JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

FEDERATIVE REPUBLIC OF BRAZIL

THE STUDY FOR THE DEVELOPMENT OF AN INTEGRATED SOLUTION RELATED TO INDUSTRIAL WASTE MANAGEMENT IN THE INDUSTRIAL POLE OF MANAUS

FINAL REPORT

SUPPORTING REPORT

August 2010

KOKUSAI KOGYO CO., LTD.

EX CORPORATION

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The exchange rate used in this report is as follows.
US$ 1.0 ＝ 89.25 Yen, 1 BRL ＝ 48.784 Yen
(March 2010)

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List of Abbreviations

Abbreviation	English	Portuguese
ABC	Brazilian Cooperation Agency	Agência Brasileira de Cooperação
ABNT	Brazilian Association for Technical Specs	Associação Brasileira de Normas Técnicas
ANA	National Water Agency	Agência Nacional de Aguas
ANEEL	Brazilian Electricity Regulatory Agency	Agência Nacional de Energia Elétrica
ANVISA	National Health Surveillance Agency	Agência Nacional de Vigilância Sanitária
ARSAM	Amazonas Regulatory Agency of Public Services	Agência Reguladora dos Serviços Públicos Concedidos do Estado do Amazonas
ATRINI	Non-hazardous & non-inert industrial waste temporary disposal site	Aterro Temporário de Resíduos Industriais Não-Inertes
CAPDA	Committee for Research and Development Activities in Amazonas	Comité das Atividades de Pesquisa e Desenvolvimento na Amazonia
CAS	Administration Council of SUFRAMA	Conseho Administração da SUFRAMA
CCINB-AM	Japanese-Brazilian Chamber of Commerce and Industry of Amazonas	Câmara de Comércio e Indústria Nipo-Brasileira do Amazonas
CD	Capacity Development	Desenvolvimento de Capacidade
CIEAM	Industries Center of Amazonas State	Centro da Industria do Estado do Amazonas
CNEN	National Commission of Nuclear Energy	Comissão Nacional de Energia Nuclear
CNI	National Confederation of Industies	Confederação Nacional da Indústria
COGEC	General Coordinator of Economic and Business Studies	Coordenação Geral de Estudos Economicos e Empresariais
CONAMA	National Council for Environment	Conselho Nacional de Meio Ambiente
COSAMA	Amazonas Sanitation Company	Companhia de Saneamento do Amazonas
C/P	Counterpart	Contraparte
DF/R	Draft Final Report	Minuta do Relatório Final
DG/L	Draft Guidelines	Esboço das Diretrizes
DI	Industrial District	Distrito Industrial
EIA	Environmental Impact Assessment	Avaliação de Impacto Ambiental
ERENOR	Representative Office of the Ministry of External Relations in the Northern Region	Escritório de Representação do Ministério das Relações Exteriores na Região Norte
FIEAM	Industries Federation of Amazonas State	Federação das Indústrias do Estado do Amazonas
F/R	Final Report	Relatório Final
FUCAPI	The Technological Analysis, Research, Innovation Center Foundation	Fundacão do Centro de Analise, Pesquisa e Inovacão
GEA	Government of Amazonas State	Governo do Estado do Amazonas
GIS	Geographical Information System	Sistema de Informação Geográfica
GOB	Federative Republic of Brazil	República Federativa do Brasil
GOJ	Government of Japan	Governo do Japão

IBAMA	Brazilian Institute for the environment and Renewable Natural Resources	Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis
IBGE	Brazilian Institute of Geography and Statistics	Instituto Brasileiro de Geografia e Estatística
IBRD	International Bank for Reconstruction and Development	Banco Internacional para Reconstrução e Desenvolvimento (BIRD)
IC/R	Inception Report	Relatório Introdutório
IDB	Inter-American Development Bank	Banco Interamericano de Desenvolvimento (BID)
IEE	Initial Environmental Evaluation	Avaliação Ambiental Inicial
INEA	State Institute of Envirnment	Instituto Estadual do Ambiente
INMET	National Institute of Meteorology	Instituto Nacional de Meteorologia
INPA	National Amazon Research Institute	Instituto Nacional de Pesquisas da Amazônia
INPAE	National Institute for Environmental Preservation	Instituto Nacional de Preservação Ambiental
IPAAM	Institute of Amazonas Environmental Protection	Instituto de Proteção Ambiental do Amazonas
IT/R	Interim Report	Relatório Intermediário
JICA	Japan International Cooperation Agency	Agência de Cooperação Internacional do Japão
MCIDADES	Ministry of the Cities	Ministério das Cidades
MDIC	Ministry of Development, Industry and Foreign Trade	Ministério do Desenvolvimento, Industria e Comercio Exterior
MFZ	Manaus Free Zone	Zona Franca de Manaus
M/M	Minutes of Meeting	Minutas da Reunião
MMA	Ministry of Environment	Ministério do Meio Ambiente
MME	Ministry of Mine and Energy	Ministério de Minas e Energia
M/P	Master Plan	Plano Diretor
MS	Ministry of Health	Ministério de Saúde
NBR	Technical Rules	Normas Brasiliras
NGO	Non-Governmental Organization	Organização Não Governamental
OJT	On the Job Training	Treinamento em Trabalho
PIM	Industrial Pole of Manaus	Polo Industrial de Manaus
PMSS	Program for the Modernization of Sanitation Sector	Programa da Modernizacao do Setor de Saneamento
PROSAMIM	Socio- Environmental Program of Manaus Igarapes River Bank	Programa Social e Ambiental dos Igarapes de Manaus
RDC	CONAMA Resolution	Resolução do CONAMA
SEA	Strategic Environmental Assessment	Avaliação Ambiental Estratégica
SEDEMA	Municipal Secretariat of Development and Environment	Secretaria Municipal de Desenvolvimento e Meio Ambiente
SEINF	State Secretariat of Infrastructure	Secretaria de Estado de Infra-Estrutura
SEMMA	Municipal Secretariat of the Environment	Secretaria Municipal de Meio Ambiente
SEMULSP	Municipal Secretariat of Urban Cleaning and Public Services	Secretaria Municipal de Limpeza e Serviços Públicos
St/C	Steering Committee	Comité de Direcção
SUFRAMA	Superintendency of the Manaus Free Trade Zone	Superintendência da Zona Franca de Manaus
SUDAM	Superintendency for the Development of Amazon Region	Superintencia do Desenvolvimento da Amazonia
S/W	Scope of Works	Escopo de Trabalho

TOR	Terms of Reference	Termos de Referência
TCSC	Technical Consultive Sub Committee	Subcomitê Consultivo Técnico
UGPI	Unit of Management of the Igarapes Program	Programa Social e Ambiental dos Igarapés
WB	The World Bank	Banco Mundial
WI_DB	Waste Inventory Database	Banco de Dados dos Inventários de Resíduos
WM	Waste Manifest	manifesto de resíduos
WSC_DB	Waste Service Company Database	Banco de Dados das Empresas de Serviço de Resíduos
W/S	Workshop	Workshop

Classification of Industries (Factories) and Industrial Wastes used in the Study

The following is the classification of the target industries (in the study, only factories) and industrial waste categorization used in the study, which served as the premise to conduct the study to improve industrial waste management.

1. Classification of Industries (SUFRAMA's factories)
2. Industrial Waste Categories
   - 2-1 General Industrial Waste
   - 2-1(a) Non-hazardous General Industrial Waste Categories used in the study
   - 2-1(b) Comparison of Study Code and CONAMA Code for Non-Hazardous General Industrial Wastes
   - 2-1(c) Hazardous General Industrial Waste Categories used in the Study
   - 2-1(d) Comparison of Study Code and CONAMA Code for Hazardous General Industrial Waste
   - 2-2 Health-care Waste
   - 2-3 Construction Waste
   - 2-4 Radioactive Waste

1. Classification of Industries (SUFRAMA's Factories)

Factory Code	Sector	
	Main Category	Sub-category
F01	Beverages	
F02	Leather	
F03	Printing	
F04	Electrical	
	4-1	Parts
	4-2	Products (except copy machines)
	4-3	Copy machines
F05	Lumber	
F06	Machinery	
	6-1	Clock/watch
	6-2	Other machinery industry
F07	Metal	
F08	Nonferrous	
F09	Furniture	
F10	Paper	
F11	Rubber	
F12	Food	
F13	Chemical	
F14	Plastic	
F15	Textiles	
F16	Clothing	
F17	Transportation	
	17-1	Two-wheelers
	17-2	Ships
	17-3	Other transportation
F18	Construction	
F19	Other	
	19-1	Optics
	19-2	Toys
	19-3	Small instruments
	19-4	Writing utensils, razor blades
	19-5	Other

Source: CGPRI & CGMER/COCAD SUFRAMA, up to 8/2008 "Industries (companies) established and producing in western Amazon with full projects approved by SUFRAMA "

2. Industrial Waste Categories

The study targeted industrial waste that factories must report upon making a waste inventory as required by CONAMA Resolution 313. Those wastes can be classified into 4 main categories, as shown below. Due to differences in the generation source and characteristics of each of these wastes, they were each surveyed individually in this study.

- General Industrial Waste: waste generated from factories other than 2, 3, and 4 below.
- Health-Care Waste: waste generated from medical facilities attached to factories.
- Construction Waste: waste generated from renovation and expansion construction at factories
- Radioactive Waste: waste generated from radioactive material used by the factory.

2-1 General Industrial Waste

In this Study, the general industrial waste generated from 187 factories of PIM was surveyed. Given the limited period of time for the study, a survey to gain an understanding of the overall management of general industrial waste in PIM was carried out using a simplified version of the complex industrial waste categories required by CONAMA Resolution 313. Namely, the study looked at 13 types of non-hazardous general industrial waste, and 16 types of hazardous industrial waste, and then clarified the management of each in terms of waste generation management (by creating "waste stream" diagrams and such). However, a user manual was put together for completing the waste inventory, which the factories are legally required to submit, according to the categories required by CONAMA Resolution 313. Tables comparing the JICA Study Team Code and the CONAMA Code are provided in order to clarify the factory survey results from the study and to facilitate cross-checks of the results of waste inventories made according to the manual after they are compiled and analyzed.

2-1(a). Non-Hazardous General Industrial Waste Categories used in the Study

Type of Non-Hazardous, Non-Inert Industrial Waste (Non-HGIW)	Non-HGIW Code
Kitchen waste (include waste from animal such as bone, skin, hair)	NH01
Wood	NH02
Paper	NH03
Plastic or polymers and resins	NH04
Textile and fiber	NH05
Animal oil, Vegetable oil	NH06
Rubber and Leather	NH07
Ash/dust from coal-fired power plants, etc.	NH08
Metals and metal alloys such as aluminum, copper, bronze	NH09
Ceramic & Glasses	NH10
Stone, sand or material that have composition of soil such as tile, brick, gypsum, cement	NH11
Mixed waste (This code shall be applied in case wastes are discharged without separation.)	NH12
Others	NH13

Source: JICA Study Team

2-1(b). Comparison of Study Code and CONAMA Code for Non-Hazardous General Industrial Waste

Study Code	CONAMA Code	Description of Non-HGIW
NH01	A001	Residues of restaurant (food remaining portions)
	A024	Bagasse of sugar cane
	A499	Carnaça
	A599	Residues organic of process (tallow, serum, bones, blood, others of the nourishing industry, etc)
	A699	Rind of rice
	A999	Residues of fruits (bagasse, must, rind, etc.)
NH02	A009	Residues wooden I contend not toxic substances
NH03	A006	Residues of paper and cardboard
NH04	A007	Polymerized plastic residues of process
	A107	Bombonas of plastic not contaminated
	A108	Etil acetate residues vinila (EVA)
	A207	Plastic films and small packings
	A208	Polyurethane residues (PU)
NH05	A010	Residues of têxteis materials
NH06	---*1	---
NH07	A008	Rubber residues
	A299	Caleadas shavings of skins
	A399	Atanado leather shavings, remnants
NH08	A111	Leached ashes of boiler
NH09	A004	Ferrous metal scrap iron
	A005	Not ferrous metal scrap iron (brass, etc.)
	A011	Not metallic mineral residues
	A012	Slag of aluminum casting
	A013	Slag of iron production and steel
	A014	Slag of brass casting
	A015	Slag of zinc casting
	A016	Sand of casting
	A104	Metallic packings (empty cans)
	A105	Not ferrous metal packings (empty cans)
	A204	Tambores metallic
NH10	A017	Refractory ceramic residues and material
	A025	Fibre glass
	A117	Glass residues
	A799	Atanado leather Serragem, bran and dust
NH11	---*1	---
NH12	A002	Generated residues outside of the industrial process (office, packings, etc.)
NH13	A003	Residues of varrição of plant
	A018	Solid residues not toxic metal composites
	A019	Solid residues of stations of treatment of effluent I contend material biological not toxic
	A021	Solid residues of stations of treatment of effluent I contend not toxic substances
	A022	Pastosos residues of stations of treatment of effluent I contend not toxic substances
	A023	Pastosos residues I contend limy
	A026	Slag of jateamento I contend not toxic substances
	A027	Used catalysers I contend not toxic substances
	A028	Residues of system of control of not toxic gaseous emission I contend substance (sleeve precipitadores, filters, among others) Products are of the specification or are of the validity stated period contend not dangerous substances
	A029	Other not dangerous residues
	A099	Salty shavings
	A199	Foam
	A308	Silt of the caleiro
	A899	Generated residues outside of the industrial process (office, packings, etc.)

Source: JICA Study Team

*1 : There is no Study code where the corresponding CONAMA code is indicated.

2-1(c): Hazardous General Industrial Waste Categories used in the Study

Type of Hazardous General Industrial Waste (HGIW)	HGIW Code	Example of Hazardous General Industrial Waste (HGIW)
Inorganic acid	HW01	Sulfuric acid (H_2SO_4), Hydrochloric acid (HCl), Nitric acid (HNO_3), Phosphoric acid (H_3PO_4), Other inorganic acids
Organic acid	HW02	Acetic acid (CH_3COOH), Formic acid (HCOOH), Other organic acids
Alkalis	HW03	Caustic soda (NaOH), Ammonia (NH_3), Sodium carbonate (Na_2CO_3), Other alkaline materials
Toxic Compounds	HW04	including Hg, As, Cd, Pb, Cr, CN
Inorganic Compounds	HW05	Plating wastes, Picking waste, Sulphides, etc.
Other Inorganic	HW06	Asbestos, Slug, etc.
Organic Compounds	HW07	Reactive chemical wastes (Oxidizing agents, Reducing agents, etc), Solvents etc.
Polymeric Materials	HW08	Epoxy resin, Chelate resin, Polyurethan resin, Latex rubber etc.
Fuel, Oil and Grease	HW09	Fats, Waxes, Kerosene, Lubricating oil, Engine oil, Grease etc
Fine Chemicals and Biocides	HW10	Pesticides, Medicine, Cosmetic, Drugs, etc.
Treatment Sludge	HW11	Inorganic sludge, Organic sludge, Septic tank sludge, etc.
Ash from incinerator	HW12	---
Dust and Air pollution control (APC) products	HW13	Soot and dust waste from incineration facilities, treating exhaust gas
Other Hazardous substance (besides HW01-HW13)	HW14	HIWs other than the above
Mixed Waste	HW15	---
Hazardous materials from Non-production process	HW16	Fluorescent tubes, Thermometer (use mercury), Batteries, Pesticides (Household use), etc.

Source: JICA Study Team

2-1(d): Comparison of Study Code and CONAMA Code for Hazardous General Industrial Waste

Study code	CONAMA code	Description of Hazardous General Industrial Waste (HGIW)
HW14	C001 to C009	Listing 10 - dangerous residues for containing volatile components, of which do not apply solubility and/or leaching tests, presenting superior concentrations to the indicated ones in listing 10 of Norm NBR 10004
HW10 HW08 HW09 HW14	D001	Dangerous residues for presenting inflammability
HW01 HW02 HW03	D002	Dangerous residues for presenting corrosively
HW01 HW02 HW03 HW07	D003	Dangerous residues for presenting reactivity
HW10 HW14	D004	Dangerous residues for presenting pathogenicity
HW05 HW06 HW10 HW11	D005 to D029	Listing 7 of Norm NBR 10004: dangerous residues characterized by the leaching test
HW04	K193	Shavings of leather tanned with chromium
HW04	K194	Leather Serragem and dust containing chromium
HW04	K195	Silt of effluent treatment stations for chromium tanning
HW14	F102	Residue of catalysers not specified in Norm NBR 10.004
HW04 HW10	F103	Deriving residue of industrial laboratories (chemical products) not specified in Norm NBR 10.004
HW14	F104	Not specified contaminated empty packings in Norm NBR 10.004
HW07	F105	Solvent contaminated (to specify solvent and the main contaminant)
HW14	D099	Other dangerous residues - to specify
HW04 HW07	F001 F0301	Listing 1 of Norm NBR 10004- admittedly dangerous residues - Classroom 1, of not-specific sources
HW07	F100	Bifenilas Policloradas - PCB`s. Packings contaminated with PCBs also transforming and capacitors
HW07	P001 to P123	Listing 5 of Norm NBR 10004 - dangerous residues for containing toxic substances acutely (remaining portions of packings contaminated with substances of listing 5; contaminated residues of spilling or ground, and products are of specification or products of commercialization forbidden of any constant substance in listing 5 of Norm NBR 10.004
HW04 HW07	K001 to K209	Listing 2 of Norm NBR 10004- admittedly dangerous residues of specific sources
HW07	K053	Remaining portions and spots of inks and pigments
HW07	K078	Residue of cleanness with solvent in the manufacture of inks
HW07 HW11	K081	Silt of ETE of the production of inks
HW10	K203	Residues of illness research laboratories
HW01 HW09	K207	Residue the used oil re-refining (containing acid)
HW14	U001 to U246	Listing 6 of Norm NBR 10004- dangerous residues for containing toxic substances (contaminated residues of spilling or ground; products are of specification or products of commercialization forbidden of any constant substance in listing 6 of Norm NBR 10.004

Source: JICA Study Team

2-2: Health-care Waste

Health-care waste categorization is regulated by the Brazilian Association for Technical Specifications (ABNT) according to ABNT NBR 12808. Moreover, Handling of health-care waste is done according to RDC 306/2004-ANVISA and CONAMA Resolution 358/2005.

In this study, a medical institutions survey was conducted using a questionnaire based on ABNT NBR 12808. After the survey, it was revealed that at present, RDC 306/2004-AVNISA is being used, so the results of the survey were converted accordingly. The following table shows conversion of health-care waste categories of the RDC 306/2004-ANVISA and ABNT NBR 12808.

Conversion of Health-care Waste Categories between RDC 306/2004-ANVISA and ABNT NBR 12808

RDC 306/2004-ANVISA			**ABNT NBR 12808**	
Group		Description	Class, Type	Description
1. Group A	A.1	Biologic	Class A, Type A.1	Biologic
			Class A, Type A.2	Blood and Derivates
	A.2	Animals	Class A, Type A.5	Contaminated animal
	A.3	Body part	Class A, Type A.3	Surgical, anatomopatologic and exudates
	A.4	Patient care etc.	Class A, Type A.6	Patient care
	A.5	Prions	Not applicable	---
2. Group B		Chemical etc.	Class B, Type B.2	Pharmaceutical waste
			Class B, Type B.3	Hazardous chemical waste
3. Group C		Radioactive waste	Class B, Type B.1	Radioactive waste
4. Group D		Common waste	Class C	Common waste
5. Group E		Piercing or Cutting	Class A, Type A.4	Piercing or Cutting

2-3: Construction Waste

Construction Waste Categories in CONAMA Resolution 307

Class	Description
Class A:	The reusable or recyclable waste as aggregates, such as:
	a) from construction, demolition, refitting and repair of pavement and other infrastructure constructions, including land preparation;
	b) from the construction, demolition refitting and repair of edifications: ceramic components (bricks, blocks, tiles, insulation planks, etc.), cement and concrete;
	c) from manufacturing and/or demolition process of concrete pre-modulated pieces (blocks, pipes, gutter, etc.) produced in the construction sites.
Class B	The recyclable waste for other purposes, such as: plastics, paper/carton, metals, glass, wood and others.
Class C	Waste which has no economically feasible technology or applications which may allow it to be recycled/recovered, such as the products arisen from plaster.
Class D	Hazardous waste arisen from construction process, such as paints, solvents, oils and so forth, or those contaminated or harmful to health arisen from demolitions, refitting and repairs of radiology clinics, industrial facilities and others, as well as tiles and other objects and materials containing asbestos or other products harmful to health. *(new text given by Resolution n. 348/04)*.

2-4: Radioactive Waste

Categorization of Radioactive Waste

Class	Type	Level
1. Waste containing beta or gamma emitters	1.1 Liquid Waste	· Low Level Radioactive Waste · Mid Level Radioactive Waste · High Level Radioactive Waste
	1.2 Solid Waste	· Low Level Radioactive Waste · Mid Level Radioactive Waste · High Level Radioactive Waste
	1.3 Gaseous Waste	· Low Level Radioactive Waste · Mid Level Radioactive Waste · High Level Radioactive Waste
2. Waste containing alpha emitters	2.1 Liquid Waste	· Low Level Radioactive Waste · Mid Level Radioactive Waste · High Level Radioactive Waste
	2.2 Solid Waste	· Low Level Radioactive Waste · Mid Level Radioactive Waste · High Level Radioactive Waste

Source: Management of Radioactive Wastes in Radioactive Facilities CNEN-NE-6.05 – December 1985

The generation of the radioactive waste is not informed by the user of radioactive materials in the study area.

1. Profile of the Study Area

1 Profile of the Study Area

1.1 Natural Conditions

1.1.1 Location and Territory

a. Manaus City

The city of Manaus, capital of the State of Amazonas, is located in the confluence of Negro and Solimões rivers, in northern Brazil, 1,932 km from the federal capital, Brasília, within coordinates 2º"57' and 3º10' South latitude and 59º"53' and 60º07' West longitude. It is limited to the North with the Municipality of President Figueiredo and to the South with the municipalities of Careiro and Iranduba. In the East are the municipalities Rio Preto da Eva and Itacoatiara and in West it has boundaries with the Municipality of Novo Airão.

The Manaus Industrial Pole (abbreviated PIM, according to the Portuguese) is concentrated mainly within the city of Manaus, the capital of the State of Amazonas. Manaus (Lat: 3°6' S, Long: 60°1' W) is located at the convergence of the Rio Negro and Rio Solimões rivers in northern Brazil about 1,932 km from the federal capital, Brasília (15º46' S, 47º55' W). The surrounding municipalities are Presidente Figueiredo to the north, Careiro and Iranduba to the south, Rio Preto da Eva and Amatari to the east, and Novo Airão to the west.

b. Manaus Free Zone

Manaus Free Zone corresponds to an area of 10,000 km², including part of the municipality of Manaus, Itacoatiara and Rio Preto da Eva, according to the map in Figure 1-1.

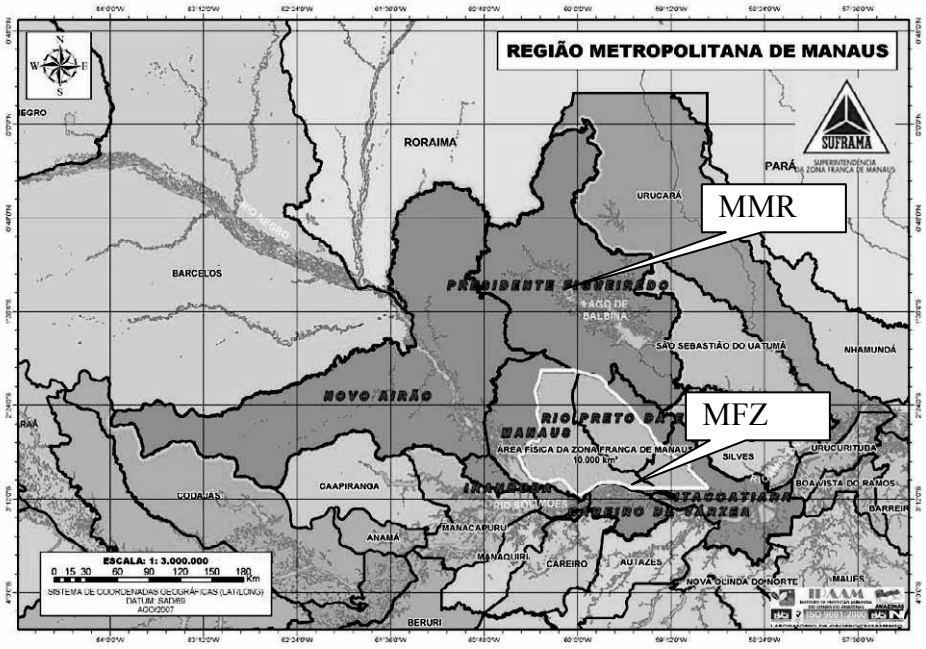


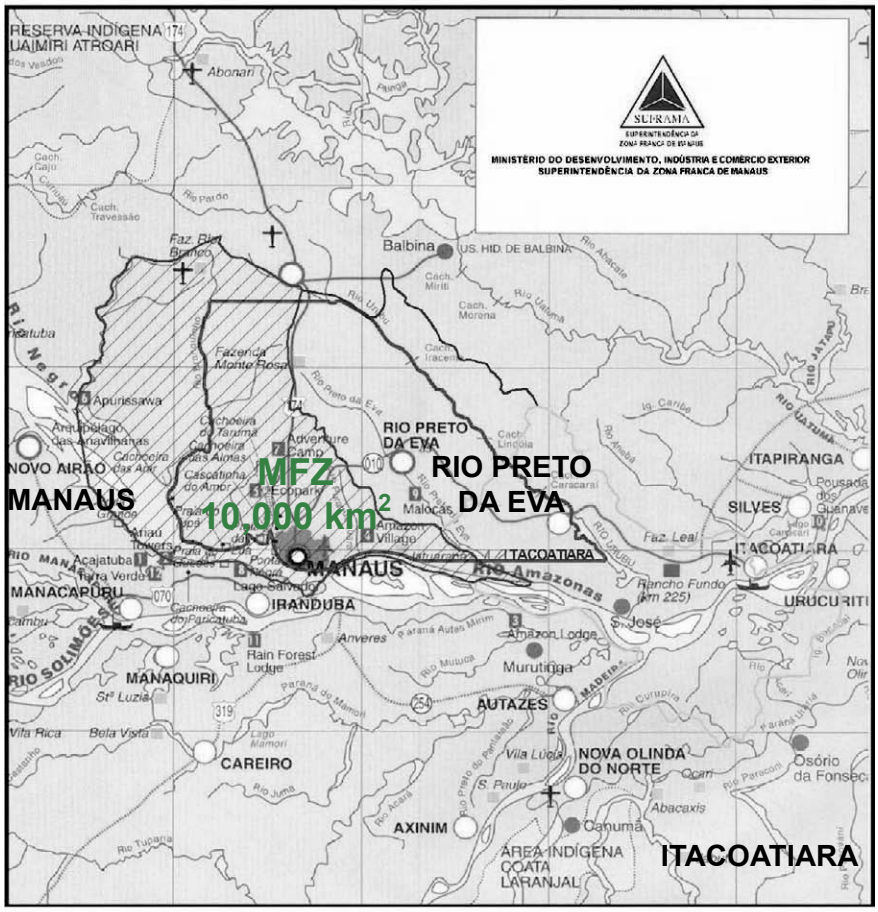
Figure 1-1: Location of Manaus Metropolitan Region (MMR) and MFZ

Table 1-1: Areas of MFZ and Municipalities

Name of Municipality	A. Municipal Area (km^2)	B. Area in MFZ (km^2)	Percentage of MFZ Area (B/A x 100 (%))
Manaus	11,458	4,950	43.2
Itacoatiara	8,600	1,250	14.5
Rio Preto da Eva	5,813	3,800	65.3
MFZ	-	10,000	-

Source: Municipal area (IBGE), MFZ area (SUFRAMA)

The Federal government provides the demarcation of a continuous area with a minimum area of 10,000 km^2, including the city of Manaus and its surroundings, located on the northwest banks of the Negro and Amazon rivers, where the Free Zone was first established.



