69	-	-	1.37	-	-	1.37	13.06
Total Less Potential Industries		**2,697.28**	**41.78**	**-**	**9.70**	**-**	**1,194.27**	**3,943.04**	**1,185.52**	**23.12**	**96.27**	**22.28**	**5.10**	**1,332.29**	**5,275.33**
Grand Total		**3,362.79**	**47.33**	**0.00**	**13.20**	**48.00**	**2,142.71**	**5,614.04**	**4,438.03**	**24.39**	**184.94**	**103.35**	**21.30**	**4,772.02**	**10,386.06**

Note:

1 Transportation by a third party for Sale
2 Transportation by a third party for Landfill
3 Transportation by a third party free of charge
4 Municipal Collection
5 Own transportation for Sale
6 Own transportation for Landfill
7 Own transportation for Free of Charge
8 Without Transportation

Table I.1.4c Comparison of JICA Survey and EWI's RISNOR Study Results

Category of survey / Disposal Method	JICA Survey			EWI's RISNOR Study		
	ISW amount	Answer code	Rate	ISW amount	Answer code	Rate
	ton/month	No.	(%)	ton/month	No.	(%)
1. Generation	18.632		100.0	10,386		100.0
2. Recycled	10,480	7	56.2	5,614		54.1
- On-site	NA		-	2,143	8	20.6
- Outside	NA		-	3,471	1,3,4,5,7	33.4
3. Not Recycled	8,152		43.8	4,772		45.9
3.1 Storage	145	4	0.8	21	8	0.2
3.2 Disposal	6,725		36.1	4,751	2,3,4,6	45.7
Disposal at municipal landfills	4,755	1,2	25.5	NA		-
On-site disposal	538	3	2.9	NA		-
Discharge to sewer, etc.	826	5	4.4	NA		-
Unknown disposal	606	6	3.3	NA		-
3.3 Others	1,282	8 and no answers	6.9	NA		-

Table I.1.4d Internal Treatment Method in Factories by JICA Survey

Treatment Method	Amount (ton/month)	Share (%)
Dewatering	14.8	1.1
Drying and/or evaporation	321.8	23.6
Neutralization	515.3	37.7
Deoxidization	0.1	0.0
Incineration	1.5	0.1
Crushing	20.7	1.5
Sorting	328.7	24.1
Oil Separation	0.1	0.0
Solidification	10.0	0.7
Others	153.4	11.2
Total	1,366.4	100.0

c. Present ISW Flow

ISW flow identified in the study is shown in the Table I.1.4e.

Table I.1.4e ISW Flow obtain by JICA Survey

	Amount (ton/month)	Share (%)
1. Generation	18,632	100
2. Recycling	10,480	56
3. Treatment	1,282	7
4. Storage	145	1
5. Final Disposal		
5-1 Disposal at municipal landfills	4,755	26
5-2 On-site disposal	538	3
5-3 Discharge to sewer, etc.	826	4
5-4 Unknown disposal	606	3
Final Disposal Total	6,725	36

The "Present ISW Flow" in the MR shown in Table I.1.4f is calculated from:

- "present ISW generation amount" multiplied by the "shares (%) obtained in Table I.1.4e".

Which is presented in a diagram of Figure I.1.4a.

The flow indicates that more than 50% of ISW generated are recycled. However, "Survey on private SWM Enterprises"by JICA Team and EWI's VIRS study pointed out that considerable amounts of ISW collected by recycling agents are treated and/or disposed inappropriately. Attention should be drawn to that residues of recycling works are illegally dumped in many occasions.

Table I.1.4f Present ISW Flow in the MR

	Share (%)	Amount (ton/year)
1. Generation	100	939,139
2. Recycling	56	525,918
3. Treatment	7	65,740
4. Storage	1	9,391
5. Final Disposal		
5-1 Disposal at municipal landfills	26	244,176
5-2 On-site disposal	3	28,174
5-3 Discharge to sewer, etc.	4	37,566
5-4 Unknown disposal	3	28,174
Final Disposal Total	36	338,090