Area of Manaus Free Zone (MFZ): 10,000 km^2
Area of Manaus Municipality (11,458 km^2) MFZ area: 4,950 km^2
Area of Itacoatiara Municipality (8,600 km^2) MFZ area: 1,250 km^2
Area of Rio Preto da Eva Municipality (5,813 km^2) MFZ area: 3,800 km^2

Figure 1-2: Location of Manaus Free Zone

c. Industrial District

According to the Human Development Atlas of Manaus/2006, the Industrial District corresponds to an area of 74.1km² with a perimeter of 61.9km located in East Manaus, 12.47km away from the city center, with 6,739 homes, 29,928 inhabitants and a demographic density of 404 inhabitants per km².

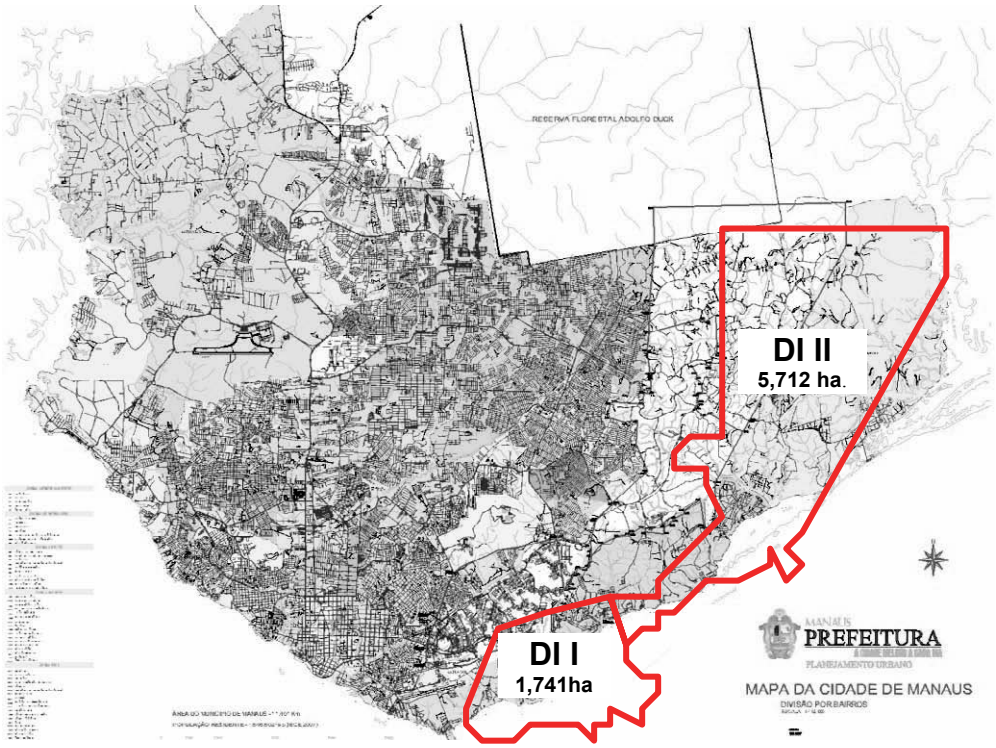


Figure 1-3: Location of Manaus Industrial Districts

1.1.2 Topography and Geology

The municipality of Manaus occupies an area of 11,401.058 km² and the altitude varies between 25 and 100 meters above the sea level. The area is largely characterized by a dense, diversified forest, high temperatures, complex hydrographic basin, a predominance of low lands and an extensive fluvial network. The plains are constituted by recent Anthropozoic era sediments. Some of those sediments continue to be carried by river currents, indicating that the Amazonian plain is still undergoing formation.

Five main types of sedimentary units are recognized throughout the Manacapuru - Iranduba - Manaus and Careiro areas in the State of Amazonas (Reis & Figueiredo 1983). Neogene sediment is represented by three types of Holocene age deposits: (1) alluvium sedimentary deposits that accompany most of the main basins and island networks, with the common presence of lakes which serve as dikes inside the unit (silt-loamy sands, variegated argillites and siltites); (2) the usually flooded alluvial plains (siltites, argillites and unconsolidated sandstones); and (3) the erosion terraces, where a wide drainage with dendrite and sub-dendrite pattern has developed (siltites, argillites and unconsolidated sandstones). Mineral deposits other than Paleo-Neogene age are Pleistocene and correspond to argillites and subordinated siltites and sandstones, where they develop into a plane morphology, and with the development of a drainage pattern that is somewhat rectilinear and with little sinuosity, is qualified to the observation of morph structural alignments. This sedimentary

unit indiscriminately corresponds to Içá and Solimões formations. Holding a great distribution and corresponding to the highest topographical surface, it outcrops sandstones and argillites related to Alter do Chão formation (Superior Cretaceous), whose relief is moderately waved and whose drainage reveals a dendrite sub-rectangular pattern, characteristic of an area in complete dissection. Lateritious profiles with the formation of ballast, kaolinite and deposits of residual sands grow on the unit. The Alter do Chão formation partially recover all the pos-silurian Paleozoic units of the Amazon Basin and its Superior Cretaceous age has been attributed through palynological studies, although some authors refer to a Paleogene age, inadvertently including layers full of Cenozoic fossils occurring in other areas of the Amazon, which more likely belong to more recent units (Caputo et al. 1971).

The following table presents the geological characterization of the area of Manaus and its surroundings as studied by the Regional Superintendence of Manaus of the Geological Service of Brazil (CPRM).

Table 1-2: Geological Characteristics Manaus Metropolitan Region

Age	Sediment Type	Description
Holocene	Silted-loamy sands, variegated argillites and siltites	Sedimentary alluvial deposits which accompany most of the main drainage nets and islands, being common the existence presence of "dikes" like lakes inside the unit.
	Siltites, argillites and unconsolidated sandstones	Alluvial plains usually flooded.
	Siltites, argillites and unconsolidated sandstones	Erosion terraces, where wide drainage with dendrite and sub-dendrite pattern are developed.
Pleistocene	Mineral deposits, argillites and subordinated siltites and sandstones.	The occurrence area develops a plane morphology, (and with the development of a) drainage pattern (something) rectilinear and with little sinuosity, qualified to the observation of morph-structural alignments. This sedimentary unit is indiscriminately corresponded to the Içá and Solimões formations.
Superior Cretaceous	Sandstones and argillites.	Of a great distribution and corresponding to the highest topographical surface, it levels sandstones and argillites related to the Alter do Chão Formation (Superior Cretaceous), whose relief is moderately waved and whose drainage reveals a dendrite sub-rectangular pattern, characteristic of an area in mid dissection. Lateritious profiles with the formation of alluvial deposit, kaolinite and deposits of residual sands grow in the unit.

Source: http://www.cprm.gov.br/publique/cgi/cgilua.exe/sys/start.htm?infoid=211&sid=32
Accessed: 06/16/2009

1.1.3 Climate and Hydrology

a. Climate

The climate of Manaus is considered equatorial (Cfa or Cwa type according to Köppen - humid subtropical climate), with more rains in the winter and an annual average temperature of 28.7°C, oscillating between 14°C and 40°C, having a high relative humidity during the year of around 80% to 90%. June is the hottest month with an average temperature of 34°C and October is the coolest at 22°C.

The relative humidity rate in Manaus is high with an average of 82%, although there are days, mainly in the rainy season, in which the humidity reaches 100%. The monthly average is up to 87% in the rainiest months (March and April) and reaches a minimum of 77% in drier months (August and September). The average annual pluviometric precipitation is 2.286 mm and the pluviometric density varies every six months.

In the table below, we present the figures on the precipitations of the year 2008 in the pluviograph station of CPRM/SUREG-MA, comparing to the average of the same period from 1998 to 2007, in the same station. It is verified that there was an increase in the rains rate in relation to the average, what also happened in the low water season (July to October), except September.

Table 1-3: Precipitations average in Manaus in the year 2008, Manaus Rains (Comparison to the 1998 to 2007 Averages)

	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Average (1998-2007)	292.0	275.7	309.3	344.9	284.1	105.8	59.0	60.1	96.5	114.4	182.4	242.7	2366.9
2008	262.2	347.5	555.8	396.2	269.5	186.8	78.6	60.3	78.5	175.9	288.6	SD	2699.9
(%)	-10.2	26.0	79.7	14.9	-5.1	76.6	33.2	0.3	-18.7	53.8	58.2	SD	14.1

Source: Mineral Resources Research Company - CPRM, Geology Secretariat, Mining and Mineral Transformation, Ministry of Mines and Energy

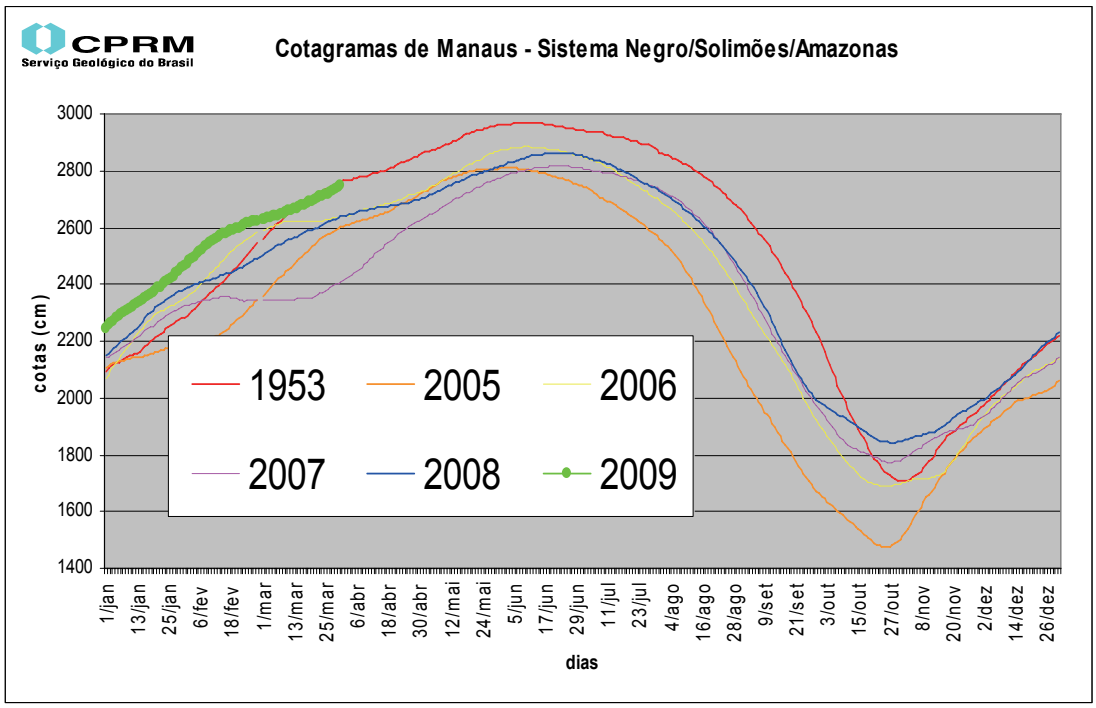
b. Hydrology

The main rivers going through the area of MFZ, in which is the city of Manaus and their surroundings, are Rio Negro and Rio Solimões, forming the great Rio Amazonas, starting from its confluence. Rio Negro is born in Colombia and it is the largest tributary of the Amazon. Rio Solimões is born in Peru and enters the Brazilian territory through the municipality of Tabatinga. Rio Amazonas is the largest of the world in volume of water, as well as extension (6,992.06 km) and it originates from Rio Apurimac (upper western areas of the Andes, in south Peru), disemboguing into the Atlantic ocean.

The fluvial floods of the Rio Negro in Manaus are perfectly normal phenomena given the dynamics of the rivers in general and, although they may vary in width, take place annually from June to August. The floods are mainly due to inflow of the Rio Solimões and its right shore tributaries and, to a lesser degree, the left shore tributaries.

Even when the estimate of risk is below five years, negative impacts happen on the shores of the Rio Negro. The 1953 flood was recorded to have reached 29.69m (Company of Research and Mineral Resources. CPRM.AM, 2000), having affected 42 thousand people on the shores of the Rio Negro and the central Igarapés of Manaus; until recently it was considered the

largest flood of the municipality and the fifth largest in history (since 1903, when the systematic measurement was initiated). In 2009, according to Figure 1-5, a flood of similar amplitude to 1953, with expectations of further proportions of impacts due to the irregular occupation in the shores of the Igarapés. In fact, the flood in 2009 eventually reached 29.71m, exceeding the amplitude of the one in 1953.



Source: CPRM – Manaus/2009

Figure 1-4: Flood days in Manaus throughout the years 1953, 2005, 2006, 2007, 2008

1.1.4 Natural Resources

The main natural resources of Amazonas State are wood, rubber, products of agriculture or extraction, fishing (ornamental and for consumption), minerals, and water, amongst others.

A system of production has been traditionally developed by family farmers in the Amazon and involves agriculture, extractive activities as well as domestic and other activities. Vegetation and animal extraction is characterized as the activity of removing products from the forests for nutritious, medicinal or handicraft purposes, such as through the collection of fruits, medicinal herb, lianas, fishes and wood. Domestic and other activities include community activities, studies and, above all, salaried work, which serve to supplement the productive activities carried out by the families in these communities.

The mining sector is of great importance for the State of Amazonas. There is a large mine in Pitinga (north of Manaus), which generates a large amount of economic activity and royalties to the state. This mine alone accounts for 80% of the nation's necessities of tin, which gives Brazil the position of exporter of the metal. These are also important oil and gas lines in Urucu and Silves, and a great deposit of *silvinita*, which has the potential of, in due time, allowing Brazil to become self-sufficient in potassium.

The state's natural gas comes from the Urucu reserves, and Petrobras is exploring in the Solimões fields, 650km West of Manaus. Cleaner and cheaper, natural gas will replace liquid fuels reducing greenhouse gas emissions. The structure will supply the thermoelectric power

plants in Manaus for the production of electric power to fill the demand for energy of 1.5 million people, as well as provide the benefit of cheaper energy for the population.

(source: Blog Economico/Ambiental da Amazonia).

1.1.5 Flora and Fauna

The State of Amazon is almost entirely covered with tropical perennial forests with an intense green color during the whole year, mostly formed by large-sized trees, characterized by high density (closed forest), with the predominance of low fertility soils, although they present good physical characteristics. The cycle of nutrients in the soil level takes place in a superficial horizon at an average depth of 20 centimeters, rich in organic mass from the decomposition of leaves, fruits, forest residues and animals, consisting of an ideal substratum for the development of countless species. It holds a group of ecosystems characterized by high complexity and biological diversity, whose main function is to work as a climatic regulator and shelter for one of the humanity's largest genetic properties.

A great part of the Amazonian basin is in the territory belonging to the State of Amazonas.

The relief is basically divided into three different levels: permanently flooded areas, where the roots of the vegetation are always under the water, the meadows, formed by lands located in intermediate quotas and which are subject to flood when the river waters are in their highest level, and the low plateau, that represents the mainland, out of the reach of the floods.

As the diversity is intense, there are countless vegetable species from the most varied ecosystems in the State of Amazonas, whose water-lily, a type of ornamental aquatic plant, is known by people as “Vitória Régia”.

There are several species of medicinal and oleaginous plants producing colorings, latex, stimulants, nutrients and others. Among the most important species are the Brazilian-nut, the rubber tree and the guaraná. The first one produces an edible nut thoroughly used in the Brazilian cuisine, the second one segregates a sap used for the production of rubber, and the third one produces a fruit holding stimulating properties, raw-material for the production of a soft drink consumed throughout Brazil.

The logging potential is enormous, providing an average extraction of 50 m^3 of wood per hectare, although the forest presents larger economic strategies if kept preserved, generating besides other benefits, carbon credits, one more economic and preservation alternative, besides the social and economic development model promoted by Manaus Free Zone.

As for the fauna, in general aspects, it comprehends insects, birds, mammals, reptiles and fish, there is a vast collection of data available to people in the Amazonian National Research Institute (INPA), extensive to vegetables and microorganisms.

1.2 Social Conditions

1.2.1 Social Indexes

According to the Atlas of Human Development of Manaus, 2006, the municipality’s highest Human Development Rate (HDR) is the same as that of Norway, the country with the highest rate according to the UN report. On the other hand, the municipality’s lowest rates of Human Development are close to the value found in Bolivia. In 2000, the HDR of Manaus was 0.774, presenting an interval of 0.660 (neighborhood of São José) and 0.941 (in the neighborhoods

of Nossa Senhora das Graças, Adrianópolis and Flores). Education is the index which contributed more positively to the HDR of 2000, with an illiteracy rate of 6%, while the number of functional illiterates is 17% for people who are 15 years of age or older (which represents a contingent of 161 thousand people). The rate of functional illiteracy for those people with less than eight years of study in the municipality of Manaus is 49%.

Regarding infant mortality, the municipality scored 13 on the scale proposed by UN (maximum of 17 deaths per 1000 children). Even those that presented higher results still must be improved; these were the neighborhoods: Nossa Senhora das Graças, Adrianópolis and Flores, with an indicator of 10 deaths per each thousand births, are still almost twice as high as the best results found in the country (5.4 per one thousand in Saint Caetano- State of São Paulo).

In 2000, the per capita family income of Manaus was R$ 262.40, ranking Manaus in the 864th position among all Brazilian municipalities. The largest incomes are verified in the neighborhoods of Nossa Senhora das Graças, Adrianópolis and Flores (R$ 1,356.87), a value 16 times higher than the lowest per capita income found in the neighborhoods of Jorge Teixeira, Val Paraíso and Chico Mendes (R$ 86.00). Ten percent of the richest people of the municipality of Manaus possess 52% of the income, while 20% of the poorest population possesses 1.6% of the income generated in the municipality.

1.2.2 Administration

a. Municipality of Manaus

The state authority (State Government of Amazonas-GEA) and the municipal authority both coexist in Manaus.

The municipal government is represented by the mayor and his body of secretaries, following the model proposed by the Federal Constitution.

The Legislative Power is represented by the City Hall, composed of 38 aldermen (in observance to the determination in article 29 of the Constitution, that requires a minimum number of 33 and maximum of 41 for municipalities with more than a million inhabitants and less than five million) elected for a period of four years. The City Hall is in charge of voting on fundamental laws for the administration and the Executive, especially the municipal budget (known as Law of Budget Guidelines).

b. SUFRAMA

Manaus holds over half of the population of the State of Amazonas and the office of Manaus Free Zone Superintendence (SUFRAMA), an autarchy linked to the Ministry of the Development, Industry and Foreign Trade (MDIC), responsible for the administration of Manaus Free Zone - for the implementation of the tax incentives policy in the area, granted to all Western Amazon - and for the regional development by using the natural resources in a sustainable way, thus assuring the economic viability and the improvement of the life quality of the local population.

After four decades, Suframa implemented the three poles that form the MFZ - commercial, industrial and agricultural - providing all the states of the area with development (Western Amazon), identifying businesses opportunities and attracting investments to Manaus Industrial Pole area, as well as the other economic sectors of the area (states of the Western

Amazon: Acre, Amazonas, Rondônia and Roraima and the cities of Macapá and Santana, in Amapá).

With the funds arisen from the services rendered to the companies granted with tax incentives, Suframa accomplishes partnerships with the state and municipal governments, teaching and research institutions and cooperatives, it finances projects to support the economic infrastructure, production, tourism, research & development and qualification of intellectual capital. The objective is to minimize the Amazonian cost, increase the production of goods and services meant to the regional vocation and qualify, train and qualify the workers in Western Amazon, Macapá and Santana.

The tax legislation is differentiated from the rest of the country and the tax incentives are granted in federal, state and municipal levels. In the federal level there is exemption for IPI (Tax Over Industrialized Products), II (Imports Tax) and IR (Income Tax); in the state level, ISS (Tax Over Services) and (Tax Over Vehicles); and in the municipal level, public cleaning and conservation services rendered by the City Hall.

As it can be seen, the current tax policy of Manaus Free Zone is different from the rest of the country, once it grants benefits almost 40% more advantageous for the investors established in Manaus industrial sector.

c. Administrative Regions

Manaus is divided into seven areas: North, South, Center-South, East, West, Center-West and Rural. The East area of the city is the most populous one, with approximately 600,000 inhabitants (IBGE-Brazilian Institute of Geography and Statistics. 2007). However, it is the North area of the city that possesses the highest rate of population growth in the last few years, as well as possessing the largest neighborhood of the city, Cidade Nova. The Center-South area holds the highest per capita income.

d. Manaus Metropolitan Region

The Manaus Metropolitan Region (MMR), which counts 2,006,870 inhabitants (according to the population data of IBGE in 2008), includes eight municipalities of the State of Amazonas, which are under conurbation process. In August 2007, a tender was offered for the construction of a bridge over the Rio Negro, which will link the capital Manaus to the neighboring municipality of Iranduba (D.O.U. – Federacy Official Journal, from 08.15.2007). The said bridge will allow further integration among the municipalities which comprise the MMR.

1.2.3 Population

The population is 1,709,010 inhabitants (IBGE in 2008), 87% urban inhabitants; 13% rural; 52.07% women and 47.93% men. It is the eighth most populous city of Brazil.

The following populations were estimated in 2008 by the IBGE: Manaus Municipality, 1,709,010; Amazonas State, 3,341,096, and Brazil, 183,900,000.

Table 1-4: Municipality, State and Country Population Comparison Chart (2008)

	Manaus	Amazonas	Brazil
Population in 2008	1,709,010	3,341,096	183,900,000
Percentage	51.15% of the state population	1.8% of the country population	-

Source: Population census carried out in 5,435 Brazilian municipalities by IBGE in 2008.

Starting from 2008, it is noticed 87% of the population of Manaus is concentrated in the urban area and 13% in the rural area, and it is the eighth most populous city of Brazil.

The table below shows the area and population of the Amazonas State and municipalities of Manaus Metropolitan Area

Table 1-5: Population Estimation by Municipalities, Metropolitan Area of Manaus, Amazonas State

Municipality/ Metropolitan Region/ Amazonas State	Area (km^2)	Population (2008 estimates)
Manaus *	11,458	1,709,010
Itacoatiara *	8,600	87,896
Rio Preto da Eva *	5,813	26,004
Careiro de Varzea	2,631	24,030
Iranduba	2,215	33,834
Manacapuru	7,329	85,279
Novo Airao	37,490	15,343
Presidente Figueiredo	24,781	25,474
Metropolitan Region of Manaus	100,260	2,006,870
Amazonas State	1,577,820	3,341,096

Note *: Municipalities included in MFZ
Source: IBGE/population estimates, July 2008

The three first municipalities (Manaus, Itacoatiara and Rio Preto da Eva), are part of the MFZ inclusion area. The total population of these municipalities is approximately 1,823,000.

Indicators of Manaus Municipality (year 2007)

- Demographic density: 144.4 inhabitants per km²
- Infant mortality up to five years of age: 21.26 per each thousand children
- Fertility rate: 3.74 children per woman
- Literacy rate: 94.63%

- Human Development Rate (HDR): 0.774
- HDR Income: 0.702
- HDR Longevity: 0.711
- HDR Education: 0.909

Table 1-6: Change of Population in Manaus. 1920 to 2007

Year	Population (inhabitants)
1920	75,704
1940	106,399
1950	139,620
1960	175,343
1970	311,622
1980	633,833
1991	1.011.501
1996	1,157,357
2000	1,405,835
2007	1,646,602

Source: IBGE

According to the data of IBGE presented in the previous figure, the increase of the population of Manaus starting from the 1960s is significant. The period from 1970 to 1980 is very important, once the population almost doubled, continuing with a high growth rate until today.

1.2.4 Infrastructure

a. Power supply

The Brazilian electric sector is regulated by the National Agency of Electric power (ANEEL). After the promulgation of the law for the sector of the new electric model, the main responsibility of ANEEL is to regulate and supervise the electric sector in agreement with the policies extolled by the Ministry of Mines and Energy (MME).

The Centrais Elétricas do Norte do Brasil S.A., or Eletronorte, is an electric company belonging to Eletrobrás responsible for the generation and transmission of electricity in the Amazon region, which corresponds to 58% of the Brazilian national territory, including the states of Amazonas, Pará, Acre, Rondônia, Roraima, Amapá, Tocantins and Mato Grosso. Eletronorte is also in charge of distributing electricity to the cities of Manaus and Boa Vista, capitals of the states of Amazonas and Roraima, respectively.

Amazonas Energia S.A. is a subsidiary of Eletronorte and it supplies electricity to 471,986 consumers in the capital of the state of Amazonas. From those, 411,277 pay for the service, including the industries of Manaus Industrial Pole (PIM).

As one of the most developed free trade zones in Brazil, the city of Manaus houses several multinationals from the electronics sector, being attributed to the industrial sector the consumption of 44% of the energy generated in the city. The lack of generation capacity in the area and the late entrance of private providers of energy results in the periodic shortage of energy, threatening the local economical stability.

b. Water supply

The current situation of water supply is relatively good if we consider only the service, the hydro measurement rate. The great challenge at the moment is to supply the demand of water mainly to the North and East areas of the city, where approximately 60 thousand families are not assisted and other 50 thousand are provided with precarious services (some hours a day). The population of those areas has a low income and is concentrated on illegal settlement areas, where the infrastructure has been implemented by the State Government and the City Hall.

The city of Manaus has three water supply systems:

- Main system: with production and treatment of water coming from two water stations located in Ponta do Ismael, in the neighborhood of Compensa, and from a treatment station located in the neighborhood of Mauazinho - Industrial District. The collection of water of the three stations is made straight from Rio Negro;
- Isolated systems: with the production and the treatment of groundwater, which provides independent supply chains in peripheral neighborhoods, terraces, parcels of lots and apartments buildings, to which the Main system does not hold supply capability;
- Mixed systems: in areas assisted by the Main System, whose demand is complemented by artesian wells. The systems assumed by the concessionary company in 2000 did not include more than 4 thousand private wells of precarious characteristics and of low depth (80m, on average) and operated without control, scattered all over the city and supplying about 15% of the urban population.

c. Sewerage System

The wastewater collection system in the city of Manaus extends for approximately 300 km. However, many water sources flow throughout the city -the so called Igarapés- where wastes are discharged directly, thus causing pollution and environmental and social damage.

Most of the residences located in some areas of the city have septic tanks, which unload their dejections in the drainage system flowing into the igarapés. The residential units also contribute to the release of wastewaters (strainer, gutters, drainages of gardens, etc.).

The discharge of industrial and domestic wastewaters altered the physical/chemical conditions of the water drastically, including a high concentration of heavy metals. Besides the Igarapé, a lot of water sources in the basin are polluted.

d. Collection and Final Disposal of Solid Waste

The administration and management of the urban solid wastes in the municipality of Manaus, attribution of the Municipal General Office of Public Cleaning SEMULSP obtained over the last years a significant improvement in the collection and final destination, although the population should contribute more by understanding and handling the wastes correctly. The destination of the urban solid wastes is the Controlled Landfill of Manaus.

e. Interstate and International Transportation Logistics

The main means of transportation for people and cargo in the region are planes or the fluvial navigation in the rivers of the Amazon. It is noticed the development of the infrastructure has not followed the growth of the city.

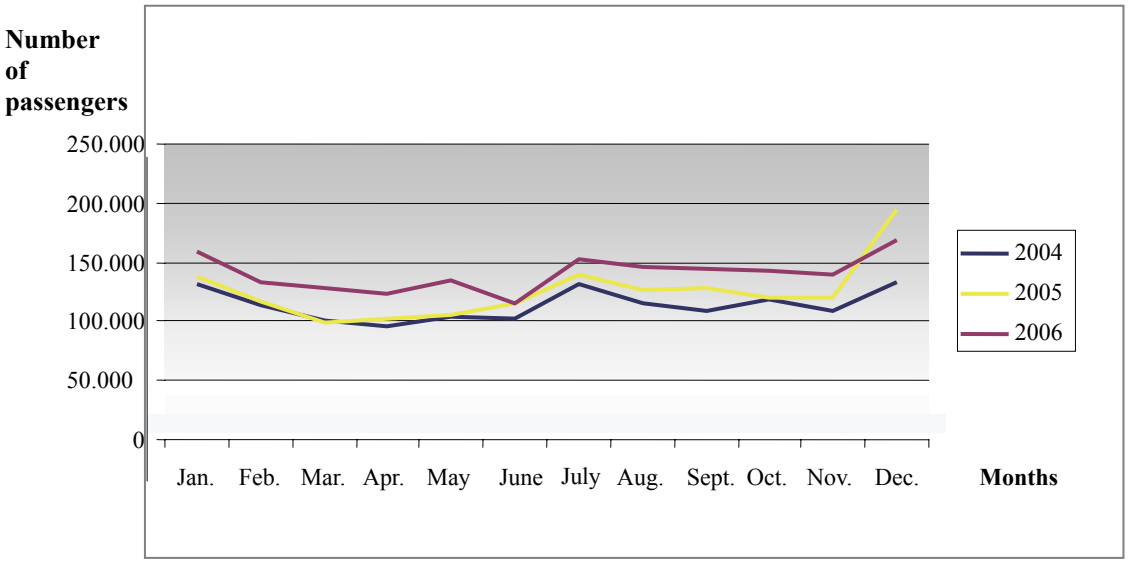
The main logistics for the transportation of people and cargo in the municipality of Manaus

are aerial and fluvial.

e.1 Air Travel

Manaus is served by Eduardo Gomes International Airport, the largest and second busiest airport in northern Brazil and the third largest in the country in terms of cargo handling. This is partially due to the creation of the Manaus Free Zone, which continues to boost the city's economy and the entire state, with high rates of growth in annual revenue.

The international airport of Manaus is located 14 km away from downtown Manaus. The permanent personnel of the airport are about 3,430 people. The movement is higher in January, July and December, registering the seasonality according to Figure below The Airport of Manaus has a five-year program (2007-2011) for improvement and enlargement of its entire compound, but it will not quantitatively affect the generation of wastes.



Source: http://www.infraero.gov.br/movi.php?gi=movi, visited on 22/05/2007

Figure 1-5: Flow of passengers at Manaus Airport (Eduardo Gomes).

The average movement seen at the airport is presented below, according to 2006 data, obtained from INFRAERO (Airport Infrastructure).

Table 1-7: Monthly movement of passengers and aircrafts in Manaus Airport (2006)

Month	Aircrafts		Passengers	
	Domestic	International	Domestic	International
January	2,407	340	152,178	6,385
February	2,078	286	128,465	3,973
March	2,484	387	124,200	4,580
April	2,252	342	223,282	2,703
May	2,522	541	132,290	3,137
June	2,308	131	110,787	4,216
July	2,432	385	145,128	8,153
August	2,627	357	138,032	8,320

September	2,668	467	123,324	2,139
October	2,536	357	135,241	7,068
November	2,388	356	132,157	7,275
December	2,747	387	160,875	8,680
Annual Average	**2,454**	**361**	**142,163**	**5,552**
Total Annual Avg	**2,815**		**147,716**	

Source : INFRAERO (Airport Infrastructure) Remade Chart and Added Averages
http://www.infraero.gov.br/movi.php?gi=movi, access 05/22/2007.

e.2 River Travel

The fluvial transport is one of the main means of access to close places, as well as the most distant areas. The Porto of Manaus has a structure for tourists' reception and the capacity to receive large transatlantic ships, which come from several parts of the world.

The infrastructure of the Port is also available for the arrival and disembarkation of products going to the Industrial Pole of Manaus, as well as for products manufactured in the city going to several places (Source: http://pt.wikipedia.org/wiki/manaus).

Source: http://pt.wikipedia.org/wiki/manaus

e.3 Land Travel

There are two federal highways connecting the city to the rest of the country. There is a paved road going North (BR-174) connecting Manaus to Boa Vista, capital of the State of Roraima, and to Venezuela. The BR-319 goes South connecting Manaus to Porto Velho, capital of the State of Rondonia.

The current fleet of vehicles of Manaus is composed, according to numbers of 2008, by 285,895 automobiles and pick-ups, 74,709 motorcycles, 8,764 buses and micro-buses (reasonable public transportation), and 30,886 trucks

Source: http://pt.wikipedia.org/wiki/manaus

1.2.5 Regional Development Plan

There is a development plan under execution by the Government of the State known as Social and Environmental Program of Igarapés of Manaus (PROSAMIM), which seems to improve the life quality of the resident population in the area of inclusion of the Program. The program is organized in three primary areas: Sanitary infrastructure, environmental and institutional recovery, and social sustainability, and it is being executed in the neighborhoods of the hydrographic basin of Educandos and São Raimundo.

1.2.6 Social Issues

a. Social Issues in Manaus

Geographically, the areas located close to the center of Manaus are inhabited usually by a population holding a larger purchasing capability, therefore, to be more developed, while the further away areas tend to be less favored, except by some in the north and east of the city.

Nowadays, Manaus is the eighth largest city of Brazil, being inhabited by almost 50% (fifty percent) of the population of the State of Amazonas. Manaus is also among the six capitals which more contribute to the GDP, 25.20% of the total of Brazil in 2006, according to the Regional Accounting. This concentration of population growth brought several problems, such as home deficits, safety and health care services.

Manaus became in the last few years a great commercial and industrial center. It is noticed in this center that a great number of people are devoted to commercial activities, employed by the formal and informal sectors of the local economy, and a small number of public employees. The minority of the population may be considered as belonging to the high income class.

Manaus also displays the concentration of income it has in relation to Brazil. Before the opening of Manaus Free Zone, the agriculture was a concentrated activity in the state, while the commercial and industrial activities were developed in the capital.

Most of the industries settled in Manaus have their main offices in other Brazilian capitals, like São Paulo.

In spite of presenting an intense economical growth, there was not a corresponding development in social areas. That is more evident in the poorest and isolated areas of the region where the social relationships are still deeply marked by a provision system that operates through the exchange of products for work, without monetary involvement.

The data related to the basic hygienic conditions point out the need for more investment. Besides that, it takes place due to the direct relation between the basic hygienic and health care services and the damage caused to the environment through the inadequate disposal of wastes.

Illegal settlements along Igarapé Quarenta

Illegal settlements in Industrial District II

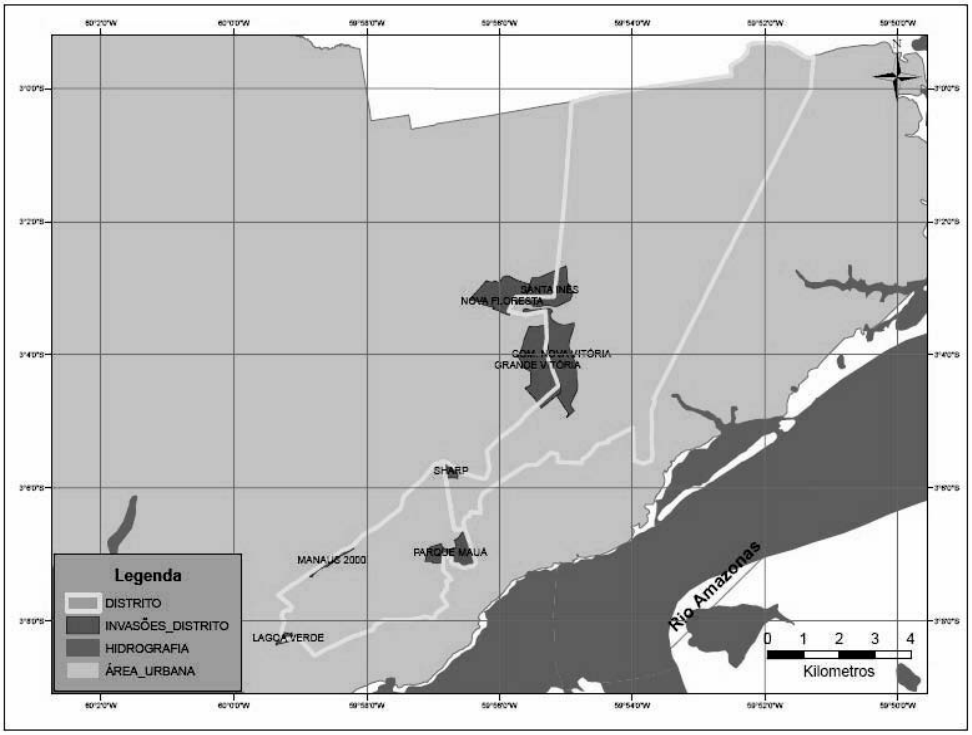
b. Illegal Settlements

The water basin along the perimeter of the municipality of Manaus has been deeply affected by illegal settlements made up of sub-standard housing with unsanitary conditions and, in recent years, large land invasions in the outskirts of the city. As a consequence, the igarapés and water sources have been polluted, silted and obstructed both by the cutting of the large-sized vegetation and the existence of a large quantity of waste, resulting from the construction of houses on the banks of those igarapés. Throughout the municipality, the extension of the main igarapés reaches around 70 km, and housing, due to the meaningful social deficit, about 400 thousand people.

The risks of collapse exist in several suburbs, such as those located in the Basin of São Raimundo (Aparecida, Aleixo, Parque Dez, Novo Israel, Nossa Senhora de Fátima, Cidade Nova, Compensa, São Jorge, São Raimundo and Bairro da Paz). Such areas, placed on very steep filled lands and measuring from 30 m to 50 m long, feature cliffs and are subject to atropism. The intensive and disorganized occupation contributes to the increase in the risk of erosion. There are also abrupt cuttings of the embankment for the construction of houses and ports, the removal of the original vegetation and the discharge of wastewater and rain water down the hills.

The accelerated process of occupation to the healthy soil has consequently resulted in the inadequacy and disarticulation of the urban street network, the inappropriate occupation of the Igarapés, in addition to real estate speculation and a deficiency in basic social services and equipment.

The figure below shows the illegal settlements (marked in red) in the Industrial District of Manaus.



Source: SEMMA 2009

Figure 1-6: Illegal Settlements within the Industrial District of Manaus

c. Ethnicity

In its historical formation, the demographics of Manaus are the result of the miscegenation (or "mixing") of three basic ethnicities: indigenous Amerindian, European and African ancestries, thus forming the *mestiço* of the region (caboclo, mulatto and cafuzo). In the late 19th and 20th century, the arrival of Japanese immigrants, as well as the post-war arrival of immigrants of Arab and Jewish decent, also has helped to characterize the population of the city. The people identify mainly as brown (caboclo, mulatto and cafuzo, 58%), white (34%), black (3%), indigenous (4%) or Asian and Middle Eastern (0.1%).

- White: The white residents and those born in Manaus are mostly Portuguese

descendants. They constitute the second largest ethnic group of the Manaus, represented by 34% of the population.

- Indigenous: The natives formed, mainly with whites, a singular culture. They constitute 4% of the population of the city.
- Asian or Middle Eastern: They are mostly of Japanese, Arab and Jewish descent, representing 0.1% of the population of the city.
- Black: African descendants in Manaus are 3% of the population. They arrived in the city in about 1907, attracted by the rubber boom. Many blacks of the city come from southeast Brazil.
- Brown: They constitute most of the population, formed by caboclos, mulattos and cafuzos, and are the main identities of the Amazon. The mestiço are the main cultural identity both of Manaus and the Amazon, the result of miscegenation of white Portuguese with the natives of the region. In total, 58% of the population of the city is included in this category.
- Migration: It is possible to see a respectable contingent of people from other states, above all Northeasterners. At the rubber boom time and the installation of Manaus Free Zone, between 19th century and the 1960s, they started to migrate to the northern region, especially to Amazonas and Acre, in search for better life conditions and work. With the structural improvement of other areas of the country, and the resulting problems of overpopulation in the big cities, the Northeastern migration has decreased considerably.

d. Health Care Aspects

The health care of the region is considered favorable, although there are many challenging health related conditions in the area. Besides the so-called tropical diseases, these are compounded by the typical problems in big cities. Malaria stands out among the endemic diseases of the area, with significant incidence of other diseases, such as dengue, as well. There is also work to increase awareness about AIDS in areas with little to no access to prevention and control measures and even to health care services.

1.3 Economic Conditions

1.3.1 National Economy

a. General

Characterized by agriculture, mining, manufacturing and services, the economy of Brazil overcomes all other countries of South America and it is present in the markets of the world. From 2003 to 2007 Brazil obtained its first commercial superavit accounted in the checking account since 1992. The increase of productivity coupled with the high prices of the commodities contributed to the increment of the exports. President Lula reaffirmed his commitment to the fiscal responsibility, maintaining the primary superavit of the country during the election of 2006. After his inauguration in October of that year, President Lula announced a package of new economical reforms to reduce the taxes and increase the investments in infrastructure. Brazil is recognized now as one of the emerging giants, together with Russia, India and China, being part of the famous BRICs, as they are known in

the world commercial community[1].

Brazil has a moderate free market and an economy guided to the internal market, with incentives to the external market. Its gross domestic product exceeds a trillion dollars, being the tenth in the world and the second of America, measured by the Parity of the Purchasing Capability (PPP), becoming the eighth largest economy of the world and the largest of America after the United States. Its GDP was estimated R$ 2,6 trillion in 2007[1].

Brazil has a moderate free market and export-oriented economy. Measured nominally, its gross domestic product surpasses a trillion dollars, the tenth in the world and the second in the Americas; measured by purchasing power parity (PPP), making it the eighth largest economy in the world and the second largest in the Americas, after the United States. In Real (Brazilian currency), its GDP is estimated at R$ 2.6 trillion in 2007[1].

Brazil is a member of diverse economic organizations, such as Mercosul, SACN (South American Community of Nations), G8+5, G20 and the Cairns Group. Its trade partners number in hundreds, with 80% of exports mostly of manufactured or semi-manufactured goods. Brazil's main trade partners are: the EU (26%), Mercosur and Latin America (25%), Asia (16%), the United States (14.3%), and others (18.7%).

As the owner of a sophisticated technological sector, Brazil also develops various projects ranging from submarines to aircraft and is involved in space research as well. Brazil is also a pioneer many fields, such as ethanol production, deep-water oil research from where 73% of its reserves are extracted[2].

b. GDP (Gross Domestic Product)

According to information from the Central Bank of Brazil, the Brazilian GDP in 2008 was R$ 2,889,719 trillion at current prices, equivalent to US$ 1,573,321 trillion. The Brazilian economy has been showing a constant growth for the last 5 years (2004-2008), with an average growth rate of 4.74%. The per capita GDP was R$ 15,240 real or US$ 8,298 in 2008.

[1] Fonte : Livro de Registros da CIA
[2] Source : Economy of Brazil (http://en.wikipedia.org/wiki/Cairns_Group)

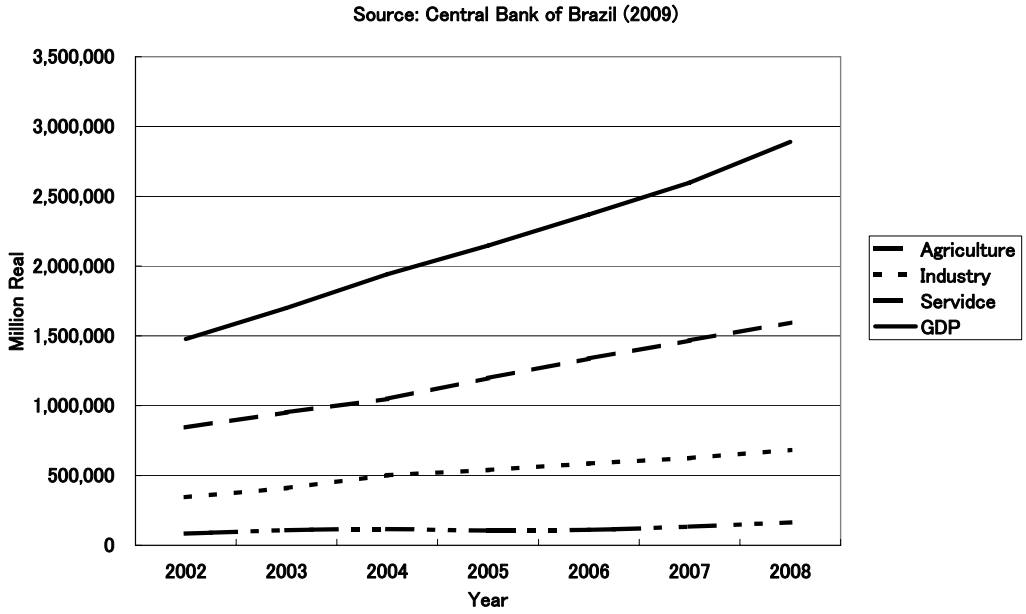


Figure 1-7 GDP Growth in Brazil (2002-2008)

The table below shows the trend of percentage distribution to GDP by economic sector in Brazil during 2003-2007. The largest contribution to GDP is made by tertiary industry (services) at 66.6%, followed by secondary industry (mining, manufacturing, construction, and production and distribution of electricity, gas, water, and sewerage public cleaning) at 27.8% and primary industry (agriculture, forestry and fishery) at 5.6% in 2007.

Table 1-8 Percentage of Contribution to GDP by Economic Activities

BRAZIL						
Economic Sector/Activities	Percentage (%)					
	2002	2003	2004	2005	2006	2007
Total	100.00	100.00	100.00	100.00	100.00	100.00
Primary Industry	**6.6**	**7.4**	**6.9**	**5.7**	**5.5**	**5.6**
Agriculture and Forestry	4.65	5.26	4.93	3.81	3.76	3.82
Livestock and Fishery	1.97	2.12	1.98	1.89	1.73	1.75
Secondary Industry	**27.1**	**27.8**	**30.1**	**29.3**	**28.8**	**27.8**
Mining	1.60	1.72	1.92	2.46	2.89	2.35
Manufacturing Industry	16.85	18.02	19.22	18.09	17.37	17.03
Construction	5.28	4.69	5.09	4.90	4.73	4.86
Electricity, Gas, Water, Sewerage Public Cleaning	3.32	3.42	3.88	3.82	3.76	3.58
Tertiary Industry	**66.33**	**64.77**	**62.97**	**65.02**	**65.76**	**66.63**
Commerce and Maintnance/Repair Services	11.33	11.70	12.02	12.15	12.51	13.15
Hotels and Restaurants	1.82	1.55	1.60	1.63	1.80	1.82
Transport, Freight and Storage	4.79	4.68	4.70	4.97	4.85	4.80
Information Services	3.56	3.63	3.85	3.98	3.79	3.83
Finances, Insurance and Social Security Services	7.47	7.09	5.82	7.05	7.20	7.68
Personal Sevices for Families and Associatives	2.53	2.40	2.31	2.42	2.44	2.29
Business Services	4.40	4.45	4.48	4.59	4.78	4.74
Real Estate and Leasing	10.24	9.64	9.07	9.01	8.66	8.50
Public Administration, Health and Education Services	15.53	15.11	14.67	15.05	15.31	15.46
Private Health and Education Services	3.46	3.33	3.25	2.96	3.17	3.12
Household Services	1.20	1.19	1.21	1.22	1.26	1.22
Souce: IBGE in cooperation with the State Statistical Agency, Government State Secretariats and Superintendency of the Manaus Free Trade Zone (SUFRAMA)						

1.3.2 Regional Economy

a. State of Amazonas

GDP of the State of Amazonas is R$42,023 billion at current price in 2007. Per capita GDP is R$13,042, which is the highest in the Northern Region of Brazil. The service sector is the largest component of the regional GDP at 52.7%, followed by the industrial sector at 42.5%. Agriculture represents 4.8% of GDP in 2007. Dominance of the manufacturing sector in GDP is distinctive in the economy of the State of Amazonas.

Table 1-9 Percentage of Contribution to Regional GDP by Economic Activities

Amazonas						
Economic Sector/Activities	Percentage(%)					
	2002	2003	2004	2005	2006	2007
Total	100.00	100.00	100.00	100.00	100.00	100.00
Primary Industry	**7.2**	**6.0**	**4.7**	**5.2**	**5.0**	**4.8**
Agriculture and Forestry	5.80	4.52	3.30	3.85	3.56	3.56
Livestock and Fishery	1.41	1.52	1.39	1.39	1.44	1.24
Secondary Industry	**44.2**	**45.0**	**46.7**	**44.3**	**45.7**	**42.5**
Mining	1.92	1.96	2.15	2.57	2.78	2.18
Manufacturing Industry	36.60	37.67	37.20	35.71	36.79	32.84
Construction	5.10	4.73	5.86	4.98	4.95	5.46
Electricity, Gas, Water, Sewerage Public Cleaning	0.59	0.68	1.45	0.99	1.16	1.98
Tertiary Industry	**48.6**	**48.9**	**48.6**	**50.5**	**49.3**	**52.7**
Commerce and Maintnance/Repair Services	9.65	10.44	9.56	10.50	9.41	12.25
Hotels and Restaurants	1.71	1.36	1.56	1.96	1.91	1.85
Transport, Freight and Storage	3.95	4.87	5.24	4.89	4.91	5.17
Information Services	1.54	1.97	1.66	2.07	1.78	2.16
Finances, Insurance and Social Security Services	2.20	1.86	1.62	1.95	2.04	2.38
Personal Sevices for Families and Associatives	1.54	1.33	1.21	1.22	1.24	1.32
Business Services	1.88	1.92	3.76	2.60	3.08	2.70
Real Estate and Leasing	6.58	6.05	5.97	6.42	5.59	5.60
Public Administration, Health and Education Services	17.22	16.85	15.80	16.72	16.96	16.83
Private Health and Education Services	1.52	1.51	1.52	1.43	1.71	1.79
Household Services	0.77	0.76	0.73	0.74	0.69	0.69
Souce: IBGE in cooperation with the State Statistical Agency, Government State Secretariats and Superintendency of the Manaus Free Trade Zone (SUFRAMA)						

b. Manaus City

Regional GDP in the city of Manaus is about R$34.4 billion at current price in 2007, of which industry sector accounts for 50.67% and followed by service sector at 49.19%. Agricultural sector only accounts for 0.13% of the total GDP in Manaus City. The per capita GDP for the year is R$20,894.

Over the last decades, a system of federal investments and tax incentives has turned the city into a major industrial centre (Zona Franca Manaus: Manaus Free Zone). The mobile phone companies Nokia, Sagem, Gradiente and BenQ-Siemens run mobile phone manufacturing plants in Manaus. Also, many other major electronics manufacturers such as Sony and LG have manufacturing plants in Manaus.

1.3.3 Manaus Free Trade Zone (MFZ)

a. Background of MFZ

Manaus Free Zone was created by the Federal Government of Brazil on February 28, 1967, through Law N. 288, with the objective of promoting the development in the Western Amazon, generate jobs and income, providing the area with economic conditions in order to

allow its development.

This model offers tax incentives to attract industrial, commercial and agriculture-industrial companies, as well as the rational use of the Amazonian biodiversity in the States of Amazonas, Acre, Rondônia, Roraima and in the cities of Macapá and Santana, in the State of Amapá.

The tax incentives policy is administrated by the Superintendence of Manaus Free Zone (SUFRAMA), a Federal Government organization which responds to the Ministry of Development, Industry and Foreign Trade.

b. Investment Incentives in Manaus Free Trade Zone

There are special incentives available for investments in Manaus Free Zone. In order to enjoy these benefits and incentives, the petitioning company should present technical and economic projects to SUFRAMA for the analysis by its technical team, and subsequent appreciation by the Council of Administration (CAS).

The Government of the State also offers incentives through the reduction of ICMS by the submission of the project for appreciation of the Council of Administration (CODAM). The Municipal Government also offers benefits.

b.1 Federal Tax and Tax Incentives

Federal tax and tax incentives include:

- an exemption from import duty for products that are destined for internal consumption (including capital goods), and for those products that are listed in Inter-ministerial Instruction 300/1996 destined for the Amazon region;
- an 88% reduction on import duty for raw, intermediary and secondary materials, and for the packaging of foreign products that are used during the manufacture of industrialized products in the free trade zone intended for consumption elsewhere in Brazil (provided that SUFRAMA approve the activity);
- an exemption from the tax on manufactured products for products that are registered in the free trade zone and the Amazon region, as well as for raw and regional agricultural and vegetable extract products within the Amazon region. A tax credit will apply to these products if used as raw, intermediary or packaging material anywhere within Brazil; and
- an exemption from the tax on exports for products that are manufactured in the free trade zone.

(Incentives under the Western Export Special Program-PEXPAM)

The PEXPAM provides the following incentives for the import of raw materials and component products that are utilized for the manufacture of goods intended exclusively for export:

- exemptions from import duty, manufactured product tax, the tax on exports and the tax on distribution of goods and services (ICMS);
- No demanded fulfillment for the Basic Production Process (PPB);
- An extra-quota import authorization; and
- Other exemption/reduction of government related taxes/tariffs

b.2 State Tax and Tax Incentives

State tax and tax incentives include:

- Exemptions from the ICMS for products that are manufactured elsewhere in Brazil and destined for the free trade zone if it is for industry or trade.
- ICMS credit granted represented outstanding balance due, which ranges from 55 – 100%
- Reduction on the ICMS calculation for the purchase of international inputs.
- ICMS credit granted to industries of final goods production in purchases of inputs from the local industries of intermediate goods.

b.3 Municipal Tax and Tax Incentives

Municipal tax and tax incentives include:

- Exemption and reducing from urban building and property tax - IPTU
- Exemption and reducing from charges from any service business -- ISSQL -- and others tributes

c. Industry in SUFRAMA Area

c.1 Current Development of Industrial Location

Up to June 2009, a total of 736 projects were approved by SUFRAMA, of which 494 project/companies began their operations, while 242 remaining projects are already in the middle of the operation. The total number of workers used by the projects above is 138,456, while about US$ 14.2 billion are totally invested in MFZ.

Table 1-10 Projects Approved by SUFRAMA (July 2009)

Projects	Enterprises in Operation			Enterprises in Preparation			Total		
	No. Enterprises	No. Workers	Total Investment (million US)	No. Enterprises	No. Workers	Total Investment (million US)	No. Enterprises	No. Workers	Total Investment (million US)
LEs	416	118,427	12,914	190	16,808	1,222	606	135,235	14,136
SMEs	78	2,072	40	52	1,158	30	130	3,230	70
Total	**494**	**120,439**	**12,954**	**242**	**17,966**	**1,252**	**736**	**138,465**	**14,206**

Source: SUFRAMA

The following table shows the distribution of the large companies with the respective numbers of workers and investments by sub-sectors of the industry and the places in MFZ. The dominant industries in MFZ are electric-electronics, communication devices, machines, metallurgy, chemistry, plastics and transportation machines.