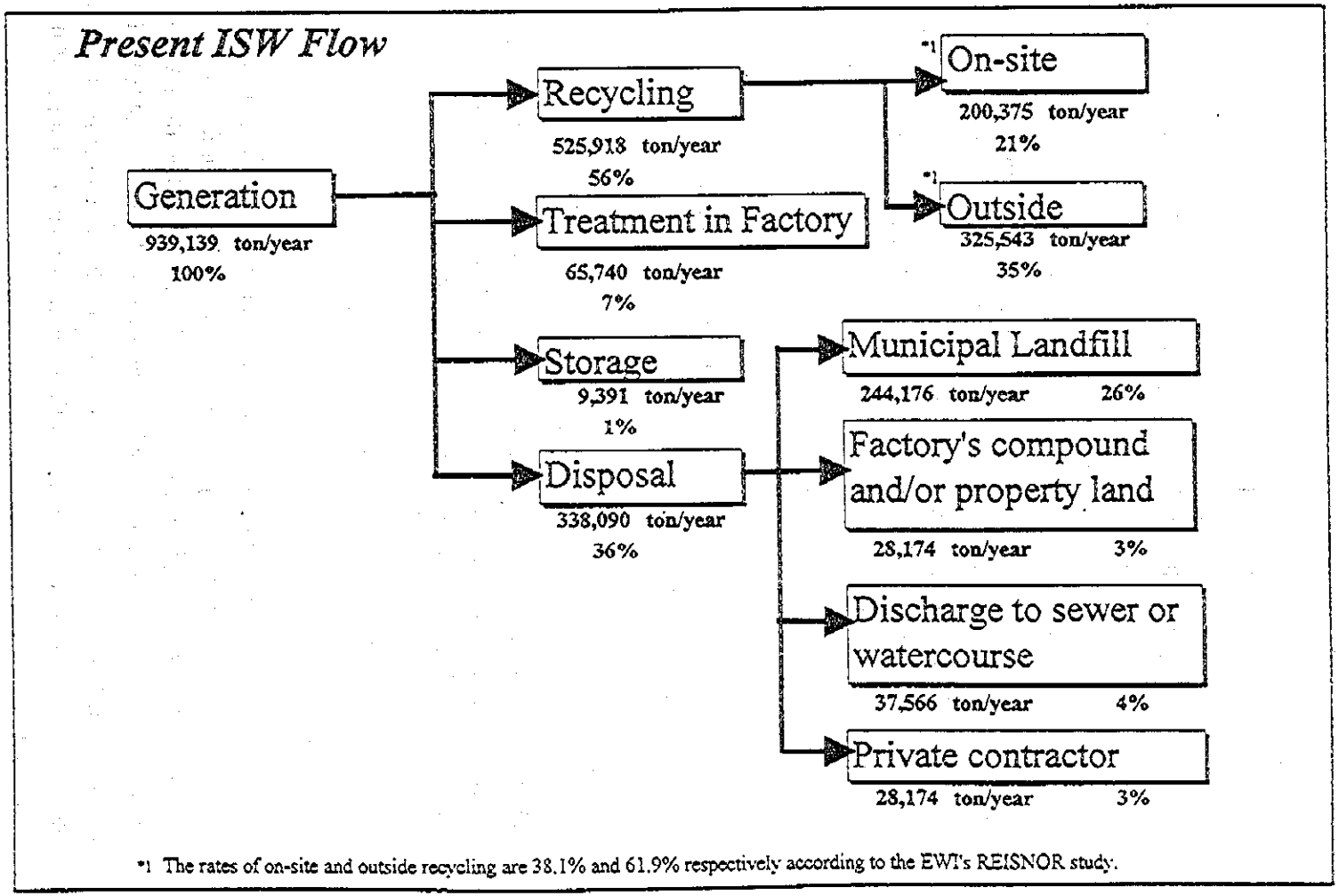

Figure I.1.4a Present ISW Flow

I.2 Forecast of Future ISW Generation

I.2.1 Forecast of Future Socio-Economic Conditions

a. Basic indicators adopted

The main objective of this section is to provide fundamental socio-economic data required for the forecast of industrial/medical SW generation. Different methods were applied for the forecast of industrial and medical SW generation. Regarding the amount of medical SW generation, the forecast was conducted by estimating the number of patients which is based on the projection of population growth up to 2010. The amount of industrial SW, on the other hand, is to be carried out on the basis of the estimated ISW generation per employee and number of employees in 2010. Therefore, the basic socio-economic indicators to be forecasted below are selected based on the methods described above.

aa. Population growth

The result of the forecast of population growth in the MR is to be used for the forecast of medical SW generation.

ab. GNP growth

Although the result of the projection is not directly used for the forecast of industrial/medical SW generation, growth of GNP is estimated as an indicator to evaluate the validity of forecasted industrial/medical SW generation.

ac. Growth in the number of employees (28 sub-sectors of Manufacturing Industry)

The most essential factor for the forecast of ISW generation is growth in the number of employees. Since the per employee ISW generation is given for each of 33 sub-sectors of manufacturing industries and 3 additional industries, the forecast of the number of employees are also carried out for each of them. The table I.2.1a below shows the specified 36 (33 sub-sectors of manufacturing industries + 3 additional industries) industries in accordance with the potential hazardousness of the waste generated.

Table I.2.1a 36 Industries Subject to the Forecast of ISW Generation

Potential Hazardousness of Wastes	CIIU (ISIC) Code		Industrial Category
Highly Potential Industries	351		Manufacture of industrial chemical products
	352		Manufacture of other chemical products
	354	3540	Oil & coal products
	356	3560	Other non-classified plastic products
	371	3710	Iron and steel industries
	372		Basic metal industries
	381		Manufacture of metal products except machinery & equipment
Potential Industries	321	3211	Textile processing and materials manufacturing
	323	3231	Leather tanning and finishing
		3232	Fur dressing, dyeing and other fur and skin articles
	331	3319	Other non-classified wooden products
	341		Paper and pulp industries
	342	3420	Printing, photoengraving, publishing and the likes
	355		Manufacture of rubber products
	362	3620	Glass and glass products
	369	3699	Other non-metallic mineral products
	382		Manufacture of non-electrical machinery
	383		Manufacture of electrical machinery
	384		Manufacture of transport machinery/equipment
	385		Manufacture of science, measuring, controlling and optic equipment
	390		Other manufacturing industries
	625	6253	Gasoline filling station
	952	9520	Laundries and dry cleaners
Less Potential Industries	311		Food manufacturing
	312		Other food manufacturing
	313		Beverage industries
	314	3140	Cigarettes, cigars and tobacco industries
	321	3212-3219	Textile industries
	322	3220	Garment industries
	323	3223	Leather products (excluding footwear)
	324	3240	Leather footwear
	331	3311-3315	Wood and cork industry
	332	3320	Furniture, fixture and the likes
	361	3610	Potteries and ceramic products
	369	3691-3696	Manufacture of non-metallic mineral products
	410	4101	Generation, transmission and distribution of electric energy

b. Methods and results of the forecast

ba. Population growth

The National Institute for Statistics (INE) has just completed the population projection up to the Year 2025. This projection is conducted by applying the DUCHESNER method, in which population projection is carried out by assuming the natural change of population from available data on of birth and mortality rate, and also by assuming social changes mainly brought about by migration.