Table 1-11 Distribution of Large-Scale Enterprises by Sub-Sectors and Locations in MFZ (July 2009)

Sub-sectors	Industrial District			Other Locations in Manaus			Western Amazon Area			Total		
	No. of Enterprise	No. of Employees	Total Investment (000 US)	No. of Enterprise	No. of Employees	Total Investment (000 US)	No. of Enterprise	No. of Employees	Total Investment (000 US)	No. of Enterprise	No. of Employees	Total Investment (000 US)
Beverage	**5**	**425**	**175,924**	**13**	**1,965**	**165,653**	**2**	**85**	**69,369**	**20**	**2,475**	**410,946**
Publishing & Printing	**7**	**268**	**14,075**	**3**	**314**	**17,881**	**1**	**150**	**1,000**	**11**	**732**	**32,956**
Electric, Electronic & Comm.	**78**	**52,492**	**4,366,422**	**52**	**112,993**	**1,933,492**	**0**	**0**	**0**	**130**	**65,475**	**6,299,913**
Components	*25*	*17,609*	*934,613*	*20*	*5,017*	*88,147*	*0*	*0*	*0*	*45*	*22,628*	*1,022,760*
Copy machines	*2*	*2,298*	*139,559*	*5*	*292*	*62,600*	*0*	*0*	*0*	*7*	*2,578*	*202,159*
Others	*51*	*32,585*	*3,292,250*	*27*	*7,684*	*1,782,745*	*0*	*0*	*0*	*78*	*40,269*	*5,074,994*
Timber/Wood products	**3**	**377**	**17,998**	**0**	**674**	**11,306**	**2**	**834**	**29,959**	**5**	**1,885**	**59,263**
Machinery	**19**	**5,358**	**283,008**	**10**	**1,313**	**62,170**	**0**	**0**	**0**	**29**	**6,576**	**343,751**
Watch	*6*	*2,078*	*79,760*	*3*	*142*	*24,757*	*0*	*0*	*0*	*9*	*2,220*	104,517
Others	*13*	*3,280*	*203,248*	*7*	*1,171*	*37,413*	*0*	*0*	*0*	*20*	*4,356*	239,234
Metallurgical	**25**	**4,512**	**359,930**	**19**	**1,347**	**103,824**	**0**	**0**	**0**	**44**	**5,859**	**463,753**
Non-Metallic Minerals	**0**	**0**	**0**	**2**	**412**	**130,907**	**0**	**0**	**0**	**2**	**412**	**130,907**
Furniture	**1**	**145**	**1,353**	**3**	**378**	**6,993**	**0**	**0**	**0**	**4**	**523**	**8,345**
Paper & Paper Products	**7**	**1,096**	**60,055**	**6**	**614**	**39,460**	**0**	**0**	**0**	**13**	**1,710**	**99,515**
Rubber	**2**	**52**	**14,137**	**1**	**61**	**23,784**	**0**	**0**	**0**	**3**	**113**	**37,921**
Food	**0**	**0**	**0**	**4**	**216**	**413,107**	**1**	**57**	**875**	**5**	**273**	**413,982**
Chemical	**15**	**937**	**85,288**	**12**	**591**	**71,171**	**1**	**52**	**7,503**	**28**	**1,580**	**163,962**
Plastics/Plastic Products	**35**	**4,544**	**247,791**	**36**	**3,821**	**230,986**	**0**	**0**	**0**	**71**	**8,365**	**478,777**
Textile	**0**	**0**	**0**	**1**	**467**	**42,096**	**0**	**0**	**0**	**1**	**467**	**42,096**
Clothes & Garment Apparels	**0**	**0**	**0**	**2**	**876**	**6,826**	**0**	**0**	**0**	**2**	**876**	**6,826**
Transport Machinery	**19**	**14,496**	**2,647,338**	**14**	**2,547**	**307,102**	**0**	**0**	**0**	**33**	**17,043**	**2,954,440**
2-wheel vehicles	*19*	*14,496*	*2,647,338*	*8*	*1,252*	*255,951*	*0*	*0*	*0*	*27*	*15,748*	2,903,289

Sub-sectors	Industrial District			Other Locations in Manaus			Western Amazon Area			Total		
	No. of Enterprise	No. of Employees	Total Investment (000 US)	No. of Enterprise	No. of Employees	Total Investment (000 US)	No. of Enterprise	No. of Employees	Total Investment (000 US)	No. of Enterprise	No. of Employees	Total Investment (000 US)
Naval Transport Machinery	*0*	*0*	*0*	*5*	*624*	*35,794*	*0*	*0*	*0*	*5*	*624*	35,794
Other Transport Machinery	*0*	*0*	*0*	*1*	*671*	*15,357*	*0*	*0*	*0*	*1*	*671*	15,357
Construction	**0**	**0**	**0**	**3**	**141**	**76,570**	**0**	**0**	**0**	**3**	**141**	**76,570**
Miscellaneous	**8**	**3,186**	**337,080**	**4**	**738**	**552,820**	**0**	**0**	**0**	**12**	**3,924**	**889,901**
Optical goods	*1*	*335*	*20,362*	*0*	*0*	*0*	*0*	*0*	*0*	*1*	*335*	*20,362*
Photographic equipment	*1*	*350*	*132,570*	*1*	*363*	*166,755*	*0*	*0*	*0*	*2*	*713*	*299,325*
Lighter, Pens, Shavers, etc.	*4*	*2,353*	*177,615*	*1*	*189*	*378,800*	*0*	*0*	*0*	*5*	*2,542*	*556,416*
Others	*2*	*148*	*6,533*	*2*	*186*	*7,265*	*0*	*0*	*0*	*4*	*334*	*13,798*
Total	**224**	**87,888**	**8,610,399**	**185**	**29,361**	**4,194,719**	**7**	**1,718**	**108,706**	**416**	**118,427**	**12,913,824**

Source: SUFRAMA

c.2 Industrial Production and Trade

The total industrial output in the Industrial Pole of Manaus has grown by 31% between 2004 and 2008 to reach about 54.4 billion real or 30.2 billion US dollars. The major contribution to this industrial output comes from electric/electronic appliances, 2-wheels (motorbikes and bicycles), and chemical industries, totally accounting 65% of the total output in 2008.

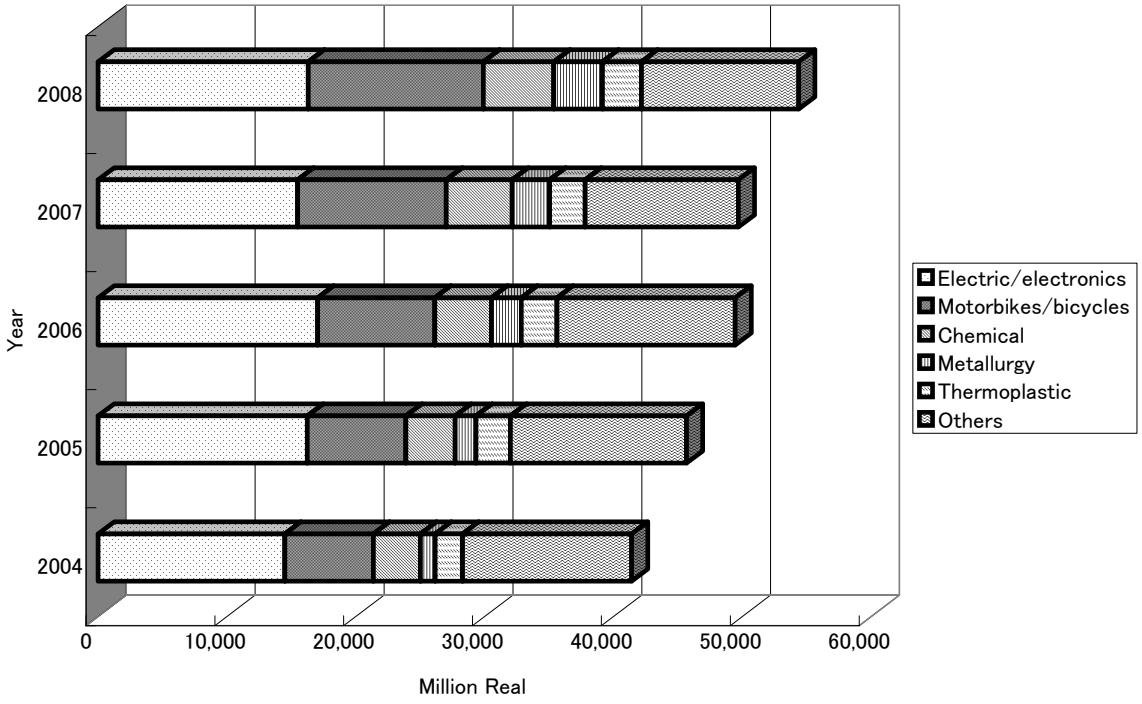


Figure 1-8 Trend of Industrial Output in the Industrial Pole of Manaus (2004-2008)

Source: SUFRAMA

The table below shows the trade balance of the Industrial Pole of Manaus in terms of overseas and domestic markets. Although PIM recorded trade deficit in overseas market, it gained enough trade surplus in the domestic market to gain net trade profit.

Table 1-12 Trade Balance of the Industrial Pole of Manaus (2004-2008)

(Unit: 1,000 Real)

Year	International Trade			Domestic (Interregional) Trade			Total Balance (G=C+F)
	Export (A)	Import (B)	Balance (C=A-B)	Export (D)	Import (E)	Balance (F=D-E)	
2004	3,162,613	10,984,923	-7,822,310	38,242,181	11,153,510	27,088,671	19,266,361
2005	4,922,147	11,520,976	-6,598,829	40,741,403	12,447,164	28,294,239	21,695,410
2006	3,227,608	12,871,664	-9,644,056	46,213,521	13,070,188	33,143,333	23,499,277
2007	2,017,806	12,229,762	-10,221,956	47,664,327	12,812,249	34,852,078	24,640,122
2008	2,176,119	15,602,186	-13,426,067	52,194,955	14,216,217	37,978,738	24,552,671

Source: SUFRAMA

The major contribution to foreign currency earnings through overseas export of the products in the Industrial Pole of Manaus is made by electric/electronic appliances, 2-wheels (motorbikes and bicycles), and chemical industries although the ratio of the export to the total industrial production output is less than 10% for all these industries in 2008. The industries recording a high percentage of product export are timber/lumber industry (45%) and manufacturers of articles for daily use (15%) such as lighters, pens, shavers, etc.

1.3.4 Superintendency of the Manaus Free Trade Zone (SUFRAMA)

a. Area of Supervision

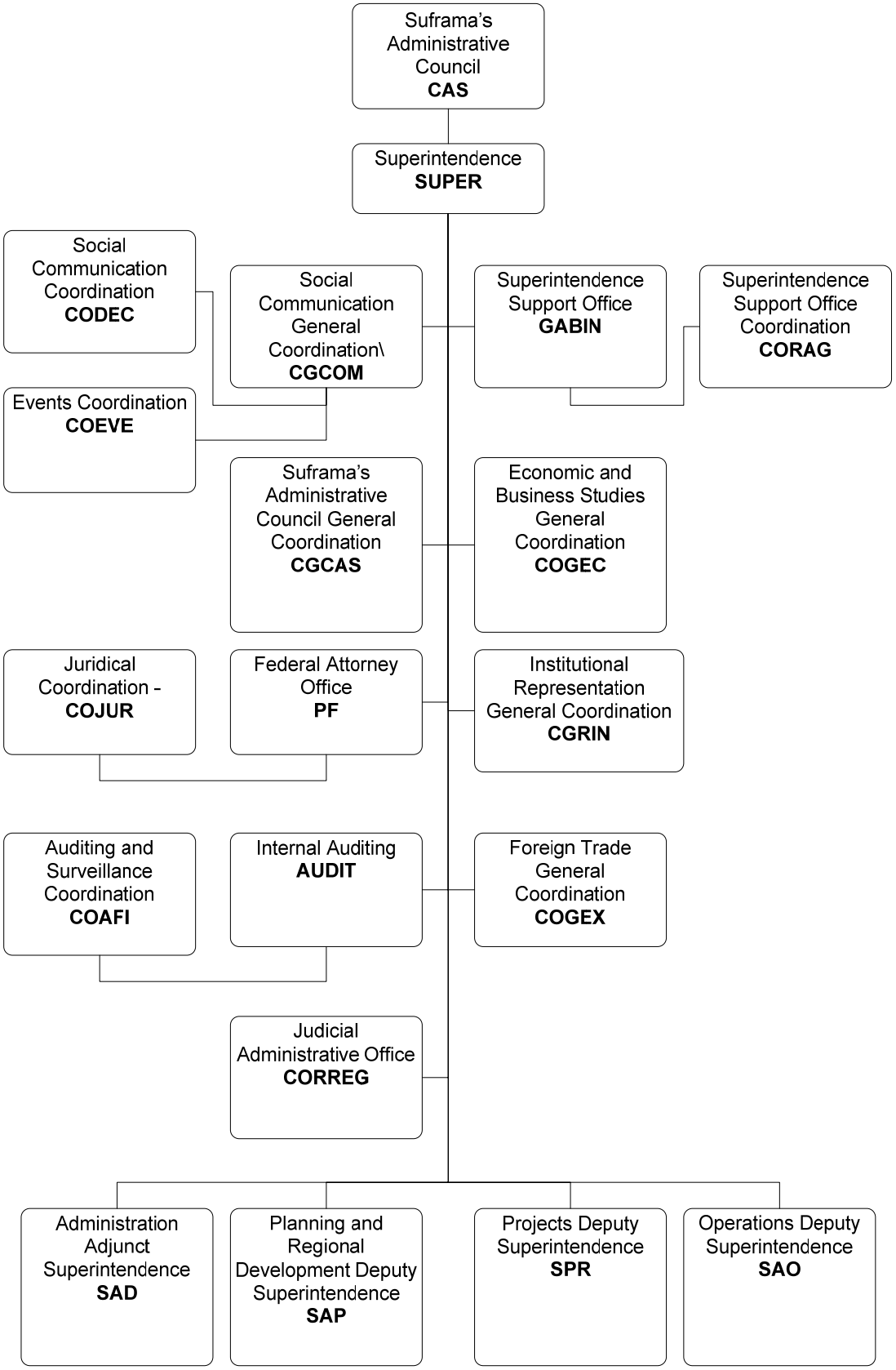
SUFRAMA is vitalizing the regional economy through creating employment opportunities and stimulating production toward socio-economic development not only in the MFZ in the State of Amazonas, but also in the other four states of the Occidental Amazon (Acre, Amapa, Rondonia, and Roraima).

b. Structure

As the figure below illustrates, there are four deputies under the Superintendent, each in charge of its own department: Administration Adjunct Superintendence (SAD), Planning and Regional Development Deputy Superintendence (SAP), Projects Deputy Superintendence (SPR), and Operations Deputy Superintendence (SAO), respectively. In addition to these four departments, there are nine coordinations and offices, such as Social Communication and Judicial Administration, directly below the Superintendent.

There is no unit at SUFRAMA in charge of industrial waste management, and therefore, the primary counterpart for this study is COGEX (Foreign Trade General Coordination)--one of the nine coordinations and offices directly under the Superintendent--which generally deals with all overseas technical cooperation and international cooperation.

However, as an output of this study, SUFRAMA has formed an Industrial Waste Management Group (IWM Group) dedicated to industrial waste management at SUFRAMA and three SUFRAMA officers, who have been assigned as counterpart members of this study since September 2009, joined the IWM Group. As of May 2010, no decision has been made as to which department the group will be attached, however, the group will be officially established within the 2010 fiscal year to strengthen the IWM system.



(Source) SUFRAMA

Figure 1-9: Organizational Structure of SUFRAMA

c. Personnel

SUFRAMA has a total of 1,354 officers and workers as of 2008, of which 356 are officially hired permanent public servants. SUFRAMA also outsource 936 administration officers, security and sanitation services, and other workers. There are also 40 trainees employed at SUFRAMA. In 2008, the total personnel expenditure at SUFRAMA for the above officers and workers amounted to R$ 77.5 million.

Table 1-13: Expenditure and Number of Personnel at SUFRAMA (2008)

Description	Number of Persons	Personnel Expenditure (Real)
Public servants working in the units	356	21,869,733.95
Temporarily hired public servants	16	1,314,295.45
Outsourced workers (security guards and janitors)	273	5,362,162,.81
Outsourced administrative workers	523	46,453,864.44
Other outsourced workers	140	1,762,820.17
Trainees	40	137,298.47
Public servants borrowed from other organizations	3	238,915.77
Public servants loaned to other organizations	3	325,522.51
Total	**1,354**	**77,464,613.59**

Source: CGDER, SAP, SUFRAMA (2008)

d. Fiscal Expenditures of SUFRAMA

The fiscal expenditure of SUFRAMA for six years, from 2003 to 2008, for development of the five states of the Occidental Amazon, including MFZ, as well as stimulus of various industrial sectors, was R$ 440 million. The following tables show the allocation of fiscal expenditure for each state and by sector. The largest expenditure went toward infrastructure development, accounting for some 73% of total expenditure for that period (2003~2008).

Table 1-14: Trend of SUFRAMA's Investment in PIM Development by State (2003-2008)

Unit: 1,000 real

States	2003	2004	2005	2006	2007	2008	Total
Acre	3,147	13,543	11,295	9,500	58,129	2,220	**97,834**
Amapa	0	8,400	415	0	2,300	9,000	**20,115**
Amazonas	3,410	35,964	10,547	16,123	28,192	1,800	**96,037**
Rondonia	0	18,450	11,053	4,900	25,145	3,870	**63,418**
Roraima	1,000	11,160	10,547	0	22,425	2,800	**47,932**
Entities	12,148	19,797	17,923	3,421	56,008	5,704	**115,002**
Total	**19,704**	**107,315**	**61,782**	**33,944**	**192,200**	**25,394**	**440,339**

Source: CGDER, SAP, SUFRAMA (2008)

Table 1-15: Trend in SUFRAMA's Investment in PIM Development by Sector (2003-2008)

Unit: 1,000 real

Types	2003	2004	2005	2006	2007	2008	Total
Production	0	1,939	2,135	4,191	5,562	5,200	**18,628**
Infrastructure	7,807	88,163	43,057	18,006	150,675	14,740	**323,447**
Investment Promotion	1,382	910	1,818	281	3,525	0	**7,917**
R & D	10,485	14,008	11,465	11,114	16,057	5,454	**68,584**
Human Resources Capacity Dept.	30	2,295	3,306	352	16,381	0	**22,363**
Total	**19,704**	**107,315**	**61,782**	**33,944**	**192,200**	**25,394**	**440,339**

Source: CGDER, SAP, SUFRAMA (2008)

1.3.5 Role and Duty of each Unit of SUFRAMA

a. The Administration Council of SUFRAMA (CAS)

The administration council of SUFRAMA should approve;

I. general guidelines for the elaboration of the annual and multi-annual work plans;
II. its internal regulations
III. the projects of the companies aiming for enjoying the Tax Incentives fixed in articles 7 and 9 of Decree-Law n. 288, from 1967, specifying the incentives to be gained by the company, as well as establish rules, demands, limitations and conditions for approval, monitoring and follow up of the said projects;
IV. indication for the nomination and dismissal of the Internal Auditing official;
V. the Internal Auditing of Annual Activities Plan
VI. general rules and criteria for the execution of plans, programs, projects, constructions and special services which the SUFRAMA is in charge of:
   1. covenants, agreements and contracts;
   2. credit and financing operations, including bearing the expenses of studies, services and constructions

The administration council of SUFRAMA should suggest the formation of technical teams for the analysis of specific subject.

b. Organizations directly below the Superintendent

b.1 The Superintendent Office (SUPER)

The Superintendent Office should

I. assist the Superintendent of SUFRAMA in its political and social representation;
II. be in charge of the preparation of the personal agenda of the Superintendent;
III. distribute and follow up the progress of documentation and processes holding interest to the Superintendent, under procedure in SUFRAMA;
IV. elaborate the Superintendent Office's Annual Activities Report; and
V. carry out other tasks committed to it by the Superintendent.

b.2 The Superintendent Supporting Office (GABIN)

The Superintendent Supporting Office should:

I. coordinate the elaboration and circulation of documents in the ambit of the Superintendent Office; and

II. provide the administrative unities of SUFRAMA with technical support to dispatch official communications.

b.3 The Social Communication General Coordination (CGCOM)

The Social Communication Coordination should:

I. plan, coordinate and supervise the social communication activities, publication, institutional divulgation, public relations, events and follow up of themes holding interest to SUFRAMA; and

II. elaborate the General Coordination Annual Activities Report.

b.3.1. The Social Communication Coordination (CODEC)

The Social Communication Coordination should:

I. elaborate and execute the Annual Communication Plan, in consonance with the guidelines defined by the Social Communication Secretariat of Republic Presidency;
II. announce to press in general, issues holding interest to SUFRAMA;
III. prepare and follow individual and collective interviews holding interest to SUFRAMA;
IV. produce and distribute institutional publications, internal and external, meant for the promotion and divulgation of the programs and actions of SUFRAMA;
V. produce and distribute printed and electronic clipping;
VI. elaborate speeches and audiovisual production of technical texts and lectures;
VII. elaborate and keep update the journalistic material in the web page of SUFRAMA;
VIII. plan, develop and execute the institutional publicity actions; and
IX. provide the other administrative unities of SUFRAMA with technical support, concerning the communication activities.

b.3.2. The Events Coordination (COEVE)

The Events Coordination should:

I. coordinate and accomplish the events holding interest to SUFRAMA;
II. Public of SUFRAMA;
III. assist the activities related to the ceremonial of SUFRAMA;
IV. assist the investors attraction missions;
V. assist the visits of importers and investors missions to Manaus Free Zone;
VI. assist the organization of events to divulgate Manaus Free Zone model;
VII. organize and coordinate the participation of SUFRAMA in fairs, exhibitions and other promotional events; and
VIII. assist the accomplishment of business round negotiations meant for the expansion of exports or the attraction of investments for the operational area of SUFRAMA.

b.4 SUFRAMA's Administration Council General Coordination (CGCAS)

SUFRAMA's Administration Council General Coordination should:

I. administratively assist the meetings of that Council, Sector Committees, Committees, Work Groups and other meetings designated to it by the Superintendent of SUFRAMA;

II. publish the decisions and deliberations of SUFRAMA's Administration Council;

III. carry out the control of the legislation and indications of representations of SUFRAMA in Collegiate Organizations, including the Administration and Fiscal Councils of State Companies, as well as keep such information updated in the website of SUFRAMA;

IV. elaborate the Annual Activities Report of the General Coordination; and

V. carry out other activities committed to it by the Superintendent.

b.5 The Economic and Business Studies General Coordination (COGEC)

The Economic and Business Studies General Coordination should:

I. assist the Superintendent in the elaboration of studies in economic and taxes incentives areas;
II. assist, in articulation with the Regional Development General Coordination, activities related to tourism sector, in partnership with the entities engaging the said sector; and
III. elaborate the Annual Activities Report of the General Coordination.

b.6 The Institutional Representation General Coordination (CGRIN)

I. The Institutional Representation General Coordination should:
II. represent SUFRAMA in Brasília;
III. assist the Superintendent and other personnel while on duty in the said location;
IV. promote and follow up the progress of subjects holding interest to SUFRAMA;
V. elaborate the Annual Activities Report of the General Coordination; and
VI. execute other competences the interest of SUFRAMA may demand.

b.7 The Foreign Trade General Coordination (COGEX)

The Foreign Trade General Coordination should:

I. formulate proposals of foreign trade programs meant for the operational area of SUFRAMA;
II. assist SUFRAMA in cooperation issues, technical assistance, covenants and international agreements, business round sessions, commercial missions, seminars, exports platforms, products distribution center, promotion of fairs and exhibitions;
III. represent SUFRAMA in discussions forums of Federal Government, pertinent to agreements negotiations, international treaties and cooperation;
IV. direct and follow up the exporter in issues pertinent to foreign trade activities; and
V. elaborate the Annual Activities Report of the General Coordination.

b.8 The Federal Attorney Office (PF)

The Federal Attorney Office, as an executing organization of Federal General Attorney Office should:

I. carry out the judicial and extrajudicial representation of SUFRAMA, operating in the lawsuits the autarchy may be the author, defendant, opponent or assistant;
II. provide the Superintendent and the unities of SUFRAMA with juridical assistance and consulting, applying whenever fit, the content of Complementary Law n. 73, from 10 February 1993;
III. assist the Superintendent with the internal control of the administrative legality of the acts to be practiced or already put into effective by him;
IV. fix, for the unities of SUFRAMA, the interpretation of the juridical order, when there is no normative orientation from Federal Government General Advocacy Office, nor from the Juridical Consulting of Development, Industry and Foreign Trade Ministry;

V. investigate liquidity and certitude of credits of any nature, inherent to the activities of SUFRAMA, registering them in active debt, for means of administrative or judicial charging;
VI. examine, issue and approve reports in the ambit of the Superintendence:
VII. the texts of tender edicts, such as the ones of the respective contracts or congener instruments, to be published and come into force;
VIII. the acts by which the unenforceability will be accredited, or decide to exempt the tender;
IX. the Resolutions, Ordinances, Public Consultation, Contract Terms (contracts, covenants, restriction agreement of the area, public alienation deeds and other congeners);
X. assist the elaboration and publishing of normative and interpretative acts, in articulation with the Unities of SUFRAMA;
XI. assist and orientate the unities of SUFRAMA with the information and fulfillment of judicial or administrative procedures and decisions;
XII. elaborate the Annual Activities Report of Federal Prosecutor's Office; and
XIII. update the webpage of SUFRAMA with the legislation of Manaus Free Zone.

b.9 The Juridical Coordination (COJUR)

The Juridical Coordination should:
I. coordinate the juridical consulting and assistance services executed by Federal Attorneys;
II. issue approval of juridical issues in general, related to the institutional purpose of SUFRAMA and the activities developed by its unities;
III. examine the content of administrative acts proposed by the unities of SUFRAMA, whenever they involve law issues;
IV. issue the Active Debts Registration document and the respective certificate, thus promoting the necessary registration;
V. analyze judicial and administrative procedures referring to the payment of precatories;
VI. analyze regularization processes of areas and alienation of real estates in the areas of Industrial District and Agricultural District of SUFRAMA; and
VII. carry out specific juridical issues studies.

b.10 The Internal Auditing (AUDIT)

The Internal Auditing should:
I. verify the fulfillment of accounting, financial and administrative rules in the ambit of SUFRAMA;
II. follow up the works of the internal and external control organizations;
III. follow up the elaboration and issue previous report about the annual accounting of SUFRAMA, as well as the special ones;
IV. propose actions in order to guarantee the legality of the acts and the reach of results, thus contributing to management improvement;
V. provide the managers of SUFRAMA with subsides for the internal control principles and rules, including the accountability;
VI. verify the consistency and authenticity of data and information to compose the account of the Republic President in the Federacy General Balance;
VII. provide the departments of SUFRAMA with previous and periodic guidance related to the execution of their activities; and
VIII – elaborate the Annual Activities Report of the General Coordination.

In the accomplishment of its competences, the Internal Auditing is administratively connected to the Administration Council in the terms of art. 15 of Decree n. 3.591, from 6 September 2000.

b.11 The Auditing and Monitoring Coordination (COAFI)

The Auditing and Monitoring Coordination should:

I – hold auditing and monitoring in the programs and actions contained in the Annual Work Plan;

II – evaluate the computerized systems and controls adopted in the ambit of SUFRAMA;

III – verify the consistency and authenticity of data and information to compose the accounts of the Republic President in the Federation General Balance;

IV – verify the accounts of people in charge of the management and application of funds supply resources, covenants and agreements, among others, as well as the use or safekeeping of public properties and money, in the ambit of SUFRAMA; and

V – follow up, evaluate and orientate the acts and facts of budget, financial and property management of the Autarchy, aiming for exercising the regular application and rational use of public properties and resources.

b.12 The Comptroller Office

The Comptroller Office should:

I – manage and execute the disciplinary investigation activities and other correction activities;

II - verify, in the interest of the corrective activity, data and information contained in the information systems of SUFRAMA;

III – verify the disciplinary aspects of fiscal deeds and other administrative procedures;

IV – examine and instruct disciplinary administrative lawsuits and other tasks about ethics and functional discipline to be submitted to the evaluation of regulating authorities;

V – evaluate, consult and express itself about issues related to duties, prohibitions and other issues about personnel ethics and discipline;

VI – verify complaints, representations and other tasks involved with personnel irregularities and promote the investigation by fulfilling the legal requirements;

VII – follow up, evaluate, execute and define criteria, methods and procedures for the disciplinary and corrective investigation activities;

VIII – request or carry out investigations, including taxes ones, request information, lawsuits and documents necessary for the investigation of the issue in its competence area;

IX – follow up the progress of judicial actions related to the corrective activities;

X – adopt preventive and repressive actions of personnel functional and disciplinary actions; and

XI – manage the information related to administrative acts - discipline.

c. The Administration Deputy Superintendence (SAD)

The Deputy Administration Superintendence should plan, coordinate and supervise the execution of the activities related to:

I – administrative organization and modernization federal systems, accounting, budget and financial execution, management of information and informatics resources, human resources and general services;

II – accountability of expenses and other responsibilities over public properties and values resulting in loss, deviation or another irregularity that may result in damage to treasury;

III – reprography services carried out by SUFRAMA, as well as follow up, monitoring and control of outsourced graphic services;

IV – maintenance and patrolling of Industrial and Agricultural Districts;
V - analysis, elaboration and monitoring of engineering and architecture projects related to public buildings under the responsibility of SUFRAMA;
VI – administration of on duty, retired and pensioner personnel of SUFRAMA;
VII – recruitment and development of human resources;
VIII – follow up and evaluation of SUFRAMA's budget proposal, together with the Planning Deputy Superintendence;
IX – budget, financial and property accounting of SUFRAMA;
X – revenue and expenditure, as well as use of the Financial Administration Integrated System of Federal Government;
XI – financial follow up of the administrative contracts of SUFRAMA;
XII - initiate Special Accounts Investigation;
XIII – purchasing of goods and services for SUFRAMA;
XIV – basic and/or executive projects and reference terms, together with the claimant area;
XV – management of equipment, materials and computer programs which constitute the technological infrastructure of the automatic support needed for the information cycle; and
XVI – institutional development, organization, quality, standardization and rationalization of work instruments, methods and procedures.

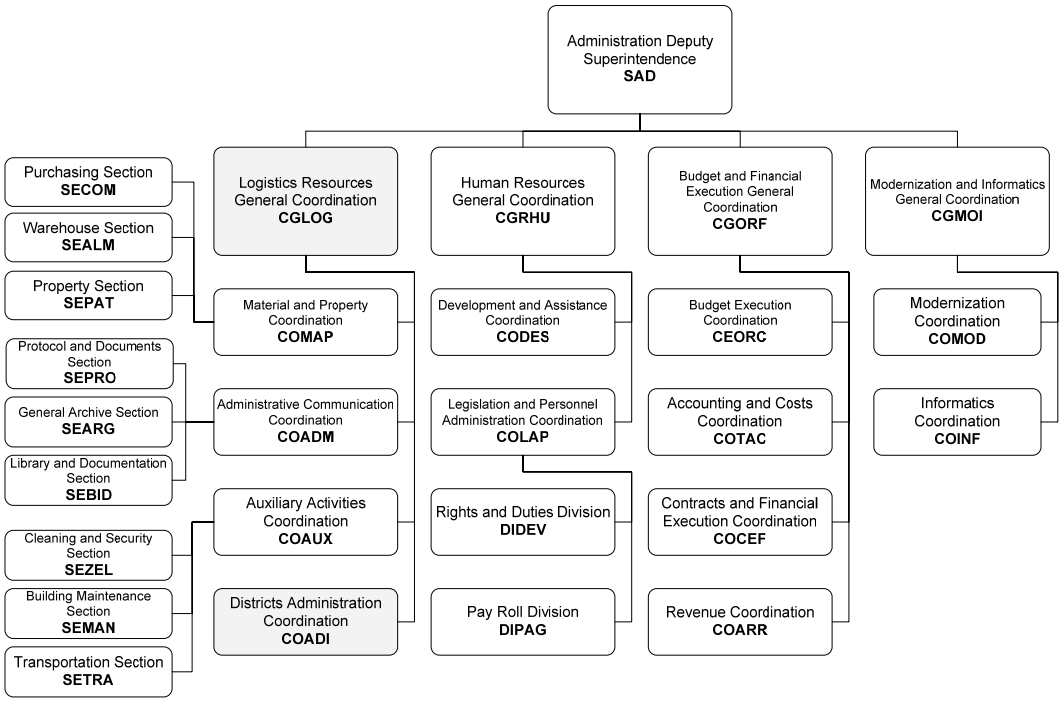


Figure 1-10: Organization Structure of Administration Deputy Superintendence (SAD)

c.1 The Logistic Resources General Coordination (CGLOG)

The Logistics Resources General Coordination should:
I - coordinate, supervise and control the execution of transportation activities, administrative communication, archive, telecommunication, cleaning, reception desk, library and documentation, budgets analysis and elaboration;

II – analyze engineering and architecture projects related to the premises of the Autarchy;
III – identify and promote the needs for stationeries and permanent materials, equipment and facilities;
IV – carry out the registration, control, inventory, maintenance and conservation of properties;
V – control the activities related to the maintenance of the infrastructure of Industrial and Agricultural Districts; and
VI – elaborate the Annual Activities Report of the General Coordination.

c.1.1. The Material and Property Coordination (COMAP)

The Material and Property Coordination should plan, organize, orientate and monitor the execution of the activities related to the management of material, warehouse, property and other tasks related to the area.

c.1.2. The Purchasing Section (SECOM)

The Purchasing Section should:
I – elaborate purchase schedule and provide the purchase of stationeries and permanent use materials;
II – provide the tender commission with information and/or specifications necessary for the purchasing of material and the contract of constructions and services;
III – elaborate and update the permanent equipment catalog; and
IV – organize and update the identification records of suppliers and vendors of constructions and services.

- The Warehouse Section (SEALM)

The Warehouse Section should:
I – standardize the distribution of material;
II – fulfill the request of material from the administrative unities;
III – carry out the physical and financial control of the purchased material, as well as those already distributed or in stock;
IV – elaborate every six months the inventory of the materials in stock;
V - attest, together with the competent department, the perfect functioning of the purchased equipment, before they are distributed to the administrative unities; and
VI – propose the purchase of stationary, regarding the stock replacement.

- The Property Section (SEPAT)

The Property Section should:
I - classify, register, access and control the properties of SUFRAMA;
II – provide the Accounting and Costs Coordination with the property variations of movables and real estate by incorporating and lessening as it may be the case;
III - elaborate, annually, the property inventory of both movables and real estate;
IV – propose the reuse, moving, alienation and other forms of annulling the properties considered as idle, irrecoverable and anti-economic;
V – provide the insurance of real estate and movables against possible damages; and
VI – control the legal documents of the real estate, engineering projects and technical specifications of the buildings of SUFRAMA.

c.1.3. The Administration Communication Coordination (COADM)

The Administrative Communication Coordination should execute the activities related to

protocol, documents filing, designation of tasks, publication of official acts, divulgation of administrative acts, binding, archive, reprography, telecommunications, library and documentation.

- The Protocol and Documents Moving Section (SEPRO)

The Protocol and Documents Moving Section should:
I - protocol, control and distribute, internally, the documentation meant for SUFRAMA;
II – fulfill the rules coming from Federal Government, when it refers to the documents protocol system;
III – formalize the filing of documents requested by the administrative unities according to the existing rules so such documents may be controlled;
IV – number ordinances, duties, service orders and declaration acts, after the signature of the competent authority;
V – provide the dispatch of documents issued by the administrative unities;
VI – execute and control the circulation of mailbags;
VII – provide the publication of official acts and other documents;
VIII – elaborate the Service Bulletin and provide its distribution;
IX – execute and control the reprography documents, of projects plants, requested by administrative unities; and
X – control the circulation of documents and lawsuits, providing information about the progress and location of them.

- The General Archive (SEARG)

The General Archive should:
I – execute and manage the fulfillment of the rules of technical procedures that govern the archived documents; and
II – keep the archive in adequate conditions for the safekeeping and conservation of the documents collection under its responsibility.

- The Library and Documents Section (SEBID)

The Library and Documents Section should:
I - collect, store and disseminate information holding interest for SUFRAMA;
II - receive, select, register, catalog and classify the bibliographic material holding interest for SUFRAMA;
III – organize and maintain the bibliographic and legislative catalog, as well as the collection of books and journals;
IV - identify, select and index the official acts holding interest for SUFRAMA;
V – provide users with their information needs;
VI – maintain services of books and journals borrowing and circulation, as well as the divulgation of information holding interest for SUFRAMA;
VII – promote studies aiming for integrating the services of the Library with other unities; and
VIII – maintain interchange of bibliographic material with other documents and information unities.

c.1.4. The Auxiliary Activities Coordination (COAUX)

The Auxiliary Activities Coordination should coordinate, supervise, control and monitor the execution of the activities related to building maintenance, conservation and installation of

equipment, vehicles, cleaning, patrolling and transportation.

- The Cleaning and Patrolling Section (SEZEL)

The Cleaning and Patrolling Section should:
I – execute the activities related to patrolling, conservation and cleaning of the facilities of SUFRAMA;
II – provide the execution of the furniture moving and circulation in the administrative unities;
III – maintain the property and execute activities related to the safety of people in the premises of SUFRAMA;
IV – coordinate and control the income and outgoing of vehicles and orientate the organization of the parking lot and traffic signals in the area of SUFRAMA; and
V – oversee the conservation of national symbols according to current legislation.

- The Building Maintenance Section (SEMAN)

The Building Maintenance Section should:
I – elaborate the building maintenance services schedule, with its respective specifications and budgets and arrange its execution;
II – check the material aiming for providing technical assistance;
III – provide the execution of carpentry, woodwork, painting, soldering, glassworks, brickworks and others related to the conservation of movables and real estate; and
IV – carry out the operation, maintenance and repair of the telecommunication equipment.

- The Transportation Section (SETRA)

The Transportation Section should:
I – follow up and monitor the contracts related to transportation services;
II – control the transportation requests and the income and outcome flow of vehicles working for the organization;
III – control the refueling activities and other services at the transportation companies hired; and
IV – make sure the internal rules and the transportation legislation are fulfilled.

c.1.5. The Districts Administration Coordination (COADI)

The Districts Administration Coordination should:
I – elaborate the basic services projects and engineering and architecture works of the buildings belonging to SUFRAMA;
II - supervise, schedule and carry out executives engineering and architecture construction services projects;
III – elaborate engineering and architecture budget projects;
IV – make available for the constituted commissions, reports of the beginning and conclusion of constructions, engineering constructions or services contracts signed with SUFRAMA;
V – follow up and monitor the activities related to maintenance contracts and safety of Industrial and Agricultural Districts;
VI – keep constant surveillance of Industrial and Agricultural Districts in order to avoid possible illegal settlements, non-authorized deforestations, disposal of wastes and irregular or non-authorized tenure;
VII – control and monitor the wastes standardized collection and transportation services, cargo and employees transportation vehicles parking lot, carried out by companies with

projects approved by SUFRAMA, installed within Industrial District;

VIII – fulfill the Industrial and Agricultural Districts Tenant Regulations and inform the competent unities about the detected irregularities;

IX – keep permanent monitoring of paving and horizontal and vertical signals conditions of Industrial and Agricultural Districts;

X – develop urbanization programs and projects, maintenance and preservation of green areas in Industrial and Agricultural Districts;

XI – propose changes and suggestions to the leasers holding the concession of public services related to the maintenance of Industrial and Agricultural districts;

XII – develop projects for the improvement and modernization of the roads in Industrial and Agricultural Districts;

XIII – elaborate and update projects aiming for contracting services related to the safety and surveillance of Industrial and Agricultural Districts; and

XIV – elaborate projects for the maintenance of the infrastructure of Industrial and Agricultural Districts, as of the priorities established by the competent areas and attested by the Superintendent.

c.2 The Human Resources General Coordination (CGRHU)

The Human Resources General Coordination should:

I - plan, coordinate, follow up, orientate and supervise the activities related to human resources policies, comprehending personnel administration, human resources development, social assistance and health care, according to guidelines coming from the central organization of Civil Personnel System;

II – propose guidelines and elaborate projects related to the development of SUFRAMA's human resources;

III – provide the Planning and Budget Schedule General Coordination with subsides for the elaboration of the budget proposal related to human resources area, as well as to agree on contracts and covenants;

IV – propitiate human resources needs supply, in the ambit of SUFRAMA;

V – keep permanent contact with regulating organizations and suchlike, aiming for the exchange of information related to human resources area; and

VI – elaborate the Annual Activities Report of the General Coordination.

c.2.1. The Employee Development and Assistance Coordination (CODES)

The Employee Development and Assistance Coordination should:

I - plan, coordinate, execute, control and evaluate the activities related to the human resources policies, programs and projects, as well as assistance to the employees;

II – plan and coordinate the activities related to the employees' functional evaluation;

III - plan and coordinate the activities related to the training of students in SUFRAMA;

IV – identify the needs for qualification and elaborate the human resources development annual schedule;

V – keep a data base of instructors and organizations promoting human resources qualification and development events;

VI – control and register certificates of courses, seminars and suchlike, carried out by SUFRAMA;

VII – follow up and evaluate the performance of employees egress from qualification courses;

VIII - include, exclude and change the records of qualification actions in the Qualification Follow up System;

IX – carry out surveys, establish procedures and prepare personnel improvement acts;
X – follow up and evaluate the performance of employees undergoing probationary training;
XI – carry out personnel psychosocial follow up, aiming for better adapting and integrating them;
XII – promote medical inspection aimed for approving or not health care leaves, accompany a family member, work accident, professional disease, pregnancy leave, body of physicians and others;
XIII – carry out or promote hiring and periodic examinations of the employees belonging to the Personnel of SUFRAMA;
XIV – develop activities meant for valorizing the employee and improving his life quality;
XV - promote, in partnership with social communication and information and informatics areas, the divulgation of subjects and news related to the benefits offered to the employees; and
XVI – constantly update the record of on-duty and off-duty employees, as well as the pensioners, of SUFRAMA, aiming for Health Care Insurance.

c.2.2. The Legislation and Personnel Administration Coordination (COLAP)

The Legislation and Personnel Administration Coordination should:
I - coordinate, supervise, control and monitor the execution of activities related to records, job titles and salaries, wages, advantages and benefits of the employees;
II – coordinate the activities related to the application of Human Resources legislation;
III – coordinate the activities related to pay roll of on-duty and off-duty employees, as well as pensioners;
IV – coordinate the execution of researches inherent to human resources legislation;
V – include in the Budget Data Integrated System, the expenditures with pay roll of on-duty and off-duty employees, as well as pensioners;
VI – verify and instruct the judicial processes and tasks related to personnel legislation, aiming for assisting the work of Federal Prosecutor's Office in the defense of the Nation in judicial procedures;
VII – elaborate the acts of designation and internal circulation of the employees of SUFRAMA; and
VIII – follow up the properties declaration delivery.

- The Rights and Duties Division (DIDEV)

The Rights and Duties Division should:
I - control, execute and update the acts and records of on-duty and off-duty employees, as well as pensioners of SUFRAMA;
II – prepare acts related to the admission, work and temporary or definitive dismissal of stable employees;
III - issue certificates, reports, declarations and maps of service length based on personnel data;
IV – prepare instructions to concede licenses;
V – control the annual vacation schedule informed by the several unities of SUFRAMA and adopt measures for monthly concessions;
VI – control and follow up the number of employees, the names and the vacancies existing in the personnel of SUFRAMA;
VII – verify and instruct processes for the reevaluation and concession of retirement and pensions, proposing those are sent to Federal Prosecutor's Office/AM, so they may be checked and approved;

VIII - include in the Concession Act Records System, the acts referring to the admission and layoff of stable employees, as well as concession of retirements and pensions;
IX – carry out researches, classifications, cataloguing and filing of the legislation applied to human resources;
X – verify and instruct processes which may involve rights, duties, advantages, appeals and requests to reconsider issues concerning the employees of SUFRAMA, related to human resources area; and
XI - receive, control and issue to its payment area, the requests and occurrences of natality assistance, replacements and others.

- The Pay Roll Division (DIPAG)

The Pay Roll Division should:
I - plan, control, elaborate pay rolls and keep updated the financial records of on-duty and off-duty employees, as well as the pensioners of SUFRAMA;
II - articulate, in the Human Resources Administration Integrated System, the issues concerning the pay rolls and other modules of the system; and
III - include, exclude and change the financial records of the on-duty and off-duty employees, as well as the pensioner ones, in the system.

c.3 The Budget and Financial Execution General Coordination (CGORF)

The Budget and Financial Execution General Coordination should:
I – assist the Planning and Budget Schedule Coordination to elaborate additional credit budgets plans and requests;
II – coordinate and follow up the execution of the budget and financial schedule;
III – coordinate the activities of accounting, costs, contracts and revenue; and
IV – elaborate the Annual Activities Report of the General Coordination.

c.3.1. The Budget Execution Coordination (CEORC)

The Budget Execution Coordination should:
I – assist the Planning and Budget Schedule Coordination to elaborate the budget schedule and the additional credit requests;
II – establish the budget procedures in the system, after approval and publication in the Federal Government's Official Journal, of the budget of SUFRAMA;
III – prepare the disbursement schedule, thus evaluating its execution;
IV – consolidate the estimative of the total revenue and follow up its accomplishment;
V – inform the available balance and budget limits to the requesting unities;
VI - issue mortgaging, decentralizations and credits and annulations authorized by the Expenses Ordainer;
VII – follow up the budget execution, elaborate and keep updated the budget controls; and
VIII – estimate and re-estimate the revenue, providing the Planning and Budget Schedule General Coordination with their results.

c.3.2. The Accounting and Costs Coordination (COTAC)

The Accounting and Costs Coordination should:
I - coordinate, orientate and execute the activities related to the financial and accounting operations of the organization;
II - control and analyze the expenses and promote their accounting classification;
III – make bank notices compatible with the amounts informed in the report supplied by the

Financial Agent;
IV – organize the documents meant for internal and external auditing;
V – elaborate the report of bank availabilities;
VI – register the revenues according to the daily conformities in the system;
VII – follow up the financial revenue of SUFRAMA;
VIII – analyze the balance sheets and analytical demonstrations, journals and the balance of SUFRAMA;
IX – attend to accounting meetings;
X – regularize the accounting inconsistencies;
XI – analyze the concessions of funds supply, as well as the accountability; and
XII – carry out the records and their updates related to the Informative Records of Non-Paid Credits and the Covenants Unified Record.

c.3.3. The Contracts and Financial Execution Coordination (COCEF)

The Contracts and Financial Execution Coordination should:
I – control the financial execution of contracts;
II – request from the administrative unities or commissions in charge, whenever necessary,

c.3.4. The Revenue Coordination (COAPR)

The Revenue Coordination should:
I – carry out the activities related to the revenue and charging of Administrative Services Fee owed due to the operational services rendered by SUFRAMA;
II – analyze and control the processes of debts parcels related to Administrative Services Fee;
III – analyze and issue report in the processes of reimbursement of Administrative Services Fee, whenever fit, based on the technical subsidies provided by the respective Administrative Unities;
IV – estimate and follow up the revenues of SUFRAMA's operational services; and
V – issue monthly reports of revenue and charging balances and parceled debts of SUFRAMA.

c.4 The Modernization and Informatics General Coordination (CGMOI)

The Modernization and Informatics General Coordination should:
I - plan, develop and control the activities related to the areas of organization and methods, informatics and quality, in the ambit of SUFRAMA;
II – register and control the companies subscribed in SUFRAMA which aim for accessing the data base of SUFRAMA; and
III – elaborate the Annual Activities Report of General Coordination.

c.4.1. The Modernization Coordination (COMOD)

The Modernization Coordination should:
I – diagnose and analyze the necessities for optimization of methods and work processes in the administrative unities of SUFRAMA;
II – elaborate the projects of physical arrangement and follow up their execution;
III – elaborate and evaluate the administrative rules and procedures;
IV – elaborate the proposal, whenever necessary, for the adequacy of the regimental structure and the internal regiment to the attributions enforced by pertinent legislation or standardization;
V – study and propose measures for the debureaucratization of administrative methods and

processes and control of SUFRAMA;
VI – participate in projects which may involve modernization

c.4.2. The Informatics Coordination (COINF)

The Informatics Coordination should:
I - propose, follow up and monitor the contract and execution of informatics services;
II - coordinate, administrate and implement information technology in SUFRAMA;
III – guarantee the maintenance of informatics equipment;
IV – carry out studies and researches aiming for identifying the necessity of implementing and optimizing computerized systems and new informatics equipment solutions;
V – control and coordinate the utilization and allocation of informatics equipment;
VI - install, test and optimize the basic programs for the operation of informatics equipment;
VII – develop and implement computerized systems for the treatment of information in SUFRAMA;
VIII – structure, elaborate, maintain and administrate the site of SUFRAMA both in the Internet and Intranet; and
IX – participate in projects which may involve informatics activities in SUFRAMA.

d. The Planning and Regional Development Deputy Superintendence (SAP)

The Planning and Regional Development Deputy Superintendence should plan, coordinate and supervise the execution of activities related to:
I – management of the planning and budget schedule system of the entity;
II - formulation, implementation and evaluation of plans and programs meant for regional development, in consonance with national policies;
III – fulfillment and follow up of the covenants signed by SUFRAMA, as well as the analysis of the accounting of the wired funds;
IV - formulation, implementation and evaluation of programs and projects meant for the development of science, technology and innovation, in the working area of SUFRAMA, in articulation with the Ministry of Science and Technology and other public and private entities;
V – implantation of competitive intelligence processes and knowledge management in SUFRAMA;
VI – formulation of studies, projects and programs related to regional planning and development;
VII - implementation, direct or indirectly, of activities related to biotechnology research and development projects;
VIII – evaluation of plans and programs aiming for developing the Bio-industry, thus increasing the opportunities of investments in the Amazon, taking advantage of the direct or indirect management of the infrastructure of the Amazon Biotechnology Center - CBA, by means of covenant or other instrument;
IX – articulation of public sector interests, private sector and scientific community to incentive the sustainable exploration of Amazonian biodiversity;
X – formulation of studies for the incorporation of technology and innovation for the productive activities of Manaus Industrial Pole - MIP, aiming for its strengthening, mainly in the areas of microelectronics, nanotechnology, micromechanics and strategic management; and
XI – articulation of partnerships for the structuring of local science, technology and innovation areas systems in the operational area of SUFRAMA.

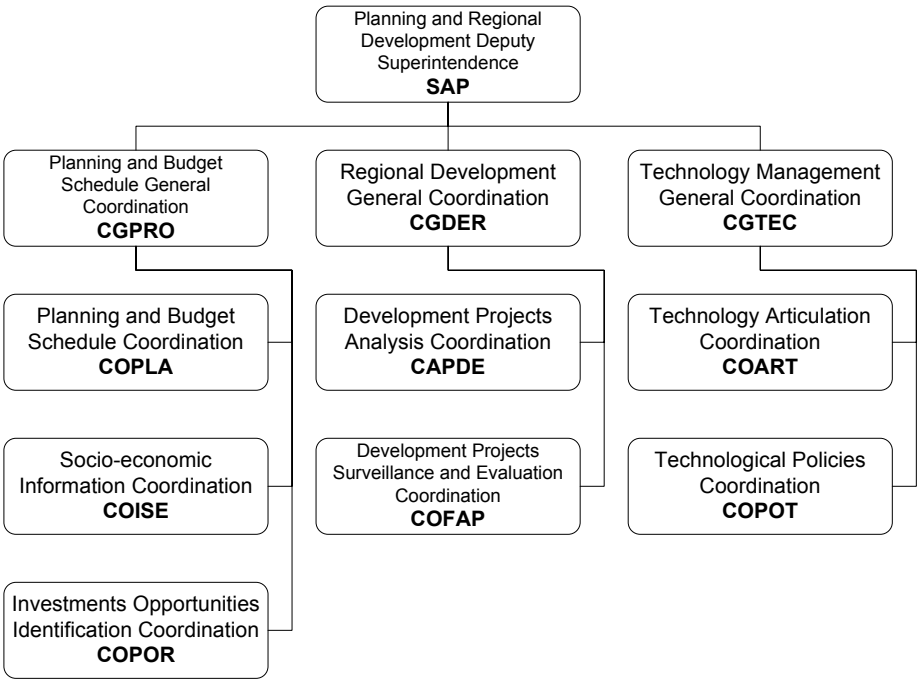


Figure 1-11: Organization Structure of Planning and Regional Development Deputy Superintendence (SAP)

d.1 The Planning and Budget Schedule General Coordination (CGPRO)

The Planning and Budget Schedule General Coordination should:

I – coordinate the activities related to the Strategic Planning of SUFRAMA;

II – coordinate the institutional planning system of SUFRAMA;

III – articulate with the unities of SUFRAMA, with Development, Industry and Trade Ministry and suchlike institutions, aiming for the planning process integration;

IV – coordinate and consolidate the elaboration of institutional plans and programs arisen from the information of the administrative unities;

V – assist the Regional development General Coordination in the elaboration of the programs and plans related to the regional development policy of the states comprised by SUFRAMA;

VI – follow up the implantation of strategic areas per sector;

VII – support and develop studies to subside the definition of public policies in the working area of SUFRAMA;

VIII – implant follow up and evaluation systems of the programs under execution;

IX – create operational mechanisms which may enable the improvement of budget schedule;

X – promote the regional potentialities and attract new investors to the region;

XI – identify the needs for investment in infrastructure and propose improvement actions in the existing ones, aiming for incrementing the systemic competitiveness for regional potentialities;

XII – coordinate the elaboration of the budget proposal of SUFRAMA, together with the Budget and Financial Execution General Coordination;

XIII – assist the Planning Central Committee and Administrative Coordination;

XIV – organize and maintain the information system of SUFRAMA, referring to its operational area; and

XV – elaborate the Annual Activities Report of the General Coordination, as well as SUFRAMA's .

d.1.1. The Planning and Budget Schedule Coordination (COPLA)

The Planning and Budget Schedule Coordination should:
I – execute the activities related to the Strategic Planning of SUFRAMA;
II - elaborate, follow up and evaluate the institutional planning;
III - elaborate, consolidate and revise the plans and programs for the operational area of SUFRAMA, based on the information of the administrative unities;
IV – follow up, evaluate and produce management information;
V – elaborate and systemize studies linked to planning;
VI – follow up, systemize and issue reports referring to the Operational Annual Plan;
VII – operate the basic rules of the Planning and Administrative Coordination System;
VIII – elaborate the budget proposal and the additional credits requests, together with the Budget Execution Coordination and follow up its approval;
IX – register the requests of budget credits and additional of SUFRAMA;
X – follow up the research, development and technological innovation activities, aiming for promoting investments meant for regional potentialities, together with the Technological Management General Coordination; and
XI – elaborate activities and management reports, based on the Annual Reports of the administrative unities of SUFRAMA.

d.1.2. The Socio-Economic Information Coordination (COISE)

The Socio-Economic Information Coordination should:
I – search for socio-economic information holding interest for SUFRAMA, thus producing its indicators;
II – coordinate the execution of works meant for statistical controls;
III – make available socio-economic information related to the operations of SUFRAMA;
IV – produce and keep updated the Profile of the Companies with Projects Approved by SUFRAMA; and
V – organize and keep updated the information system of the autarchy, meant for its operational area.

d.1.3. The Investment Opportunities Identification Coordination (COPOR)

The Investments Opportunities Identification Coordination should:
I – execute and keep updated the data base of the products competitiveness studies, activities and services related to regional potentialities;
II – develop actions in the area of investments and business opportunities promotion, meant for regional potentialities;
III – keep information updated about the economic and social infrastructure in the region, in order to make the attraction of investments meant for regional potentialities feasible;
IV – keep an update record of the main existing infrastructure, in order to subside the Coordination of Development Projects Analysis to analyze regional development projects;
V – join the follow up of research actions, technological innovation and development, aiming for promoting investments and business opportunities meant for regional potentialities;
VI – identify the setbacks for public and private investments, mainly at the small and medium-sized companies, as well as suggest improvement solutions; and
VII – keep and divulgate permanent information related to the investments promotion and business opportunities.