Following this population projection, we set up the population of the MR for 2010 as approximately 6,930 thousand. The average annual growth rate of population in the MRS during 1990-2010 is about 1.5%.

bb. Growth of GNP

According to the government statement on the future outlook of macro-economy in Chile, economic growth will be maintained at 6% per annum in the mid-term. Based on this, it is assumed that the average annual economic growth would be kept at 6% up until the year 2000. After the year 2000, we adopted the growth rate given in the long-term plan of Central Macro Zone (MZC). Thus, the annual average growth rate was set up at 5% for the period of 2000-2005 and 4% for 2005-2010. The Gross National Product in the year 2010 will be, based on these assumption, about 114,900 million US dollars (1994 prices). Average annual growth rate during 1994-2010 shall be 5.1%.

bc. Growth of the Number of Employees

The forecast of the number of employees here is conducted on the basis of the estimates of industrial production growth and labor productivity increase. The details of the forecast are given on a step by step manner below.

Step 1: Forecast of industrial production growth

Based on the available data on the trend of industrial indices during 1982-1994 for 28 sub-sectors of manufacturing industry, the future industrial production growth was forecasted by making a linear regression analysis with least square method[*1]. As the data on industrial indices is available only by each of sub-sectors classified with 3 digits of ISIC Code, the Study selected 28 sub-sectors that totally cover 33 sub-sectors of manufacturing industries. The correlation between 28 and 33 sub-sectors is given in Table I.2.1b. The estimated rates of

industrial production growth for each of 28 sub-sectors are applied to 33 sub-sectors in accordance with this table. Regarding the additional 3 industries, different methods of forecast, that are separately mentioned in Section bd., are applied so as to take into account their different activity types and data availability.

*1: Liner Regression by Least Square Method

Linear Regression by Least Square Method is a typical method of linear regression analysis. With this method, the future trend of industrial growth is estimated by extrapolating its past trend which is given in a linear equation. In this case, the basic equation is given as follows:

$$y = A_0 + A_1 x \quad (1)$$

y: industrial index
x: year

Ideally, all the given data (in this case, past data on industrial index) satisfies the equation (1), but normally there is an error between the actual data and the equation. Therefore, the equation is modified as follows for each actual given data.

$$y = A_0 + A_1 x_i + \partial_i \quad (i = 1,2,3,4,\cdots n) \qquad (2)$$

This equation is called "Linear Regression Model", and ∂_i is given as an expected error. A_0 and A_1 of the liner equation above is determined by minimizing the sum of the squared values of the expected errors. This is the method called "Least Square". The future growth of industrial index is calculated in accordance with the linear equation given above.

Additionally, the Study do not consider any irregular factors that may change the future tread of industrial development such as relocation of factories between the MR and outside the MR, establishment of new types of industries, and so forth.

Table I.2.1c shows the result of projection on the growth rate of industrial production during 1994-2010 for each of 28 sub-sectors of manufacturing industries.

Table I.2.1b Matrix Table of 28 and 33 Categories of Manufacturing Industries

28 Categories		33 Categories	
Code	Industrial Categories	Code	Industrial Categories
311/312	Food manufacturing	311	Food manufacturing
		312	Other food manufacturing
313	Beverage industries	313	Beverage industries
314	Tobacco industries	3140	Cigarettes, cigars and tobacco
321	Textile industries	3211	Textile processing and materials manufacturing
		3212-3219	Textile industries
322	Clothing manufacturing	3220	Garment industries
323	Leather industries	3231	Leather tanning and finishing
		3232	Fur dressing, dyeing and other fur and skin articles
		3233	Leather products (exc. footwear)
324	Leather footwear manufacturing	3240	Leather footwear
331	Wood & cork industries	3311-3315	Wood and cork industry
		3319	Other non-classified wooden products
332	Wooden furniture & fixture	3320	Furniture, fixture and the likes
341	Pulp & paper manufacturing	341	Paper & pulp industries
342	Printing & publishing	3420	Printing, photoengraving, publishing and the likes
351	Industrial chemical products	351	Manufacture of industrial chemical products
352	Other chemical products	352	Manufacture of other chemical products
353	Petroleum refineries	N/A	
354	Petroleum & coal products	3540	Oil & coal products
355	Rubber products manufacturing	355	Manufacture of rubber products
356	Plastic products manufacturing	3560	Other non-classified plastic products
361	Ceramics, tiles and other clays	3610	Potteries and ceramic products
362	Glass products manufacturing	3620	Glass and glass products
369	Non-metallic mineral products	3691-3696	Manufacture of non-metallic mineral products
		3699	Other non-metallic mineral products
371	Iron & steel industries	3710	Iron and steel industries
372	Non-ferrous metal products	372	Basic metal industries
381	Metal products	381	Manufacture of metal products except machinery & equipment
382	Non-electrical machinery	382	Manufacture of non-electrical machinery
383	Electrical machinery	383	Manufacture of electrical machinery
384	Transport equipment	384	Manufacture of transport machinery / equipment
385	Professional, scientific, measuring, controlling and optic equipment	385	Manufacture of science, measuring, controlling and optic equipment
390	Other manufacturing	390	Other manufacturing industries

Table I.2.1c Projected Growth Rate of Industrial Production by 28 Sub-Sectors of Manufacturing Industry