d.2 The Regional Development General Coordination (CGDER)

The Regional Development General Coordination should:

I – subside the Planning and Budget Schedule General Coordination in the elaboration of the plans and programs related to region development policy of the states within SUFRAMA's operational area;

II – articulate with organizations and entities, partnerships aiming for elaborating, following up and executing development projects for the states within the operational area of SUFRAMA;

III – provide the Planning and Budget Schedule General Coordination with data and information of the results of development projects/plans results of the states, aiming for their schedule and divulgation;

IV – evaluate the results of the Development Projects of the States within the operational area of SUFRAMA;

V – assist and develop studies and researches aiming for contributing towards the Occidental Amazon sustainable development;

VI – analyze and follow up the execution of the covenants with the Agricultural Projects Analysis and Follow up General Coordination and the Technological Management General Coordination in their respective operational areas;

VII – coordinate the Resources Request Analysis Group; and

VIII – elaborate the Annual Activities Report of the General Coordination.

d.2.1. The Development Projects Analysis Coordination (CAPDE)

The Development Projects Analysis Coordination should:

I – assist the Planning and Budget Schedule Coordination to elaborate the institutional planning with data and information of studies and Development Plans for the States of Occidental Amazon and the Free Trade Area of Macapá/Santana/AP;

II – assist the Investments Opportunities Identification Coordination with data and information of the results of the implementation of the States development plans and projects;

III – elaborate economic feasibility studies of the development projects in the States within the operational area of SUFRAMA;

IV – analyze the projects presented aiming for conceding financial support;

V – analyze, follow up and evaluate proposal related to Development Plans and Projects of Occidental Amazon States and the Free Trade Area of Macapá/Santana/AP;

VI – articulate with regional development organizations of regional development, funding, research, extension and teaching, aiming for maintaining updated information about productive activities and infrastructure projects in the region; and

VII – formalize covenants and provide funds release authorizations.

d.2.2. The Development Projects Monitoring and Evaluation Coordination (COFAP)

The Development Projects Monitoring and Evaluation Coordination should:

I – follow up the physical and financial execution of the signed agreements;

II – keep updated the records of the covenants in the system;

III – analyze the Accounting of the covenants;

IV – carry out socio-economic evaluation of approved covenants;

V – create and keep the socio-economic indicators of the evaluated projects;

VI – monitor the investments carried out by SUFRAMA aiming for guaranteeing the continuity of the objectives proposed in the financed projects; and

VII – elaborate the Annual Activities Report of the General Coordination.

d.3 The Technological Management General Coordination (CGTEC)

The Technological Management General Coordination should:

I – follow up and evaluate, together with the Development and Industry and Foreign Trade Ministry and the Science and Technology Ministry, the fulfillment of the obligations of the companies which produce informatics goods or services, as for the application of investments in Research and Development - R&D;

II – assist the Committee of Research and Development Activities in the Amazon;

III – assist the Regional Development General Coordination in the analysis and follow up of the execution of the covenants related to the application of funds in intellectual capital, in its competence area;

IV - assist, technically, participations of SUFRAMA in forums, sector chambers, seminars, inter-institutional alliances related to technology and other events of the same nature;

V – assist in a direct or indirect way, the activities related to biotechnology research and development projects;

VI – assist the actions meant for Bioindustry development, thus incrementing the investment opportunities in the Amazon;

VII – assist in a direct or indirect way, actions meant for incorporating technology or innovation to the productive activities of Manaus Industrial Pole - MIP, aiming for its strengthening, specially in the areas of microelectronics, nanotechnology, micromechanics and strategic management;

VIII – assist the structuring and strengthening actions of local science, technology and innovation systems in the operational area of SUFRAMA;

IX – induce the technological innovation culture in the strategies of micro and small-sized companies, aiming for their consolidation;

X – induce and participate in the establishment of partnerships among public and private institutions, articulating knowledge networks, strategies, alliances and corporative actions, aiming for incrementing the technological dynamics of productive sector;

XI – stimulate the creation of technologically based companies;

XII – stimulate and coordinate the accomplishment of technological platforms for the definition of cooperative projects which may stimulate the productive chains in articulation with the Regional Development General Coordination, Planning and Budget Schedule General Coordination, Industrial Projects Analysis General Coordination and Agricultural Projects Analysis and Follow up General Coordination; and

XIII – elaborate the Annual Activities Report of the General Coordination.

d.3.1. The Technological Articulation Coordination (COART)

The Technological Articulation Coordination should:

I – carry out articulation actions with state governments and regional policies federal organizations, as well as representative private institutions, registering the follow up of regional and national technological policies;

II – stimulate actions which may enable the insertion of technological and innovation variables into the strategies of the companies within the operational area of SUFRAMA;

III – stimulate universities and research centers to guide their actions by the demands of productive sector companies;

IV – induce the holding of seminars and other events about technology and innovation, holding interest to productive sector;

V - monitor and disseminate technological opportunities and information; and

VI – carry out technological prospecting studies.

d.3.2. The Technological Policies Coordination (COPOT)

The Technological Policies Coordination should:

I – promote the implementation of technological and innovation development policies in articulation with institutional organizations;

II – propose the definition of priority programs for the reception of funds arisen from Law n. 10.176, from 11 January 2001, as well as prior legislation;

III – orientate investments in Research and Development - R&D of the companies of Manaus Industrial Pole, by defining priority programs;

IV – identify and stimulate mechanisms to finance research projects in both master and doctor degree levels aiming for increasing the technological qualification of the companies;

V – stimulate the academia–company integration, aiming for increasing the technological innovation opportunities; and

VI – follow up, monitor and evaluate the results of the applications of funds related to the investments in Research and Development - R&D, making information available to the Industrial Processes Analysis Coordination.

e. The Projects Deputy Superintendence (SPR)

The Projects Deputy Superintendence should plan, coordinate and supervise the execution of the activities related to:

I – analysis of industrial, agricultural and services projects aiming for conceding Tax Incentives administrated by SUFRAMA;

II – analysis and approval of the imported inputs list meant for the industrialization of products in Manaus Free Zone;

III – follow up, surveillance and evaluation of industrial, agricultural and services projects;

IV – administration of the occupation of areas within Industrial and Agricultural Districts;

V – analysis and surveillance of engineering and architecture projects related to constructions in areas of Marechal Castelo Branco Industrial District;

VI – studies and researches meant for subsiding the industrial policy for both Manaus Industrial Pole and the Occidental Amazon;

VII – studies and researches meant for subsiding the agroindustrial and forestry policy for the Agricultural District of Manaus Free Zone and for the Occidental Amazon; and

VIII – attraction of investments for Manaus Industrial Pole and the Agricultural District of Manaus Free Zone.

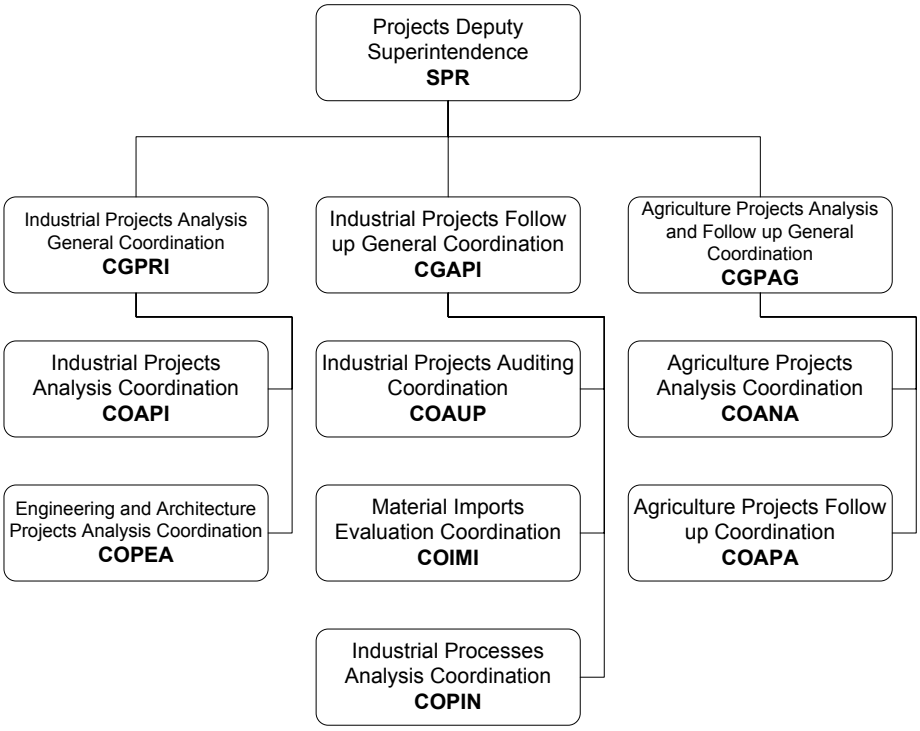


Figure 1-12: Organization Structure of Projects Deputy Superintendence (SPR)

e.1 The Industrial Projects Analysis General Coordination (CGPRI)

The Industrial Projects Analysis General Coordination should:

I – coordinate the investors industrial projects analysis, aiming for the concession of the incentives foreseen by own legislation;

II – participate in studies and researches meant for subsiding the industrial policy for Manaus Industrial Pole and Occidental Amazon;

III – participate in the process of attracting investments for Manaus Industrial Pole;

IV - analyze, follow up and monitor the respective engineering and architecture projects, aiming for controlling the areas; and

V – elaborate the Annual Activities Report of the General Coordination.

e.1.1. The Industrial Projects Analysis Coordination (COAPI)

The Industrial Projects Analysis Coordination should:

I – analyze industrial and services projects aiming for obtaining the incentives administrated by SUFRAMA, according to the current guidelines, rules and technical standards;

II – propose rules and technical standards for the presentation of industrial and services projects analysis;

III – hold and participate in studies and researches aimed for subsiding the industrial policy for Manaus Industrial Pole and the Occidental Amazon; and

IV – execute actions related to the attraction of investments for Manaus Industrial Pole.

e.1.2. The Engineering and Architecture Projects Analysis Coordination (COPEA)

The Engineering and Architecture Projects Analysis Coordination should:

I – propose rules, guidelines and technical standards for the use and occupation of land properties meant for the implantation of industries, service companies and other entities in

Manaus Industrial District;

II – control the occupation of land properties in Manaus Industrial District, as per its specific purpose, thus fulfilling the industrial demands of service companies and other entities;

III - analyze, follow up and monitor the implantation of engineering and architecture projects of the industries, service companies and other entities in Manaus Industrial District;

IV – control the land areas meant for the installation of industries, service companies and other entities, in Manaus Industrial District;

V – follow up and monitor the fulfillment of Technical Rules and the engineering and architecture projects of the industries, service companies and other entities in Manaus Industrial District, as they develop their activities so it may be either updated or appropriate, whenever necessary;

VI – follow up and monitor, complementarily to regulating public organizations, the fulfillment of environmental legislation by industries, service companies and other entities in Manaus Industrial District; and

VII – hold and participate in studies and researches aiming for subsiding the environmental control policy in Manaus Industrial District.

e.2 The Industrial Projects Follow up General Coordination (CGAPI)

The Industrial Projects Follow up General Coordination should:

I – coordinate the follow up and monitoring of the industrial projects approved by SUFRAMA;

II – coordinate the activities related to the control of the conformity of imports of raw-materials, intermediate products, secondary products and packaging, components and other inputs used in the productive process of the products contained in the said projects;

III – coordinate the accomplishment of studies and researches necessary for the proposition of rules and technical standards for the surveillance of industrial projects which benefit from the incentives administrated by SUFRAMA;

IV – coordinate studies for the setting up and evaluation of the Productive Processes conformity; and

V – elaborate the Annual Activities Report of the General Coordination.

e.2.1. The Industrial Projects Auditing Coordination (COAUP)

The Industrial Projects Auditing Coordination should:

I – follow up and monitor industrial projects approved according to the current guidelines, rules and technical standards, making them available to the Technological Policies Coordination;

II – hold studies and researches necessary for the proposition of rules and technical standards for the surveillance of industrial projects which benefit from the incentives administrated by SUFRAMA; and

III – follow up and evaluate the fulfillment of the basic productive process of the companies holding approved industrial projects.

e.2.2. The Material Imports Evaluation Coordination (COIMI)

The Inputs Imports Evaluation Coordination should:

I - analyze, attest and propose conformity standards for the imports of raw-materials, intermediate products, secondary materials and packaging, components and other inputs to the respective productive processes of products which benefit from the incentives; and

II – control and elaborate the records referring to legal restrictions or exceptions, in own modules, of the approval system of inputs imports meant for the industrialization of

products in Manaus Free Zone.

e.2.3. The Industrial Process Analysis Coordination (COPIN)

The Industrial Processes Analysis Coordination should:
I – carry out studies and researches necessary for the proposition to set up basic productive processes, according to current legislation; and
II – analyze the non-inherent industrial projects follow up parameters directly to the other Coordinations.

e.3 The Agricultural Projects Analysis and Follow up General Coordination (COPAG)

The Agricultural Projects Analysis and Follow up General Coordination should:
I – implement and coordinate the actions foreseen in the policies of SUFRAMA for the agricultural sector;
II – analyze, follow up and evaluate technical-economic and agroindustrial projects;
III – assist the Regional Development General Coordination in the analysis and follow up of the execution of covenants in its respective competence area;
IV – participate in the Investments Attraction Process for the Agricultural District of Manaus Free Zone; and
V – elaborate the Annual Activities Report of the General Coordination.

e.3.1. The Agricultural Projects Analysis Coordination (COANA)

The Agricultural Projects Analysis Coordination should:
I – elaborate and participate in agro-industrial plans, programs and projects related to them, sector diagnosis and projects profiles, as well as feasibility studies carried out by SUFRAMA, aiming for the development of the agricultural sector;
II – execute the actions related to the attraction of investments for the Agricultural District of Manaus Free Zone;
III – propose rules and technical standards for the presentation and analysis of agroindustrial projects;
IV – analyze forestry and agroindustrial projects aiming for obtaining incentives administrated by SUFRAMA, according to the current guidelines, rules and technical standards;
V – analyze rural engineering projects and topographic surveys of the land properties of the entrepreneurs which intend to settle down in the Agricultural District;
VI – regularize the occupation situation of forestry and agroindustrial activities in the expansion area of Manaus Industrial District; and
VII – elaborate and control the documentation necessary for the alienation reserve of the occupied areas in the Agricultural District and in the Industrial District expansion area.

e.3.2. The Agricultural Projects Follow up Coordination (COAPA)

The Agricultural Projects Follow up Coordination should:
I – propose rules and technical standards to follow up and monitor the forestry and agroindustrial plans, programs and projects;
II - participate, in its competence area, together with the Agricultural Projects Analysis Coordination, in the analysis processes of the projects and programs submitted to SUFRAMA;
III – indicate in the field, the areas intended for reserve or alienation to be occupied in the

Agricultural District or regularized in Industrial District expansion area and keep the control of their occupation;

IV – follow in a quantitative and qualitative way, the execution of the implementation of forestry, agroindustrial and rural engineering projects approved by SUFRAMA, according to the current guidelines, rules and technical standards; and

V – issue reports and awards with the evaluation of the parameters which may influence the implantation of forestry, agroindustrial and rural engineering projects, from the technical, economic, financial, administrative, social and environmental points of view.

f. The Operations Deputy Superintendence (SAO)

The Operations Deputy Superintendence should plan, coordinate and supervise the execution of activities related to:

I – control of physical and documental income of national goods and the documents of foreign goods, holding incentives in the operational area of SUFRAMA;

II – registration and licensing of companies which may claim for the tax incentives administrated by SUFRAMA;

III – administration of the final operations of the decentralized unities, in articulation with the other unities of SUFRAMA;

IV – follow up of the operation of goods warehouse activities in the operational area of SUFRAMA; and

V - analysis, control, follow up and evaluation of the operation of processes related to special exports programs.

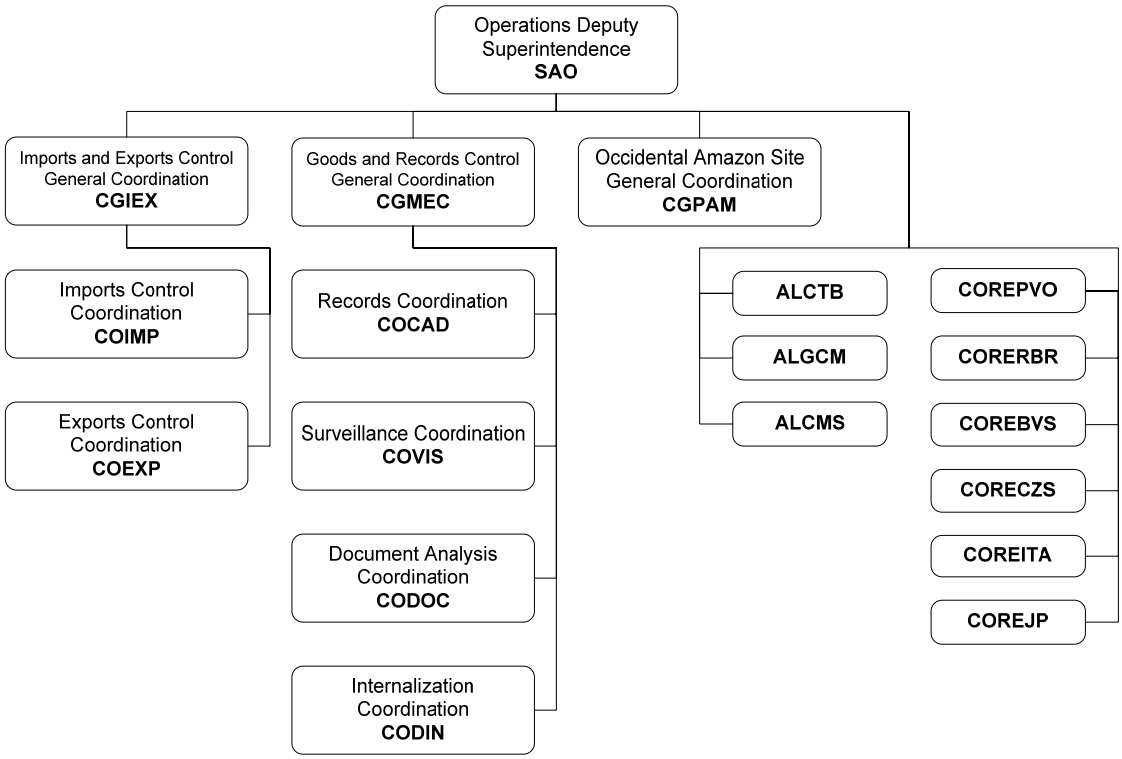


Figure 1-13: Organization Structure of Operations Deputy Superintendence (SAO)

f.1 The Import and Export Control General Coordination (CGIEX)

The Imports and Exports Control General Coordination should:

I – orientate and control the documents income and foreign goods movement, holding tax incentives administrated by SUFRAMA;

II – follow the operation of the processes and programs meant for stimulating and incrementing exports; and

III – elaborate the Annual Activities Report of the General Coordination.

f.1.1. The Import Control Coordination (COIMP)

The Imports Control Coordination should:

I – control the imported goods income documentation according to the pertinent legislation;

II – analyze and control the documentation of imported goods transfer under taxes suspension regimen among Manaus Free Zone, the Free Trade Areas and the Occidental Amazon;

III – analyze the goods imports licensing requests, except those meant for the industries holding a project approved by SUFRAMA, whose goods are meant either for industrialization or commercialization, respectively;

IV – register and control the imports limits covered by the Occidental Amazon Exports Special Program;

V – keep updated integration procedures between SUFRAMA and SISCOMEX - Imports, pertinent to the imported goods under the regimens administrated by SUFRAMA;

VI – input and keep updated the data base with the necessary registrations for the approval of SUFRAMA for the imports licensing requests; and

VII – subside other departments of SUFRAMA, whenever fit, in the analysis of the issues related to goods imports by means of technical information and/or availability of documents.

f.1.2. The Exports Control Coordination (COEXP)

The Exports Control Coordination should:

I - analyze, control, follow up and evaluate the operation of the processes related to exports special programs;

II – identify official information sources which may subside, stimulate and increment the exports in the operational area of SUFRAMA;

III – identify and improve the foreign trade instruments administrated by SUFRAMA, aiming for increasing the exports volume and the diversification of markets;

IV – implement keep information, in a data base, about exports processes and programs; and

V – subside other departments of SUFRAMA, whenever fit, in the analysis of issues related to exports, be means of technical information and availability of documents.

f.2 The Goods and Records Control General Coordination (CGMEC)

The Goods and Records Control General Coordination should:

I – orientate and control the activities related to, re-registration, records reactivation of the beneficiary companies and entities, registration and approval of licensed companies;

II – orientate and control the income and movement of national goods in the areas holding tax incentives administrated by SUFRAMA; and

III – elaborate the Annual Activities report of the General Coordination.

f.2.1. The Registration Coordination (COCAD)

The Registration Coordination should:

I – carry out registration, re-registration, records activation, licensing, relicensing and

approval of the companies/entities holding benefits and licenses, in its operational area, by receiving, analyzing, verifying, controlling and filing the documentation demanded by the current legislation;

II – carry out inspection in the companies under registration process in conformity with current laws;

III – qualify companies for the presentation of projects and technical reports of independent audit, in conformity with current legislation; and

IV – keep the Records Data Base updated and make the pertinent information of the companies and entities and licensed registered companies available.

f.2.2. The Inspection Coordination (COVIS)

The Inspection Coordination should:

I - orientate, control and execute the activities related to national goods inspection, coming into Manaus Free Zone, in the Centralized Stations;

II – follow up and control the carried out physical inspections, as well as forward the pertinent fiscal documents to the processing unity, after the inspection is carried out;

III – analyze the technical inspection requests, issuing information and approval according to current legislation, as well as adopting the necessary procedures so the customs clearance may be done;

IV – analyze and issue technical information and approval in processes and tasks related to national goods customs clearance; and

V – elaborate and provide service schedule for the Inspection Centralized Station.

f.2.3. The Document Analysis Coordination (CODOC)

The Document Analysis Coordination should:

I – analyze the fiscal documentation related to the income and customs clearance of national goods;

II - identify, amidst the analyzed documentation, those able to enjoy tax incentives; and

III – classify the fiscal notes to be registered, in relation to the Administrative Fee charged by SUFRAMA, and provide the necessary data for its issuance.

f.2.4. The Custom Clearance Coordination (CODIN)

The Customs Clearance Coordination should:

I – complementarily control the fiscal documentation received from the processing unity and related to the income of national goods and organize the filing of the inspected fiscal documents;

II – search and generate information related to the income situation of fiscal documents;

III – cancel the information related to the notices of debts unduly generated, input data in the system, whenever necessary, for the generation of a new notification; and

IV – subside other departments of SUFRAMA, whenever fit, in the analysis of issues related to national goods, by means of technical information and availability of documents.

f.3 The Occidental Amazon Site General Coordination (CGPAM)

The Occidental Amazon Portal General Coordination, located in Vilhena/RO, should:

I – administrate the pertinent tax incentives instruments;

II – operate the national and foreign goods imports and income mechanisms;

III – carry out the registration, re-registration, records reactivation, approval, re-approval and licensing of the companies and entities holding benefits and approval;

IV - represent SUFRAMA, in its respective jurisdiction area;
V - supervise, orientate and control the execution of the activities developed in its operational area; and
VI – elaborate the Annual Activities Report of the General Coordination.

f.3.1. The Free Trade Areas and Regional Coordination

The Free Trade Areas and Regional Coordination, in their respective operational areas, should:
I – administrate the pertinent tax incentives instruments;
II – operate the imports and income mechanisms of national and foreign goods;
III - carry out the registration, re-registration, records reactivation, approval, reapproval and licensing of the companies and entities holding benefits and approval;
IV - represent SUFRAMA in its operational area; and
V – administrate the customs warehouses under the responsibility of SUFRAMA.

g. The Attribution of the Managers

The Superintendent should:
I – set the operation guidelines and carry out the general management of the unities of SUFRAMA;
II – propose the annual budget plan, and after its approval, inform SUFRAMA's Administrative Council, as well as the partial and annual reports of the developed activities;
III – submit to the approval of Development, Industry and Foreign Trade Ministry, the Internal Regiment of SUFRAMA;
IV – agree on the operation of the unities, as well as on the special activities performance;
V – propose alterations in the operational structure due to the regional development plans or new programs of Federal Government for Occidental Amazon and other areas, by taking the current legislation into account;
VI – sign agreements, contracts and covenants with national and international entities, by taking the current legislation into account;
VII – provide the effective positions of SUFRAMA's Personnel, arisen from qualification by public contest, as well as carry out the disciplinary power, in the terms of current legislation;
VIII - represent SUFRAMA in court or out of it;
IX - present, on set deadlines, the accountability corresponding to prior year;
X – authorize the provision of financial and material resources necessary for the execution of programs, projects and activities;
XI – hire outsourced technical services either with companies or individuals as per pertinent legislation, to carry out special works;
XII – practice all acts pertinent to the financial, accounting, material and general services administration, as per the current legislation, as well as determine the audits and periodic verifications in those areas;
XIII – determine the proceeding of trial according to pertinent rules and legislation;
XIV - submit to SUFRAMA's Administrative Council issues which depend on the approval of that collegiate;
XV – propose to SUFRAMA's Administrative Council the alienation of real estate and movables belonging to it;
XVI – fulfill and enforce the fulfillment of the decisions of SUFRAMA's Administrative Council; and

XVII - promote, exempt and approve tenders, as well as sign contracts for the purchasing of materials, execution of works and services and real estate lease, as per current legislation.

The Deputy Superintendent should plan, manage, coordinate and orientate the evaluation and execution of the activities in his respective unities and carry out other attributions assigned to him by the Superintendent of SUFRAMA.

The Superintendence Main Office Chief, the Chief-Prosecutor, the Chief-Auditor, the Magistrate, the General Coordinators, the Free Trade Areas Coordinators, the Regional Coordinators, the Coordinators, the Division, Service and Section Chiefs, should plan, manage and coordinate the execution of the activities they are in charge of, as well as carry out other attributions assigned to them.

1.3.6 Socio-Economic Issues

It will be necessary to resolve the following issues in order to secure the future development of MFZ.

a. Acquisition of Environmental License of PIM

Although SUFRAMA has invested basic infrastructure such as roads and electricity, PIM was developed on the premise that individual enterprises are responsible for obtaining environmental licenses to develop factory sites, construct buildings, effluent treatment facilities and other environmental protection measures before entering MFZ. Thus, with the exception basic infrastructure such as roads and electricity, there is no overall development plan for PIM. Such development measures were used for both industrial districts, so that with the exception of construction plans for roadways and electrical supply facilities, PIM and the two industrial districts (DIs) were developed without the necessary environmental protection plans to conduct environmental impact assessment (EIA).Thus, in order to understand the environmental protection plan of the DIs and PIM overall, it is necessary to combine the environmental licenses obtained when individual factories were constructed. Moreover, understanding the current environmental conditions of the DIs and PIM requires that each factory plan and their actual operation conditions be surveyed and the results synthesized. Such work is extremely labor intensive and SUFRAMA cannot perform it unassisted. Rather, the bulk of such analysis must be done by IPAAM, which issues the environmental licenses and rights for operation. Nevertheless, SUFRAMA must have a firm grasp of the structure for environmental protection of PIM/MFZ if it is to promote PIM to potential investors. Even if an individual business takes the necessary precautions for environmental protection, in the case that pollution of the overall PIM area is indicated, great damage is done to that company's activities. Furthermore, SUFRAMA has the right to withhold the special tax benefits to companies pointed out by IPAAM that they do not carry out sufficient environmental protection measures.