CIIU (ISIC) Code	Sub-sector	Growth rate during 1994-2010 (%)	CIIU (ISIC) Code	Sub-sector	Growth rate during 1994-2010 (%)
311-312	Food Manufacturing	46.7	354	Petroleum & Coal Products	4.2
313	Beverage Industries	77.1	355	Rubber Products Manufacturing	94.8
314	Tobacco Industries	50.6	356	Plastic Products Manufacturing	41.3
321	Textile Industries	61.3	361	Ceramics, Tiles and Other Clays	123.7
322	Clothing Manufacturing	69.8	362	Glass Products Manufacturing	100.9
323	Leather Industries	10.1	369	Non-Metallic Mineral Products	69.9
324	Leather Footwear manufacturing	58.9	371	Iron & Steel Industries	57.4
331	Wood & Cork Industries	-14.1	372	Non-Ferrous Metal Products	27.4
332	Wooden Furniture & Fixture	115.7	381	Metal Products Manufacturing	77.3
341	Pulp & Paper Manufacturing	58.5	382	Non-Electrical Machinery	81.5
342	Printing and Publishing	122.8	383	Electrical Machinery	121.4
351	Industrial Chemical Products	61.9	384	Transport Equipment	49.5
352	Other Chemical Products	68.0	385	Professional, Scientific, Optics	106.2
353	Petroleum Refineries	74.3	390	Other Manufacturing Industries	-38.3

Step 2: Assumption on productivity increase in manufacturing industry

Since the unemployment rate reached 4% in 1995 and it is considered that the labor market is almost saturated, the imminent production growth is assumed to be mainly influenced by productivity increase ; i.e. the increase of employees is to be less than that of production, contrary to the period between 1984 and 1992. Therefore, in order to forecast the number of employees, the labor productivity factor needs to be estimated. As for the labor productivity factor, because it can not be extrapolated from past labor-intensive production trends in Chile, the Study adopted to assume it by estimating the elasticity between the increase rate of production and number of employees by each 28 sub-sector of manufacturing industry for the period of high economic growth in Japan during 1970-1985. Table I.1.2d shows the estimated elasticity for 28 sub-sectors.

Table I.2.1d Elasticity between the increase rate of production and number of employees in Japan during 1970-1985

CIIU (ISIC) Code	Sub-sector	Elasticity	CIIU (ISIC) Code	Sub-sector	Elasticity
311-312	Food Manufacturing	0.68	354	Petroleum & Coal Products	0.64
313	Beverage Industries	0.42	355	Rubber Products Manufacturing	0.52
314	Tobacco Industries	0.42	356	Plastic Products Manufacturing	0.18
321	Textile Industries	0.49	361	Ceramics, Tiles and Other Clays	0.37
322	Clothing Manufacturing	0.64	362	Glass Products Manufacturing	0.33
323	Leather Industries	0.91	369	Non-Metallic Mineral Products	0.38
324	Leather Footwear manufacturing	0.81	371	Iron & Steel Industries	0.33
331	Wood & Cork Industries	0.60	372	Non-Ferrous Metal Products	0.36
332	Wooden Furniture & Fixture	0.70	381	Metal Products Manufacturing	0.35
341	Pulp & Paper Manufacturing	0.36	382	Non-Electrical Machinery	0.45
342	Printing and Publishing	0.78	383	Electrical Machinery	0.27
351	Industrial Chemical Products	0.54	384	Transport Equipment	0.31
352	Other Chemical Products	0.30	385	Professional, Scientific, Optics	0.28
353	Petroleum Refineries	0.90	390	Other Manufacturing Industries	0.35

Step 3: Forecast of the number of employees

Based on the forecasted increase rate of production and labor productivity factor (elasticity), the future number of employees is given by the following equation:

FE = (PIR *LPF)* NE

FE : Future number of employees in 2010

PIR : Production increase rate during 1994-2010

LPF : Labor Productivity factor (elasticity)

NE : Number of employees in 1994

bd. Growth of the Number of Employees in 3 Additional Industries

bda. Gasoline filling stations (6253) and laundries/dry cleaners (9520)

Since production indices could not be obtained for the above two sectors, the Study forecasted the number of employees by directly extrapolating the growth trend of number of employees during 1985-1992.

bdb. Electricity supply industry (4101)

There is only one coal-fired power plant which is mainly used for peak demand in MR. Because electricity demand in MR is mainly covered by hydropower plants that are located outside MR and it is estimated that additional power demand in the future will also be covered by the plants outside MR, the Study assumed that there will be no additional development of power plant in MR up to 2010. Based on this assumption, the number of employee in electricity supply industry is determined not to change up to 2010.

The result of the forecast of number of employees for 33 sub -sectors of manufacturing industry and 3 additional industries is shown in Figure I.2.1a, 1b, 1c and 1d and in Table I.2.1e.

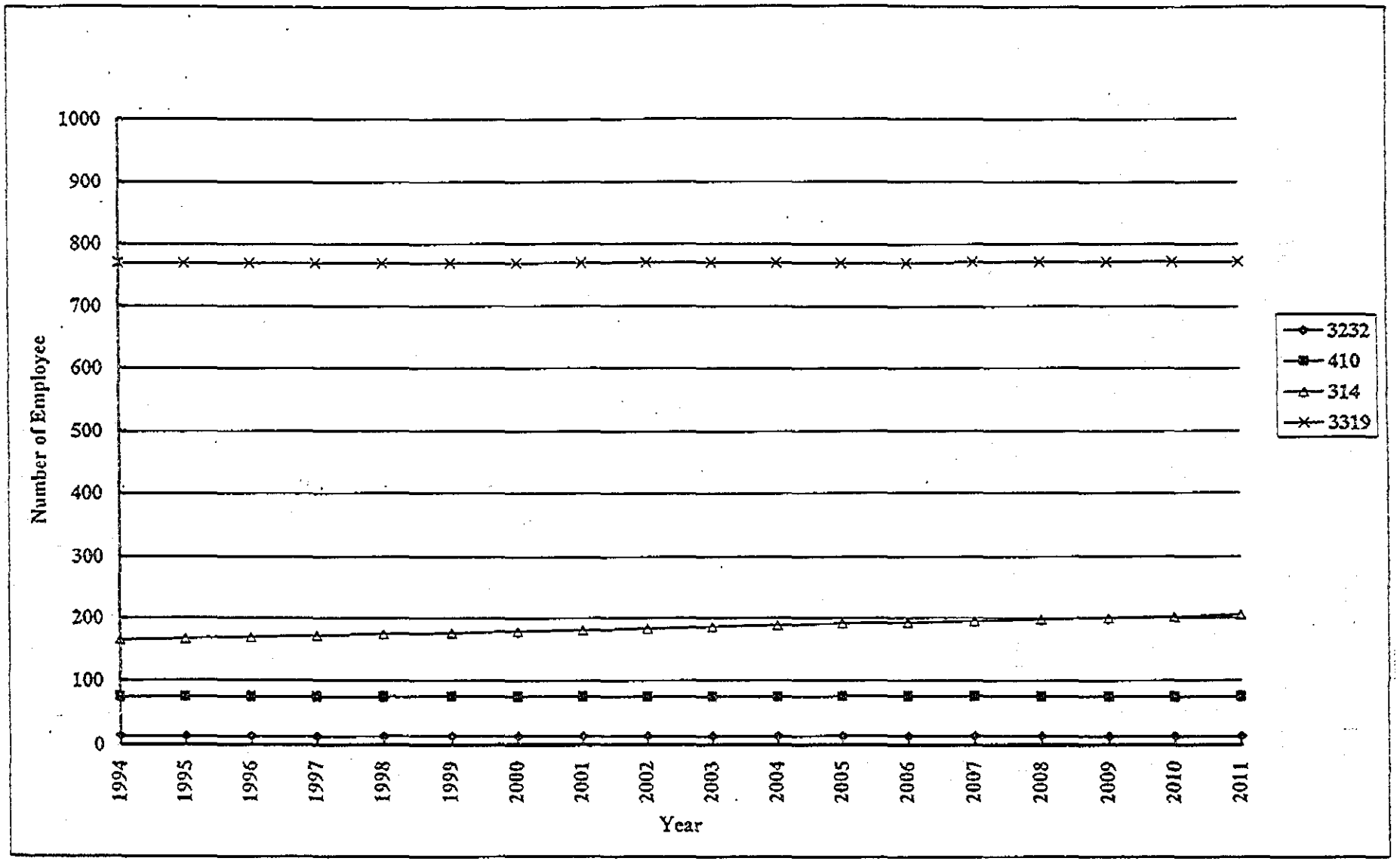

Figure I.2.1a Forecast of the Number of Employees by Sub-Sector of Industry (0 to 1000)