As shown above, in order to obtain the environmental licenses for PIM, SUFRAMA and IPAAM--given their respective responsibilities--must work together to formulate an environmental protection plan for the DIs and entire PIM and conduct an environmental impact assessment (EIA). In order to carry out such work, the data and information obtained in this study will serve as an important base.

b. Changes in the Industrial Structure of MFZ

Presently, assembly production is the central activity of the PIM factories, which import parts for products largely consumed in the domestic market. Thus, the trade balance of MFZ is running at a deficit. In order to improve the situation, the Ministry for Development, Industry and Foreign Trade and SUFRAMA are working to entice the parts industry, and moreover, are considering attracting the materials industry and others to further raise the added value of the area. An increase in the parts and materials industries will provide more economic benefit to the MFZ than by reducing the trade deficit and increasing added value. On the other hand, in contrast to the assembly industry, parts and materials include a large number of processes which impact the environment, such as materials processing, surface treatment, and exhaust and effluent treatment.

It is likely that changes to the industrial structure of MFZ will bring about significant changes in accordance with production to the type and quantity of industrial waste that is generated. That is, due to the fact that packaging waste, the current primary waste, is relatively easy to recycle, one should expect higher environmental impact, difficulty in recycling, and more complicated treatment measures to arise.

c. Infrastructure Preparation

There are a number of infrastructure-related issues, as follows, in order to guarantee the future development of MFZ.

- Manaus is currently independent of the Brazilian national electricity grid, using thermal- and hydro-electric generation; however the generation cost for these is considerably higher than the national average. Presently, the federal government is providing compensation for this cost difference. Moreover, given the current power supply structure, there are frequent power outages in the dry season when power demand is high. Thus, there is a constraint apparent in introducing industries that consume a great deal of electricity, such as the materials industry.
- On-land public transportation is limited to roads, resulting in heavy traffic jams in Manaus City during the morning and evening rush times. For a large municipality with a population of over 1.7 million, dependence on a road network alone for on-land public transport indicates a significant restriction.
- Manaus City does not have a wastewater treatment facility and untreated effluent is released into the Amazon River. In order to attract tourism and sustain and improve the waterfront, a sewerage treatment facility is needed.

1.4 State of Environmental Management

The situation of environmental management could be different if demand was stronger for environmental legislation to be executed. The state and municipality, although they have political and administrative autonomy, need to fulfill the constitutional principles and rules, as well as the federal legislation.

Article 23 of the Federal Constitution from 1988 establishes it is the joint competence of the Federal, States, Federal Districts and Municipalities, in Clause VI, to protect the environment and to combat pollution by any means and, in Clause VII, to preserve forest, fauna and flora.

Article 24, in Clause VIII, establishes the competence to the Federal, States and Federal Districts to jointly legislate the responsibility for damage to the environment.

In the federal extent, the National Council for Environment (CONAMA), linked to the National Environment System (SISNAMA), is in charge of advisory and deliberative attribution instituted by Law 6.938/81 about the National Environment Policies regulated by Ordinance 99.274/90. Section 2.5.2 below shows the representation and attributions of this Council.

At the state level, the Environment State Council of Amazonas State, linked to the Sustainable Development State Secretariat, is in charge of advisory and deliberative attribution.

At the municipal level, the Municipal Council of Development and Environment (COMDEMA), linked to the Municipal Secretariat of the Environment (SEMMA), is in charge of the advisory and deliberative attribution for environmental issues, created by ORDINANCE N. 8.921 of March 14, 2007.

1.4.1 Environmental Laws and Regulations

a. Federal Legislation

The Legislation Base of IBAMA (Brazilian Institute for the Environment and Renewable Natural Resources) is fed by CNIA (National Center of Information, Environmental Technologies and Publication).

The base presents references of the legal actions, normative and administrative, relative to the environment area and correlate, emanated of the Federal sphere, including the Executive and Legislative Power, and Organizations of Direct and Indirect Administration. It stores laws, law-decrees, decrees, agreements, ordinances, resolutions, agreements, etc. （

a.1 Federal Decrees

- Decree no. 50.877, June 29, 1961. Disposes on the release of poisonous or oily wastes in the inland or coastal waters of the country and takes other measures.
- Decree no. 76.389, October 03, 1975. Disposes on prevention measures and control of industrial pollution mentioned in Law no. 1.413, August 14, 1975 and takes other measures.
- Decree no. 85.206, September 25, 1980. Alters Article 80 of Ordinance no. 76.389/75 which disposes on the preventive measures and control of environmental pollution.
- Decree no. 88.351, June 1, 1983. Regulates Law no. 6.938, August 31, 1981, which disposes on the Environmental National Policy and on the creation of Ecological Stations and Areas of Environmental Protection, respectively, and takes other measures.
- Decree no. 93.630, November 28, 1986. Alters the content of Ordinance no. 88.351, modified by Ordinance no. 91.305 June 3, 1985, which regulated the Laws that dispose on the Environmental National Policy and the creation of Ecological Stations and Areas of Environmental Protection, and takes other measures.
- Decree no. 99.274, June 06, 1990. Regulates Law no. 6.902, April 27, 1981, and Law 6.938, August 31, 1981, which disposes on the creation of Ecological Stations and Areas of Environmental Protection and on the Environmental National Policy,

respectively, and takes other measures.

- Decree no. 875, July 19, 1993. Promulgates the text of the convention for the control of over-border movements of hazardous wastes and their deposit. Convention of Basel.

b. Federal Law Decree

- Law no. 303, February 28, 1967. Creates the National Council for the Control of Environmental Pollution and takes other measures.
- Decree no. 1413, August 14, 1975. Disposes on the control of environmental pollution caused by industrial activities.

c. Normative instructions

- Normative Instruction IBAMA no. 40, March 26, 1993. Disposes about the period to submit to IBAMA data and technical justifications as for the actual need for waste imports.

d. Federal Laws

- Law no. 6.803, July 02, 1980. Disposes on the basic guidelines for the industrial zoning in the critical areas of pollution and takes other measures.
- Law no. 6.938, 31 August, 1981. Disposes about the Environmental National Policies, their purposes and application and formulation mechanism, and takes other measures.
- Law no. 7.347, July 24, 1985. Disciplines the responsibility Public Civil Action for Damages Caused to the Environment, to the Consumer, to Rights, to Artistic, Esthetical, Historical, and Tourist Value and takes other measures.
- Law no. 7.802, July 11, 1989. Disposes on the research, experimentation, production, packing and labeling, transport, storage, commercialization, commercial propaganda, use, import, export, final destination of wastes and packages, the registration, classification, control, inspection and monitoring of pesticides, their components and such, and takes other measures.
- Law no. 7.804, July 18, 1989. Alters Law no. 6.938, August 31, 1981, which disposes about the Environmental National Policies, their purposes and application and formulation mechanisms; Law no. 7.735, February 22, 1989; Law no. 6.803 July 2, 1980; Law no. 6.902, April 21, 1981; and takes other measures.
- Law no. 7.804, July 18, 1989 (rectification). Alters Law no. 6.938, August 31, 1981, which disposes about the Environmental National Policies, their purposes and application and formulation mechanisms; Law no. 7.735, February 22, 1989; Law n. 6.803, July 2, 1980; Law no. 6.902, April 21, 1981; and takes other measures.
- Law no. 9.605, February 12, 1998. Disposes about the penal and administrative-penal sanctions derived from conduct and activities harmful to the environment and takes other measures.
- Law no. 9.782, January 26, 1999. Defines the National System of Sanitary Surveillance, creates the National Agency of Sanitary Surveillance and takes other measures.
- Law n.11.445, January 5, 2007. Establishes national basic sanitation guidelines, alters Law no. 6.766, December 19, 1979; Law no. 8.036, May 11, 1990; Law no. 8.666, June 21, 1993, Law no. 8.987, February 13, 1995; revokes Law no. 6.528, May 11,

1978; and takes other measures.

Resolution of CONAMA 313

For the first time, it is demanded that the Brazilian companies make an inventory of their industrial waste. This inventory, arranged by a resolution that the National Council of the Environment (CONAMA) released in October of 2002, provides the government organizations the information that they need to develop plans of solid and liquid waste management by year 2005.
The resolution (No. 313) requires that the companies prepare the inventories every two years, to be submitted to the state environmental organisms and the Brazilian Institute for the Environment and Renewable Natural Resources (IBAMA), the application authority of the country's environmental rights. The companies should describe not only the quantity and nature of the waste that it generates exclusively, but also the way that it is stored, transported and disposed.

CONAMA released this resolution because neither CONAMA neither IBAMA could analyze the magnitude of the potential pollution problems and the dangers created by the industrial liquid and solid wastes.

e. Governmental decrees

- Governmental decree no. 3, of September 19, 1977: Establishes rules that force both the installed companies and the ones to be installed in National Territory to prevent or to correct the inconveniences and coming damages caused to the environment due to pollution and contamination.
- Minter governmental decree no. 53, of March 1, 1979: Establishes the rules for specific projects of treatment and disposal of solid wastes, as well as the monitoring of their implantation, operation and maintenance.
- Governmental decree no. 3, from the Department of the Interior, of January 19, 1977: Establishes rules that force both the installed companies and the ones to be installed in National Territory to prevent or to correct the inconveniences and coming damages caused to the environment due to pollution and contamination.
- Governmental decree no. 53, of the Department of the Interior, of March 1, 1979: Defines the treatment that should be given to solid hazardous wastes, poisonous or not, and makes the pollution control state organizations responsible for the monitoring of the implantation, operation and maintenance of solid wastes treatment and disposal projects.

f. State Laws and Decrees

The main environmental management laws of the State of Amazonas are as follows:

- Amazonas State Constitution (Chapter 11)
- Law no. 1,532/82: State Policy for the Prevention and Control of Pollution, Improvement and Recovery of the Environment and Protection of the Natural Resources. Requirement of licensing.
- Decree n. 10,028/87: On the State Licensing System of Activities with Potential Environmental Impact and Application of Penalties and other Measures

- Law n. 2.513/98: Obligation for the registration of companies responsible for the transportation of hazardous cargoes or products in the State Environmental Organization
- Law n. 3,135/07: Climate Change State Policy, Environmental Conservation and Sustainable Development of the State of Amazonas
- Law n. 1991, August 21, 2007: Establishes the National Policy on Solid Wastes and other Measures.
- Decree 10.028/87, amended by Decrees 15.708/94 and 15.842/94:
- Ordinance n. 1/2004: Environmental Licensing for Waste Generation Sources

g. Legal Instruments of the Municipal Administration

The environmental legal aspects that orientate the public administration exist in the instruments contained in the following list:

Table 1-16: Legal Instruments of the municipal administration

Law/Decree/Rule	Comments
Law n. 665/2002	Regulates the subdivision of the urban land use in the municipality of Manaus. Defines the non-constructive areas.
Organic law of the Municipality of Manaus	Reveals in environmental aspects, the need to make the enterprise feasible, before its establishment is begun, in agreement with the urban policies satisfactory to the quality of life of the population.
Law n. 671/2002 Master Plan	Aims to define the areas holding interest for social, economical, town planning, historical and environmental planning. Also, defines the urban policies and several plans and programs for its effective implementation.
Law n. 663/2002 Construction Rules of the Municipality of Manaus	Aimed for the establishment, illumination and ventilation of the facilities, mentions the construction in the land should fulfill the demands of the effective environmental legislation as for the foreseen non-constructive areas and the Shores Protection Plan of the water sources.
Law n. 605/2001 Environmental Law	Regulates the action of the Municipal Public Power and its relationship with the citizens and public and private institutions in the preservation, conservation, defense, improvement, recovery and control of an ecologically balanced environment, diffuse and natural asset essential for a healthy quality of life. Reveals the inclusion of the Areas of Permanent Preservation, establishes the need for the protection and recovery of superficial and underground water ecosystems, with special attention to fountainhead areas, the lowland areas of igarapés and igapós and other relevant ones for the maintenance of the biological cycles.
Law n. 672/2002 Soil Use and Occupation Rule in the Municipality of Manaus	Institutes the rules for the use and occupation of the soil in the municipality of Manaus, and takes other measures. Institutes the Areas of Environmental Protection which correspond to the areas under a meaningful level of degradation. These are priority areas for the application of intervention instruments of the associated urban administration.
Law n. 674/2002 Licensing and Monitoring of Activities in Companies and Public Areas	Related to the licensing and monitoring of activities in companies and public areas, which integrates the set of postures of the municipality of Manaus. This law integrates the municipal postures, together with the rules on: Sanitation, Environment, Construction and Building.

1.4.2 Environmental Organizations

The organizations concerned in environmental sector in Brazil with their functions are described in the table below.

Table 1-17: List of Organizations related to Environmental Issues

Abbreviation (Jurisdiction)	General description
ABC (Federal)	The **Brazilian Cooperation Agency (ABC)** of the Ministry of Foreign Affairs (MRE) is the agency of the Federal Government in charge of the whole international technical cooperation established between the Brazilian Government and other countries or international organizations. Its main responsibility is to negotiate, coordinate, implement and follow the Brazilian technical cooperation programs and projects based on the agreements signed between Brazil and other countries and international organizations.
ERENOR (Federal)	The Ministry of Foreign Affairs (or MRE) recognized that its Manaus office should assist the whole region and not only the city of Manaus. Consequently, EREMA (Representation Office of MRE in Manaus) was modified to **ERENOR** (**North Region Representation Office** of MRE) in 2008, which is representative for the region. • The ERENOR office is located in SUFRAMA headquarters, and it is the linkage between SUFRAMA and the MRE. The roles of ERENOR are to coordinate and support actions developed by the MRE at state and municipal levels, as well as the federal ones located in their respective jurisdiction areas and local academic, cultural, business and other sectors. • SUFRAMA aims toward regional development, and for that reason ERENOR was settled in its headquarters. ABC and ERENOR are agencies of MRE. ABC is the Federal representative located in the Federal District and ERENOR represents the North Region in Manaus. • The interest of ERENOR for the JICA Study is to collect information for MRE/ABC, so that the Federal Government can provide support and follow-up, and technicians from the Federal District won't have to come from the capital to Manaus. The duties of North Region Representation Office (ERENOR) are: I. Participate in actions aimed for increasing and diversifying the exports of products and services from the North Region, assist the international scientific, technical, technological and cultural cooperation in the Amazon by attracting foreign investments to states, as well as search for the expansion of tourism activities; II. Promote institutional cooperation and coordination between MRE and public and private sectors in the North Region; III. Promote the linkage between public and private institution and entities of the North Region as well as the international organizations interested in the

	development in its most diverse modalities; and IV. Provide the authorities of its jurisdiction with guidance and assistance to elaborate, to follow up and to conclude cooperation tools with foreign partners.
MMA (Federal)	The **Ministry of Environment (MMA)** was created with the denomination of Ministry of Urban Development and Environment, on March 1, 1985, through Ordinance No. 91.145. The Ministry is responsible for the national policy of environment • Environmental programs for Amazonas • Policy of water resources • Policy for preservation, conservation and sustainable use of the ecosystems, biodiversity and forest • Policy for the integration of the environment and production. • Strategies for the improvement of the environmental quality and the sustainable use of the natural resources. • Ecological-economical zoning
CONAMA (Federal)	The **Environment National Council (CONAMA)** is the consulting and deliberation organization of the Environment National System (SISNAMA), it was instituted by Law 6.938/81, about the Environment National Policy, regulated by Decree 99.274/90. CONAMA is formed by the Plenary, CIPAM, Consulting Groups, Technical Chambers and Work Groups. The Council is presided over by the Environment Ministry and its Executive Secretariat is managed by the Environment Ministry Executive Secretary. The Council is a representative collegiate from five sectors: federal, state and municipal organizations, business sector and civilian society. The Plenary is composed of: the Environment State Minister and Executive Secretary, a representative of IBAMA; a representative of National Water Supply Agency-ANA; a representative of each one of the Ministries, Republic Presidency Secretariats and Military Commands and Defense Ministry, indicated by the respective titleholder; representatives of each one of the State Governments and Federal District, indicated by the respective governors; representatives of Municipal Governments, a representative of each geographic region of the Country; twenty-two representatives of workers unions and civilian society. CONAMA meets every 3 months in the Federal District, sometimes holding Extraordinary Meetings out of Federal District, whenever called together by the President by his own initiative or when required by at least 2/3 of the members. Among others, CONAMA is in charge of: • Establishing, by means of a proposal of the Brazilian Institute of Environment and Natural Renewable Resources (IBAMA), the other organizations which integrate SISNAMA and the Counselors of CONAMA, rules and criteria for the licensing of effective or potentially polluting activities, to be granted by the Confederation, by the States, by Federal

	District and Municipalities and monitored by the said Institute; • Determining, whenever necessary, the execution of a study of the alternatives and possible environmental consequences of public or private projects, requesting from federal, state or municipal organizations, as well as from private entities, information, notably the essential ones for the appreciation of Environmental Impact Previous Studies and their respective reports, in the case of constructions or activities holding meaningful environmental degradation, specially in the areas considered as national property; • Deciding after evaluation of the Environmental Policies Integration Committee, in the last administrative instance, in appeal degree, by means of previous deposit, about fines and other penalties imposed by IBAMA; • Determining, by means of representation of IBAMA, the loss or restriction of taxes incentives granted by Public Power, in general and conditional nature, and the loss or cessation of participation in financing programs of official credit entities; • Regularly evaluating the implementation and execution of environmental policies and rules of the country, thus establishing indicating systems; and • Recommending the regulating environmental organization the elaboration of the Environmental Quality Report. The acts of CONAMA include: • Resolutions, dealing with deliberations linked to guidelines and technical rules, criteria and standards related to environmental protection and the sustainable use of environmental resources; • Propositions, dealing with manifestations, of any nature, related to environmental issues; • Recommendations, dealing with manifestation about the implementation of policies, public programs and rules reflecting the environmental area, including the partnership agreements comprehended by Law n. 9.790, from 23 March 1999; • Proposals, dealing with environmental issues to be forwarded to the Government Council or to the Committees of Senate House and House of Commons; and • Decisions, dealing with fines and other penalties imposed by IBAMA, in last administrative instance and appeal degree, provided the Environmental Policies Integration Committee is previously heard (CIPAM).
IBAMA (Federal)	The **Brazilian Institute for Environment and Renewable Natural Resources** known as IBAMA is a federal autarchy linked to the Ministry of the Environment (MMA). It is the responsible executive organ for the execution of the National Policies of the Environment (PNMA) and develops several activities for the preservation and conservation of nature, exercising the control on the use of natural resources (water, flora, fauna, soil, etc.).

	Also, IBAMA realizes environmental studies and grants environmental licenses for enterprises at the national level.
RENIMA (Federal)	RENIMA (Environmental Information National Network) is a decentralized network formed by cooperating centers and a coordinating center, under the responsibility of the National Information, Environmental Technologies and Publishing (CNIA). Created to support the environmental management process, it provides the techno-scientific and industrial activities with information. Its main role is to integrate the organizations which compose the National Environment System (SISNAMA), especially the state environmental entities. The information unities of such institutions join the Network as Cooperating Centers where SEMMA is included. RENIMA also integrates IBAMA's Specialized Information Unities all over Brazil. The information unities establish mutual cooperation, thus enabling the distribution and use of the country's information resources. By using the database, the Network makes several information services available, such as bibliographic research, elaboration of specialize bibliographies, searches to environmental legislation, information about events and institutions.
MCidades (Federal)	The creation of the **Ministry of Cities (MCidades)** constituted an innovative fact in the urban public policies, because it was able to overcome the sectoral shortage in housing, sanitation, transportation and measures to deal with traffic. With the creation of the Ministry they could be finally integrated by taking into account land use and occupation. The structure of MCidades is today a paradigm, not only in Brazil, but all over Latin America. The social movement formed by professionals, trade unions and social leaders, NGOs, intellectuals, researchers and university professors, was fundamental for its creation. Such movement has made many achievements in the last 15 years, such as the previously unheard of insertion of urban issues into the Federal Constitution of 1988, the City By-Law of 2001, and the Provisory Measure 2220, also of 2001. Another fundamental aspect of its creation is in trying to define a national urban development policy in agreement with the state and municipal governments, as well as legislative and judiciary powers, not to mention the participation of society, aiming to coordinate and integrate the investments and actions in Brazilian cities so social inequality may be reduced and environmental sustainability may be implemented.
IPAAM (State)	**Institute of Amazonas Environmental Protection** The mission of IPAAM is "to execute Politics of Environmental Control of the State of Amazons" seeking for the sustainable development of the region. The activities of environmental control in the State of Amazon began in 1978 in the State Secretariat of Planning and General Coordination-SEPLAN, executed by the Development Commission of the State of Amazon (CODEAMA). • The first Law of State Environmental Policy was published in 1982 (Law 1532). • In 1989 the Institute for Development of Natural Resources and Environmental Protection of Amazon's State (IMA/AM) was created, whose

	purpose was to execute the environmental policy, beginning with a process of more systematic environmental control. • However, with the creation of the Institute of Environmental Protection of Amazon (IPAAM on 14/12/95), that substituted the IMA/AM, gave way to great progress on environmental issues in the State, because IPAAM started to coordinate and to execute the State Policy of the Environment exclusively. • Starting from February 2003, IPAAM was linked to the State Secretariat of the Environment and Sustainable Development (SEMADS), executive organization of the Policy of Environmental Control of Amazon State. • The activities of IPAAM, including environmental control, are environmental licensing approval, inspection, and environmental monitoring.
PROSAMIM (State Program)	**Socio-Environmental Program of Manaus Igarapés River Bank** It is a Social and Environmental Program of Igarapés of Manaus, developed by the Government of Amazon State. At present, the program has benefited about 2 thousand families of Igarapé and 40 of the neighborhoods of Cachoeirinha and Mestre Chico. The program offers to the families who live in the PROSAMIM intervention area, three payment options for people that live in the margin of the Igarapé: compensation, housing credits and transfers to housing complexes of Nova Cidade and João Paulo.
SDS (State)	**State Secretariat of Environment and Sustainable Development** SDS plays a fundamental role in the implementation of the Program of Green Free Zone, in articulation with other State Government agencies and organizations: Institute of Amazonas Environmental Protection (IPAAM), State Foundation of the Indigenous Communities (FEPI), Sustainable Development Agency (ADS) and Gas Company of Amazon (Cigás). Mission: To guarantee the protection of the nature and use of the natural resources, considering socio-environmental and economical, valorization, seeking the sustainable development of Amazon.
SEPLAN (State)	**State Secretariat for Planning and Economic Development** The mission of SEPLAN is to develop the state system of strategic planning and to coordinate public policies for socioeconomic development of the Amazon. Its area of activities are: • Elaboration and evaluation of an Annual Plan; • Formulation and execution of strategy of economical growth; • Incentives to raise productivity and wages; • Articulation and cooperation between the State and the society to reach the objectives for socioeconomic development; • Establishment of economical negotiations in the national and international plans seeking to strategic investments through reception of resources and of technical cooperation; • Formulation of fiscal policies and technological incentives to strengthen the

	state economy; • Support the establishment of job and income generating companies; • Preparation of studies and researches for socioeconomic conjuncture to subsidize the formulation of public policies. http://www.seplan.am.gov.br/
SEMMA (Municipal)	**Municipal Secretariat of the Environment** The Municipal Secretariat of the Environment (SEMMA) has the attribution to formulate and execute the municipal policies of development and environment of the city of Manaus along the lines of the established guidelines for the national policies of economic development, scientific and technological matters and the environment. One of the most important actions that stands out is the creation of the Urban Ecological Corridor of Igarapé Cachoeiras do Tarumã, with ordinance and complete descriptive report already published in the Official Newspaper of the Municipal District of February 4, 2009. Environmental Education: All of the activities of this Secretariat have components of environmental education. The actions in that area have been developed through projects, activities and trainings returned for the environmental education close to the schools and communities of the municipal district, in partnership with several State and Municipal district office, besides companies in the private sector. Actions and Proposals of SEMMA **Environmental Control Area** • Improvement of personnel structure conditions, infrastructure and technical qualification which may enable the municipality to fulfill the environmental monitoring and licensing demands of Manaus; • Qualification of SEMMA's monitoring and licensing technicians to participate in urban environmental management; • Creation of the Environmental Compensation Chamber; • Creation of the parks of Municipal Garden, Manaus Forest Bank, and Parks and Gardens Foundation; • Proposals for the creation of the Tree Planting and Gardening Master Plan aiming for composing the landscape garden scenery of the municipality; • Reactivation of the Seedling Production Center in Road AM-010 to supply all distribution demands and forestation of Manaus; • Creation of Municipal System for parks, plazas and gardens and Free Space Municipal Systems, besides implementation of the Protected Areas Municipal System; • Incentive to the elaboration of management plans for the municipal conservation areas. **Territorial and environmental management area** • Elaboration and publication of environmental atlas with maps elaborated

	through geologically referenced information of green areas, ecological corridors, permanent preservation area, conservation unities, illegal settlements, hydrographic basins, erosion, forest fragments and delimitation of urban and rural boundaries; • Definition of zones for the creation of new ecological corridors; • Analysis of green areas for the establishment of environmental projects. **Public policies area** • Formation of the Development and Environment Municipal Council aiming to increase social participation; • Improvement of political discussions meant for socio-environmental development of the municipality with the creation of Tree Planting and Landscape Gardening Master Plan, Protected Areas, Municipal System of plazas, Parks and Gardens, Solid Waste Master Plan. **Environmental education area** • Articulation of agreements and other arrangements with education and research institutions; • Increasing of environmental education actions in the state teaching network and the society as a whole.