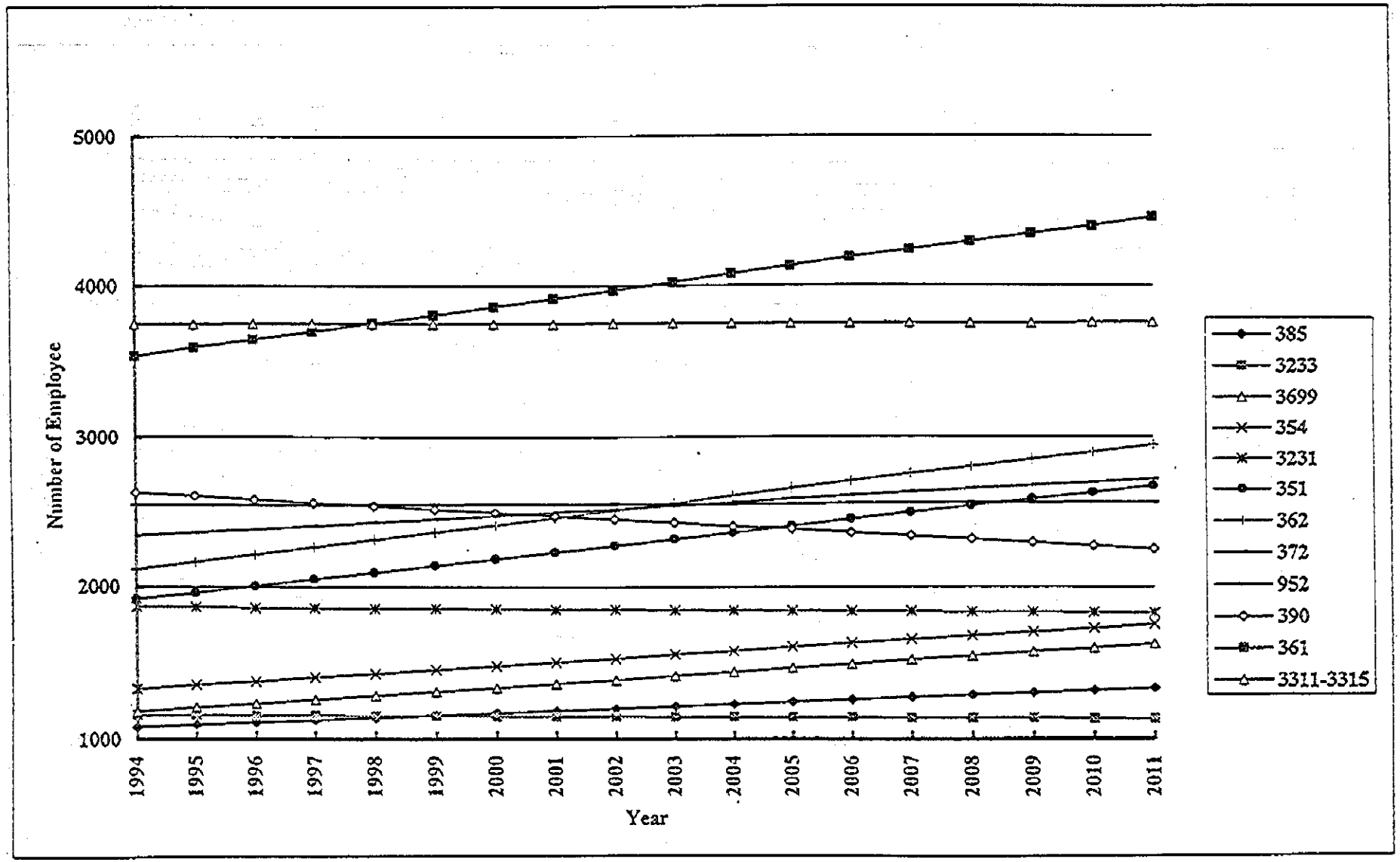

Figure I.2.1b Forecast of the Number of Employees by Sub-Sector of Industry (1000 to 5000)

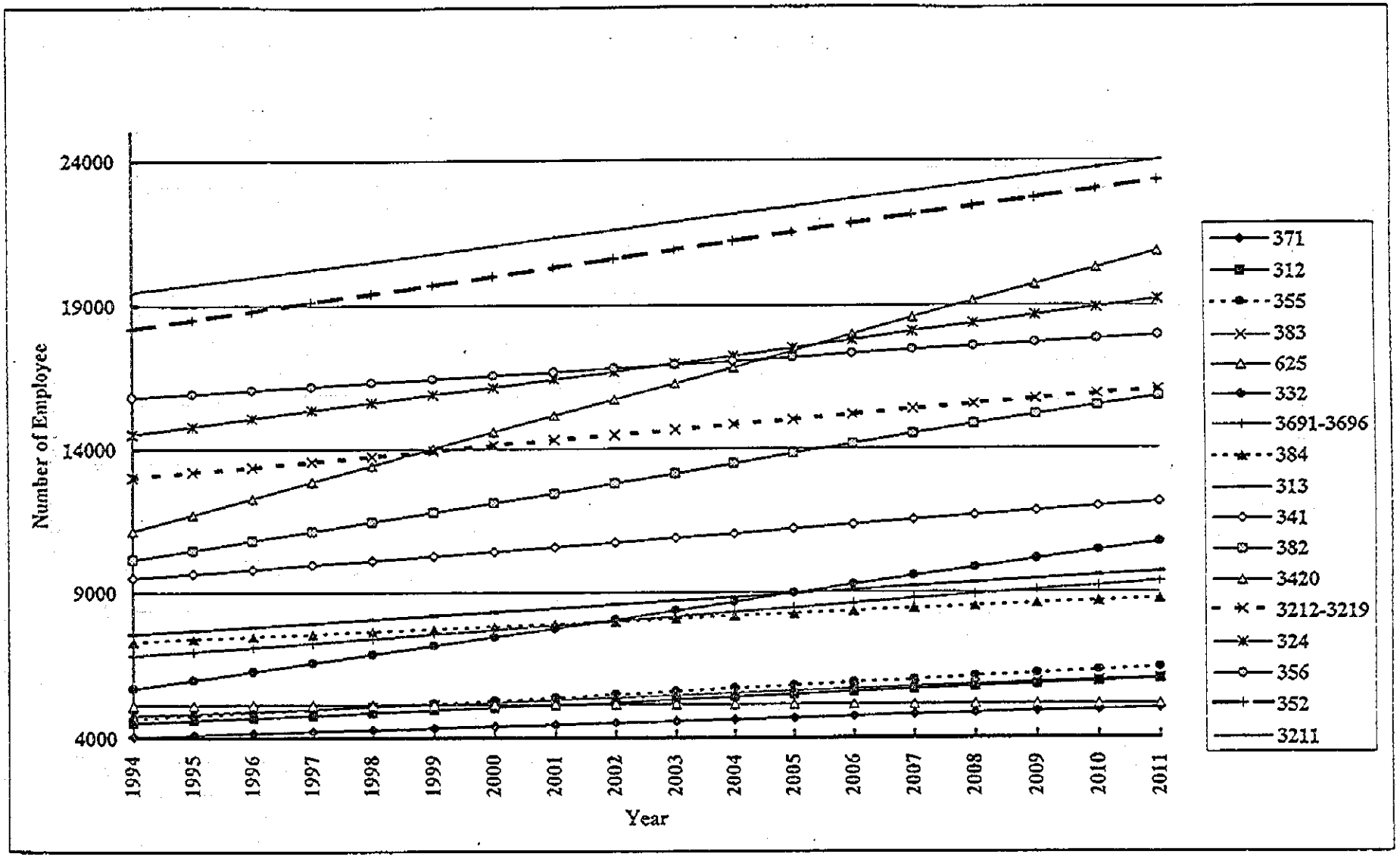

Figure I.2.1c Forecast of the Number of Employees by Sub-Sector of Industry (15000 to 25000)

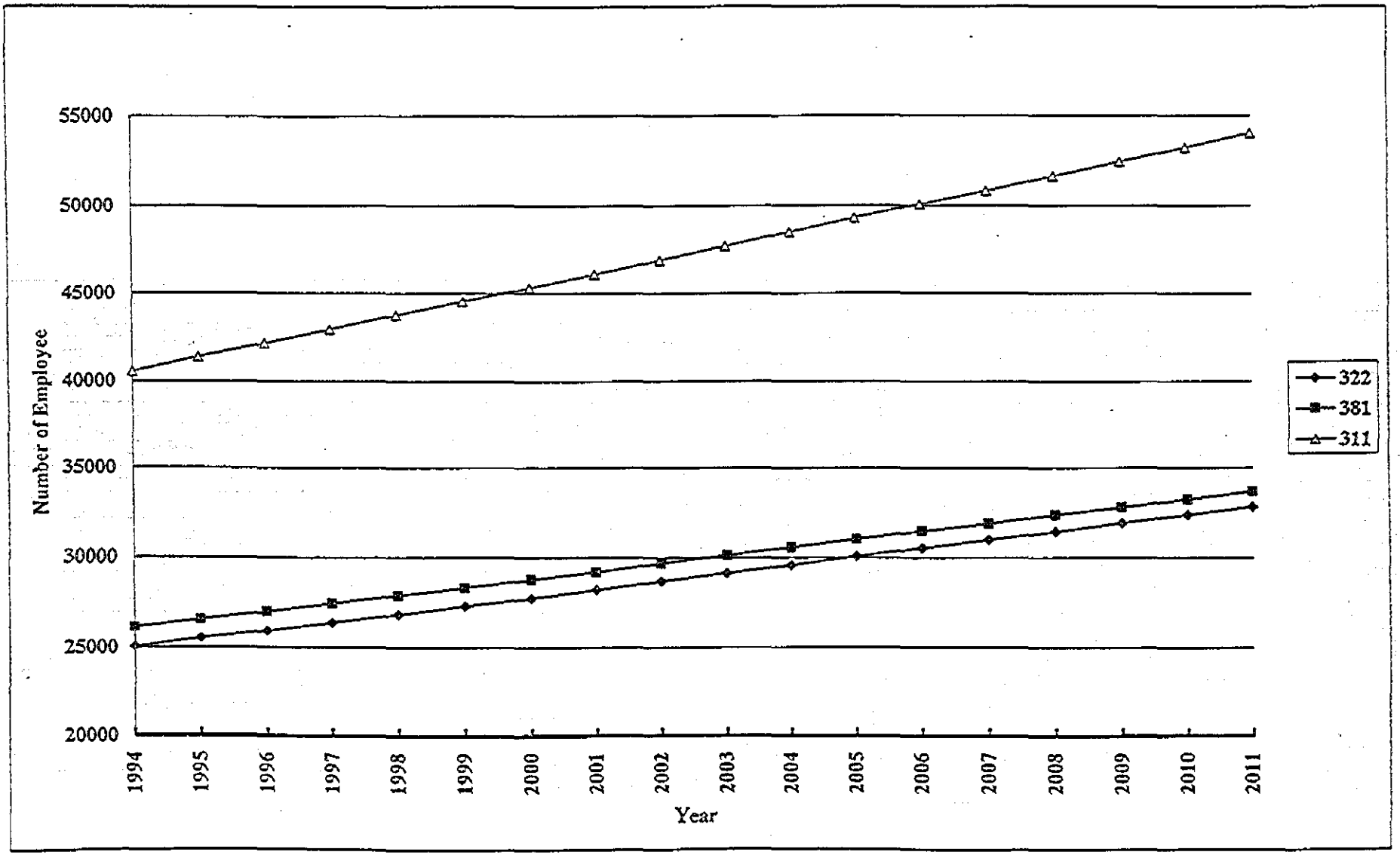

Figure I.2.1d Forecast of the Number of Employees by Sub-Sector of Industry (25000 to 55000)

Table I.2.1e Forecast of the Number of Employees by Sub-Sector of Industry

Potential	CIIU Code		Industrial Category	Year																		
				1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Highly Potential Industries	351		Manufacture of industrial chemical products	1,920	1,962	2,006	2,051	2,093	2,137	2,180	2,226	2,270	2,313	2,356	2,400	2,444	2,488	2,534	2,577	2,620	2,664
	352		Manufacture of other chemical products	18,205	18,512	18,804	19,115	19,405	19,714	20,005	20,315	20,606	20,916	21,207	21,516	21,807	22,117	22,409	22,700	23,009	23,300
	354	3540	Oil and coal products	1,335	1,360	1,384	1,409	1,433	1,459	1,484	1,509	1,533	1,559	1,583	1,608	1,632	1,658	1,683	1,708	1,732	1,758
	356	3560	Other non-classified plastic products	15,805	15,931	16,057	16,184	16,326	16,453	16,579	16,705	16,832	16,958	17,085	17,211	17,353	17,480	17,606	17,733	17,859	17,986
	371	3710	Iron and steel industries	4,050	4,106	4,163	4,220	4,276	4,333	4,390	4,446	4,503	4,556	4,617	4,669	4,726	4,787	4,839	4,896	4,953	5,009
	372		Basic metal industries	2,335	2,355	2,377	2,399	2,422	2,446	2,466	2,491	2,511	2,534	2,555	2,579	2,600	2,623	2,647	2,668	2,690	2,712
	381		Manufacture of metal products except machinery & equipment	26,160	26,602	27,045	27,492	27,935	28,354	28,826	29,245	29,688	30,133	30,578	31,023	31,468	31,885	32,358	32,776	33,220	33,665
Potential Industries	3211	3211	Textile processing and materials manufacturing	19,445	19,717	19,970	20,242	20,514	20,786	21,058	21,331	21,583	21,856	22,128	22,381	22,653	22,925	23,197	23,470	23,742	23,995
	3231	3231	Leather tanning and finishing	1,870	1,868	1,864	1,862	1,860	1,860	1,856	1,855	1,855	1,851	1,847	1,845	1,843	1,841	1,840	1,838	1,836	1,832
	3232	3232	Fur dressing, dyeing and other fur and skin articles	15	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14
	3319	3319	Other non-classified wooden products	770	770	770	770	770	770	770	770	771	771	771	771	771	772	772	772	773	773
	341		Paper, printing and publishing industries	9,495	9,655	9,807	9,968	10,120	10,272	10,434	10,595	10,747	10,908	11,059	11,221	11,374	11,535	11,686	11,849	12,001	12,161
	3420	3420	Printing, photoengraving, publishing and the likes	11,165	11,734	12,303	12,884	13,442	14,023	14,592	15,162	15,731	16,300	16,870	17,439	18,009	18,589	19,147	19,728	20,286	20,867
	355		Manufacture of rubber products	4,650	4,751	4,853	4,961	5,058	5,165	5,267	5,370	5,472	5,575	5,681	5,783	5,886	5,988	6,091	6,193	6,360	6,397
	362	3620	Glass and glass products	2,115	2,163	2,212	2,260	2,309	2,358	2,406	2,455	2,504	2,552	2,601	2,650	2,700	2,749	2,798	2,846	2,895	2,944
	3699	3699	Other non-metallic mineral products	1,185	1,211	1,237	1,263	1,289	1,315	1,341	1,367	1,393	1,419	1,445	1,471	1,497	1,525	1,551	1,577	1,603	1,629
	382		Manufacture of machinery except electrical	10,145	10,477	10,812	11,146	11,481	11,817	12,151	12,486	12,832	13,156	13,500	13,836	14,159	14,506	14,840	15,175	15,509	15,844
	383		Manufacture of electrical machinery	4,755	4,829	4,906	4,980	5,058	5,133	5,209	5,285	5,366	5,438	5,514	5,594	5,672	5,746	5,823	5,899	5,975	6,051
	384		Manufacture of transport equipment	7,315	7,402	7,489	7,568	7,655	7,744	7,832	7,911	7,998	8,090	8,177	8,264	8,343	8,432	8,519	8,607	8,686	8,773
	385		Manufacture of science, measuring, controlling equipment(inc. lens)	1,080	1,094	1,111	1,126	1,140	1,155	1,171	1,188	1,202	1,217	1,234	1,248	1,263	1,279	1,294	1,310	1,325	1,340
	390		Other manufacturing industries	2,626	2,598	2,573	2,552	2,531	2,508	2,486	2,466	2,445	2,422	2,400	2,380	2,356	2,334	2,312	2,290	2,270	2,249
	625	6253	Gasoline filling station	5,115	5,115	5,120	5,120	5,125	5,125	5,130	5,130	5,135	5,135	5,140	5,140	5,145	5,145	5,150	5,150	5,155	5,155
	952	9520	Laundries and dry cleaners	2,535	2,535	2,537	2,537	2,540	2,540	2,542	2,542	2,545	2,545	2,547	2,547	2,550	2,550	2,552	2,552	2,555	2,555
Less Potential Industries	311		Food manufacturing	40,550	41,357	42,128	42,898	43,709	44,519	45,332	46,102	46,872	47,643	48,492	49,305	50,075	50,846	51,657	52,467	53,240	54,049
	312		Other food manufacturing	4,505	4,595	4,680	4,765	4,855	4,945	5,035	5,121	5,206	5,297	5,387	5,477	5,563	5,648	5,738	5,828	5,914	6,005
	313		Beverage industries	7,570	7,696	7,817	7,947	8,067	8,196	8,325	8,447	8,575	8,703	8,825	8,954	9,074	9,203	9,325	9,452	9,574	9,703
	314	3140	Cigarettes, cigars and tobacco	165	167	169	172	174	176	179	181	183	186	188	191	193	195	198	200	202	205
	3212-3219		Textile industries	13,040	13,223	13,390	13,571	13,754	13,937	14,120	14,303	14,471	14,655	14,837	15,007	15,188	15,372	15,554	15,737	15,919	16,088
	322	3220	Garment industries	25,050	25,525	25,951	26,427	26,878	27,354	27,780	28,256	28,707	29,158	29,609	30,085	30,535	30,986	31,437	31,913	32,364	32,815
	3233	3233	Leather products (exc.footwears)	1,160	1,158	1,156	1,155	1,154	1,154	1,151	1,150	1,149	1,148	1,146	1,144	1,143	1,142	1,141	1,140	1,139	1,136
	324	3240	Leather footwears	14,518	14,785	15,061	15,351	15,612	15,902	16,164	16,454	16,715	17,005	17,266	17,557	17,818	18,108	18,369	18,659	18,935	19,211
	3311-3315		Wood and cork industry	3,745	3,745	3,748	3,748	3,748	3,748	3,748	3,748	3,752	3,752	3,752	3,752	3,752	3,755	3,755	3,755	3,759	3,759
	332	3320	Furniture, fixture and the likes	5,675	5,975	6,270	6,571	6,872	7,167	7,468	7,763	8,064	8,359	8,660	8,955	9,255	9,556	9,851	10,152	10,447	10,748
	361	3610	Potteries and ceramic products	3,535	3,591	3,644	3,697	3,750	3,807	3,860	3,916	3,969	4,022	4,079	4,132	4,188	4,242	4,295	4,351	4,404	4,461
	3691-3696		Manufacture of non-metallic mineral products	6,815	6,962	7,111	7,262	7,411	7,562	7,712	7,862	8,012	8,162	8,312	8,461	8,612	8,767	8,919	9,068	9,218	9,368
	410	4101	Generation, transmission and distribution of electric energy	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75
			Total	280,480	285,613	290,614	295,760	300,855	306,023	311,138	316,242	321,284	326,423	331,537	336,685	341,736	346,863	351,975	357,125	362,198	367,301