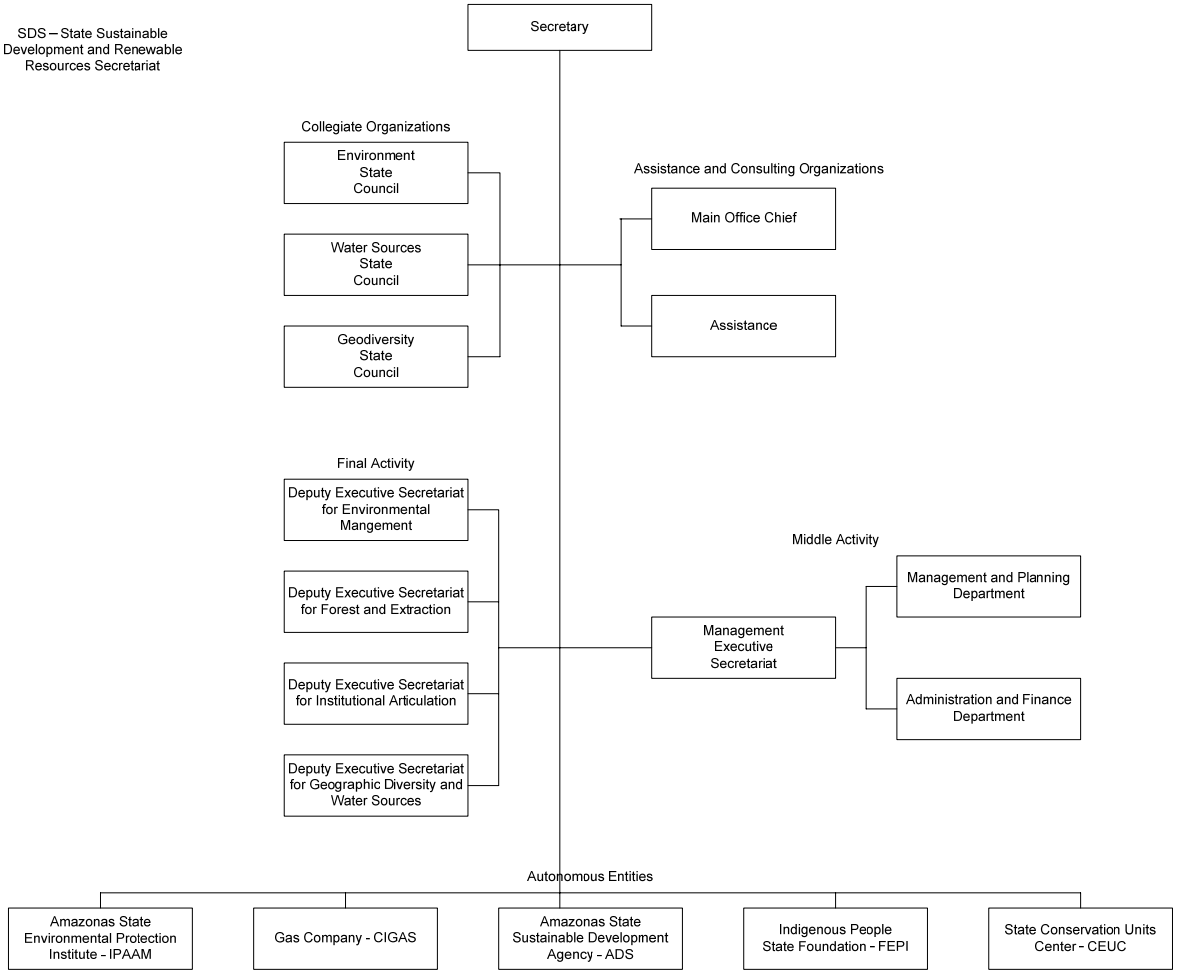


Figure 1-14: Organization Chart of SDS

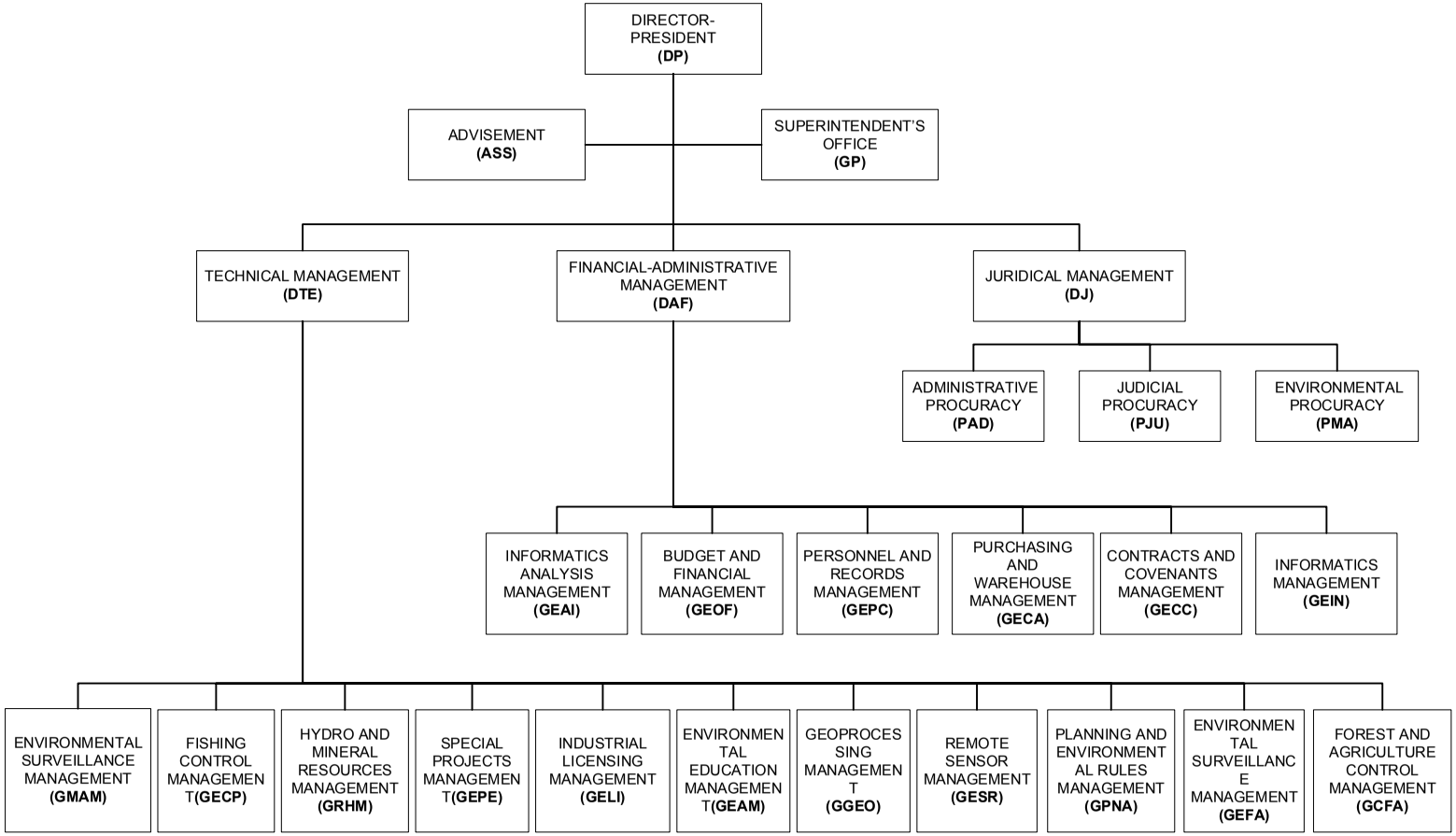


Figure 1-15: Organization Chart of IPAAM

1.4.3 Environmental Licensing System

a. Environmental Impact Assessment and Environmental License System

The Environmental Impact Assessment (EIA) in Brazil is included in the procedures to obtain an environmental license. The inclusion of EIA in the procedures to obtain an environmental license is true for the State of Amazonas and other States in Brazil as well.

b. Environmental Licensing System in Federal Level

There are three environmental licenses that a proponent must acquire when conducting a project, starting with the Previous License (PL) from the planning stage to the implementation stage, and then an Installation License (IL) and Operation License (OL), according to the provisions put forth in CONAMA Resolutions 01/86 and 237/97. CONAMA Resolution 237/97 provides a summary of each license and the effective period of validity. In cases where state regulations differ from the said resolution, the state regulation takes precedent.

Table 1-18: CONAMA Resolution 237/97 Environmental Licenses Description and Validity

Environmental License	Description	Period of Validity
Previous License (PL)	Granted in the planning phase of the enterprise or activity, approving its location and conception. It is not possible to start construction with the PL; must clear the PL requirements and then obtain an installation license (IL)	5 years
Installation License (IL)	Authorizes the installation of an enterprise or activity according to the specifications of the approved plans, programs and projects, including the environmental control measures and other conditions, of which new determinations are constituted	6 years
Operation License (OL)	Authorizes the operation of the activity or enterprise after the verification of the effective fulfillment of the content of prior licenses, with the environmental control measures and conditions determined for the operation	4~10 years

CONAMA Resolution 237/97, Article 10 states, "to start the process in accordance with the required license, upon discussion with the proponent, the environmental monitoring body (IBAMA, State, Municipal environmental agency) will determine the forms, environmental plans and environmental studies required. Based on this same resolution, the proponent will meet with the relevant environmental monitoring body at the first stage in acquiring an environmental license.

Through this preliminary discussion, the governing body will determine the environmental license needed for the project[1], and may determine that the project is partially exempt from the process, when deciding the type of license (PL, IL, OL) required.

[1] The governing body may take into consideration the details and scale of a given project, as stipulated in Federal Law 7,804/90 and CONAMA Resolution 237/97, and alter the requirements at the preliminary discussion stage.

c. Environmental Licensing System in Amazonas State

c.1 Environmental Licensing Types

The environmental licensing system in the state of Amazonas (SA), is different from the federal. Compared to the federal system, the validity of each license is very short, up to prior approval.

The Previous License (PL) is valid for a maximum of 1 year, and will be granted in the preliminary project planning phase or activity by considering its location and design, certification of environmental sustainability and the establishment of basic requirements and conditions to be met in the next phase of its implementation.

Installation License (IL) shall be valid for a maximum of 2 years, at IPAAM discretion, subject to the restrictions established in the licensing. This IL authorizes the installation of the project or activity in accordance with the specifications of the plans, programs and projects approved, including environmental control measures and other conditions, which will be a determinant factor.

The Operation License (OL) will be valid for a maximum of 2 years at the discretion of IPAAM, subject to limitations established in the licensing. The OL authorizes the operation of the activity or project, after the verification of effective implementation of all licenses previously granted to environmental control measures and certain restrictions for the operation.

The issue of the environment, whatever their form, only enter into force upon confirmation by the proponent, and payment of the respective fee.

The Table below summarize the period of validity of each license.

Table 1-19: Environmental Licenses Description and Validity in Amazonas State

Environmental License	Description	Period of Validity
Previous License (PL)	As defined in CONAMA Resolution 237/97	1 year
Installation License (IL)	As defined in CONAMA Resolution 237/97	2 years
Operation License (OL)	As defined in CONAMA Resolution 237/97	2 years

The issue of the environment, whatever their form, only enter into force upon confirmation by the proponent, and payment of the respective fee.

Documents to be submitted by the proponent for environmental licensing in the State of Amazonas are almost similar to federal requirements. The Table below shows a list of documents required to obtain environmental licenses.

Table 1-20: Necessary Documents for Environmental Licensing in Amazonas State

License Type	Necessary Documents
Previous License (PL)	Application for Previous License (PL)
	Copy of publication of PL application
	Presentation of the Environmental Impact Assessment (EIA) and their Environmental Impact Report (RIMA) or RAS/EAI

Installation License (IL)	Application for Installation License (LI)
	Copy of the PL publication
	Copy of deforestation permit issued by IPAAM
	Municipal permit
	Copy of publication of the application of IL
Operation License (OL)	Application for Operation License (OL)
	Copy of the IL publication
	Copy of the publication of OL application
	Copy of license registration

c.2 Industrial Activities which require Environmental License

Environmental licensing in the State of Amazonas was established by the first State environmental law No. 1532 of 6 July 1982. The details are given in Regulation No 10028. According to Law No.1532, stipulates that CODEAMA (The Center for Development, Research and Technology of the State of Amazonas) will issue environmental licenses in Amazonas State, but CODEAMA was abolished and now the rights for this were transferred to IPAAM. Provisions in Act 8 state that industrial activities, as shown below, that could potentially impact the environment require an environmental license[1].

- Mineral excavation, treatment
- Tree harvesting
- Agriculture, cattle breeding
- Hunting, fisheries
- Manufacturing
- Engineering, construction, land creation/zoning
- Collection, storage, treatment and final disposal of products, raw materials and wastes
- Infrastructure (dams, airports, ports, roads, etc.)
- Hospitals, clinics, laboratories
- Activities with commercial- or service-oriented use of fuel (solid/liquid/gaseous)
- Incineration of waste or materials
- Activities that change igarape and other aquatic ecology
- Use or stowage of agrochemicals
- Activities with potential environmental impact to landscape or nature
- Activities with potential environmental impact to cultural assets, historical artifacts, etc.
- Activities IPAAM deems may have potential impact to the environment

[1] Decree No 10028 of February 1987

As shown above, most industrial activities require a license. These activities are divided into categories according to 32 codes, and further into sub-category codes. The following table shows the major classification codes of activities with potential environmental impact under which are the detailed classification codes.

Table 1-21: Major classification code of activities with possibility of environmental impact

Code	Activities with potential environmental impact	Code	Activities with potential environmental impact
01＊＊	Extraction and treatment of minerals	17＊＊	Clothing, shoes, fabric and leather items manufacturing
02＊＊	Non-metallic material and product manufacturing	18＊＊	Food manufacturing
03＊＊	Metallurgy (ferrous, nonferrous)	19＊＊	Beverage production
04＊＊	Mechanical products manufacturing	20＊＊	Tobacco manufacturing
05＊＊	Electric & electronic products manufacturing	21＊＊	Printing
06＊＊	Transport machine manufacturing	22＊＊	Commerce and services
07＊＊	Lumber & wood product manufacturing	23＊＊	Construction and infrastructure
08＊＊	Furniture manufacturing	24＊＊	Auxiliary services including provision of electricity and water
09＊＊	Paper and cardboard manufacturing	25＊＊	Wholesale
10＊＊	Rubber manufacturing	26＊＊	Transportation and terminals
11＊＊	Leather products manufacturing	27＊＊	Economic and domestic activities services
12＊＊	Chemical product manufacturing	28＊＊	Medical and veterinary services including laboratory
13＊＊	Pharmaceutical products manufacturing	29＊＊	Stock-breeding, fishing and water-farming and vivariums and wild fauna stewardships
14＊＊	Perfume, soaps and candles manufacturing	30＊＊	Waste treatment and recycle
15＊＊	Plastic material and product manufacturing	31＊＊	Components and electronic devices manufacturing
16＊＊	Textile product manufacturing	32＊＊	Vegetable oil extraction

Source: Classification of pollution sources IN 001/06, published on 3/12/2007

c.3 Environmental License related to Waste Management

The following table shows detailed codes in terms of waste management.

Table 1-22: Detailed code of activities with potential environmental impact related to waste management

Code	Activities with potential environmental impact（major classification）	Code	Activities with potential environmental impact（detailed classification）	
				Impact
22＊＊	Commerce and services	2217	Incineration service	Large
		2218	Co-Processing service of waste	Large

		2219	Collection center of pesticides	Medium
24＊＊	Auxiliary services including provision of electricity and water	2407	Collection and/or treatment of industrial solid wastes	Large
		2408	Final destination of municipality wastes	Large
		2410	Collection and transportation of inert solid wastes	Micro
		2411	Collection and/or storage and/or commercialization of sold wastes	Medium
		2412	Collection and/or treatment of industrial hazardous liquid wastes	Large
		2417	Disposal of industrial waste in landfill	Large
26＊＊	Transportation and terminals	2615	Transportation and storage of industrial hazardous solid wastes	Large
30＊＊	Waste treatment	3001	Treatment of solid industrial waste without chemicals	Medium
		3002	Treatment of liquid industrial waste	Medium
		3003	Treatment and solid industrial waste with chemicals	Large
		3004	Treatment of pallet	Medium
		3005	Recycle of paper and cardboard	Medium
		3006	Treatment of mineral wastes (Re-processing of wastes)	Medium

Source: Classification of pollution sources IN 001/06, published on 3/12/2007

Only recently has the reuse and recycling of wastes become prevalent in the state of Amazonas, and thus the only codes which have been set are for recycling paper and cardboard. According to the survey of waste management companies, the following codes are also used for the environmental license of companies engaged in reuse and recycling activities. As stated above, the current environmental licensing code system in terms of waste management does not identify all the waste management companies and improvement is needed in some areas.

Table 1-23: Major classification code of activities with possibility of environmental impact

Code	Activities with potential environmental impact （major classification）	Code	Activities with potential environmental impact （detailed classification）	
				Impact
02＊＊	Production of non-metal products and material	0213	Production of tile, block and other material	Medium
03＊＊	Smelting (Iron and steel making, non-ferrous metal production)	0301	Production of iron by reduction of iron ores (iron making)	Large
		0315	Production of non-ferrous metal by primary smelting (non-ferrous metal smelting)	Large
		0326	Production of solder and other materials	Medium
07＊＊	Manufacturing wooden products	0711	Manufacturing of wooden products for home and industrial use	Small
09＊＊	Manufacturing of paper and cardboard product	0903	Manufacturing of general paper products	Large

15＊＊	Manufacturing of plastics product	1502	Manufacturing of industrial plastic products	Medium
		1503	Manufacturing of plastic products for home and individual use	Medium
		1505	Manufacturing of plastic products for package and printing use	Medium
		1506	Manufacturing of plastic pipes, tubes and connecting parts	Medium
		1507	Manufacturing of several types of plastic products	Medium

c.4 Items described in the Environmental License (Operation License)

The environmental license issued by IPPAM contains a total of two pages, and the following items are described in the license. An example of an environmental license--the Operation License, which is explained further afterwards--is shown in the box below.

BOX: Example of the Operation License

OPERATION LICENSE – O.L. ＊＊＊＊(Environment License Number)

Name of the enterprise：＊＊＊＊

Address：＊＊＊＊

CNPJ Number：＊＊＊＊　　Registration Number of Amazonas State：＊＊＊＊

TEL：＊＊＊＊　　FAX：＊＊＊＊

Registration Number of IPAAM：＊＊＊＊　　Processing Number：＊＊＊＊

Target activity: ＊＊＊＊

Location of the target activity: ＊＊＊＊

Purpose of the target activity (concrete description of target activity):

Authorize the treatment by ultra-filtration of emulsion oils and soluble oils, the destruction/shredding of used fluorescent lamps, mercury vapor lamps, sodium vapor and mixed light, using a equipment named BULB EATER, the temporary storage and the segregation/treatment/co-processing of hazardous industrial wastes (galvanic sludge, paint dust, foundry dust, soil contaminated by substances deriving from petroleum, oil dust from fuel tanks bottom, used hydraulic oil, contaminated organic solvents and diluents, boiler dust), and non-inert wastes (foundry sand, wastewater and water treatment sludge), CTR glass waste and glass artifacts, wooden packaging (pallets), paper/carton, plastic wastes and polymerase in general, health service solid wastes, fenolite PCBs with components, organic acids and contaminated minerals, vegetal and animal fat, organic solid wastes, wastes from aromatic synthetic concentrates, contaminated glues and varnishes, petroleum industry wastes, ore extraction wastes, chemical wastes (bases, salts and oxides), contaminated personal safety equipment and containers/packages.

Potential of pollution and environmental degradation: Large

Size of target activity: Medium

Validity of this license: 365 days

Notice:

This license is composed by 11 restrictions and/or conditions written in the back of this sheet, whose non-fulfillment is subject to invalidate it and/or punishment foreseen by the law.

This license does not attest nor replace the real estate ownership document.

This license must be kept visible at the company's office. (both sides)

If this license is copied, it must be done to both sides.

Manaus-AM,

＊＊＊＊ ＊＊＊＊

Technical Director Director-President、IPAAM

Restrictions and /or conditions for the validity of this license

This license will only be valid when it is published by the Municipality official journal or advertised in regional or local papers of large pubic reach within 30 days after it has been granted, as per the Instruction IPAAM/P/N. 003/2003.

Once the publication limit date expires, an edition of the publications must be sent to IPAAM within 05 working days.

The present License is being granted based on the information contained in the process n. 1863/T/02 and in loco observations.

All and every modification inserted in the project after the License is issued will implicate on its automatic invalidation, and a new one must be solicited, after the interested party pays the fees.

The solicitation of the Environmental License renewal must be done within 60 days before it expires, as per Instruction IPAAM/P/N. 001/2003.

This license is valid only for the location, activity and purpose contained in the verse. The interested party must solicit IPAAM a new License whenever any of these items change or is amended.

This License does not excuse nor replaces any document required by Federal, State or Municipal legislations.

The storage of wastes must fulfill the Rules NBR 12235/92 and 11174/90 of ABNT.

It is utterly forbidden to dispose wastes on the soil, on the surface and underground water sources and in draining systems of rainwater and wastewater.

It is utterly forbidden the outdoors incineration of any type in the facilities of the company.

Carry out the environmental surveillance, every two months, of the wastewater generated from the ultra-filtration system of oil wastes, through an analytic survey carried out by a laboratory holding a license and registration number issued by IPAAM for such activity, prioritizing the follow parameters for the analysis: pH, oils and greases, phenol rates, turbidity, color and suspended solids, starting from the beginning of the operation of the ultra-filter, to be previously communicated to the Institute.

c.5 License Types and Fulfillment of Conditions

There are three types of environmental licenses, as shown below. Business activities require

three types of license be obtained.

1. Previous License (PL): Granted at the preliminary stage of the enterprise or activity. It is granted for up to one year, after which the license must be reissued. In order to obtain the PL license, the place and activity must be approved in accordance with local government guidelines.
2. Installation License (IL): Authorizes the construction of a factory and installation of a facility, with a maximum term of 2 years; it is necessary to extend the license prior to expiration.
3. Operation License (OL): Authorizes the operation of the activity or enterprise, with a maximum term of 2 years; it is necessary to extend the license prior to expiration.

c.6 Required Documents for Waste Management

The required documents and conditions are given in articles No.10 to No.13 of "Regulation No 10028. According to Lei No.1532"; these documents and conditions vary according to the particular activities. The following table shows the necessary documents and conditions in the case of storage, treatment and final disposal of wastes.

Table 1-24: Environmental Licensing Documents necessary for Storage, Treatment and Final Disposal of Wastes

Type of License	No	Type (B/C*)	Requirements
Previous License	1	B	Application for SELAPI and Previous License (IPAAM Form)
	2	B	Payment receipt of administration fee (IPAAM Form)
	3	B	Company contract or similar document in case of juridical person
	4	B	Copy of ID (identification) and CPF (registration) of the legal representative
	5	B	Permit by the Municipality informing that proposed location and activity are in accordance with the Municipal guidelines
	6	B	Certificate of possession of property sent by SUFRAMA, incase that the property is located in industrial district
	7	B	Certificate of possession of property, in case that the property is located in rural area
	8	B	Certificate of registration of land, plant and building
	9	B	Location map of the enterprise
	10	B	Report of process of the activity development which is signed by the responsible person of the company
	11	B	Location, installation floor plans of the facilities
	12	C	Environmental studies
	13	C	Others (specify)
Installation License	14	B	Application of installation license (IPAAM Form)
	15	B	Payment receipt of administration fee (IPAAM Form)
	16	B	Registration of activities: sanitary and industrial landfill (IPAAM form)
	17	B	Debts Clearance Certificate issue by Ministry of Finance of Amazonas, in case of enterprise
	18	B	Details of storage, treatment and final disposal including monitoring points
	19	B	Project plan approved by competent authority
	20	B	Detail drawing of installation of facilities and plants, including effluent discharge and exhaust gas emission points.
	21	B	Domestic and industrial wastewater treatment system approved by competent authority

	22	B	Preliminary license which satisfied all the requirement and restriction clauses
	23	C	Others (specify)
Operation License	24	B	Application of operation license (IPAAM Form)
	25	B	Payment receipt of administration fee (IPAAM Form)
	26	B	Registration of activities: storage, transportation of products and waste (IPAAM form)
	27	B	Previous License and Installation License which satisfied all the requirement and restriction clauses
	28	C	Others (specify)

Note: B: Basic requirement, C; Complementary requirement

Source: IPAAM homepage

The environmental studies necessary for the Previous License (item No 12) are simple compare to environmental impact previous studies (EPIA). Those who apply for an environmental license for activities of storage, treatment and final disposal of waste submit the documents from No 14 to No 23. Then, when IPAAM determines an EPIA is necessary, they must carry this out and submit it to IPAAM. A summary report of EPIA is an environmental impact report (Relatorio de Impacto Ambiental, RIMA). The RIMA is shown to the public, for example, on the IPAAM website. An EPIA is a detailed and lengthy report which includes all the data of the studies, whereas, on the other hand, the RIMA report will total approximately one hundred pages. In the case of the hazardous industrial waste landfill project in Manaus, IPAAM judged that an EPIA was necessary, which was conducted, and the RIMA made available at the IPAAM website.

d. Environmental License Fee in Amazonas State

Normative Instructions 01/06 and 01/07 of IPAAM were substituted by Law no. 3219 of 28/12/2007, which regulates the granting of environmental licenses in the State of Amazonas and other measures. Through this law, the Government of Amazonas State establishes Environmental Licensing Fees in the State of Amazonas. Individuals or legal entities performing activities should pay environmental licensing fees to IPAAM. Only the State Executive Bodies and Agencies are exempt from environmental licensing fees.

The following activities are subject to PL: construction, installation, expansion, enlargement, alteration, rehabilitation, operation and operation of polluting activities, users of environmental resources, and companies that cause environmental degradation.

IPAAM provides basic criteria, by which studies will be required environmental impact assessment for environmental licensing, subject to federal and state laws. The Environmental Impact Assessment (EIA) will be prepared by qualified technicians; the costs shall be borne by the project proponent. The environmental impact assessment and other studies will be accessible to the public. The activities mentioned in this article that do not comply with environmental regulations will be sanctioned according to provisions of Law 1532 of 6 July 1982 and Decree No. 10028, of 4 February 1987.

The environmental licensing fees, subject to the provisions of Decree 10,028, of 4 February 1987 are as follows:

1) Previous License fee;

2) Installation License fee;

3) Operation License fee.

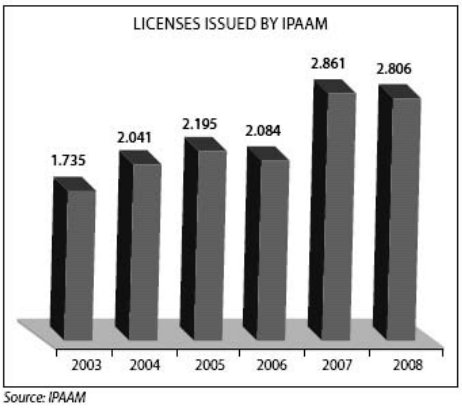
Exempt from environmental licensing fee in the State of Amazonas, are nonprofit

associations operating in the field of solid waste recycling or committed to reducing pollution. The amounts of the prescribed fees for licensing, can be charged in proportion to the duration of the environmental license.

e. Role of IPAAM

IPAAM may prosecute a polluter that has obtained an environmental license in the case of illegal activity. When IPAAM issues the environmental license, they check the application forms and the site. Also, when the licenses are renewed after one or two years, they monitor by checking the forms and site. Moreover, should there be protest or reports from residents of the surrounding area, IPAAM may carry out a check even during the license period, and if there is any illegal activity found, may revoke the license or impose a fine.

According to the 2008 Annual Report of IPAAM, there were 2,806 licenses (new and renewals) for 2008, of which 1,041 were for the rural area outside of city boundaries and 1,765 within city boundaries. According to issue, about 70% were related to PIM and municipal (Brown Issue), 413 were related to aquafarming, aquatic or mineral resources (Blue Issue), and 436 were for forestry resources and agriculture (Green Issue). Furthermore, 44% of the licenses were for 861 projects within PIM. IPAAM earns 6 to 7 million Real (Brazil currency) for the issuance and renewal of environmental licenses.



Source：Annual Report of IPAAM (2008)

Figure 1-16: Number of environmental licenses issued by IPPAM

Table 1-25: Indicators of IPAAM activities

Indicators	2007	2008
Issued Licenses	2.861	2.806
Surveillances	1.334	998
Monitored Processes	524	1.879
Complaints	61	456
Notices Issued	2.793	3.919
Audits	1.773	2.517
Fines	103	438
Skilled Employees	168	183
Licensing Revenue (BRL$)	6.075.790	7.367.686

Source: Annual Report of IPAAM (2008)

1.4.4 Environmental Impact Assessment (EIA) System[1]

a. EIA-related Laws and Ordinances at the Federal Level

The environmental impact assessment (EIA) system in Brazil was introduced with the Basic Environmental Law (Federal Law n. 6,938/81). The CONAMA Resolution 01/86 (1986) and CONAMA Resolution 237/97 (1997) define the detailed provisions for EIA requirements, evaluation and approval process. The following table presents major laws and ordinances related to the EIA system in Brazil.

Table 1-26: Major Laws and Ordinances related to the EIA System in Brazil

Regulation	Year Enacted	Description
1. Federal Constitution, Art. 225	1988	Ch 1, Art 225 concerning the environment, establishes guidelines for environmental conservation and protection of natural resources.
2. Federal Law		
2.1 Basic Environmental Law (n. 6,938/81)	1981	Prescribes national policy on environment, introducing environmental licensing system and the EIA system
2.2 Environmental Crimes Law (n. 9605/98)	1998	Provides a definition for environmental crime, the law rearranges violations and penal provision sections of the environment law.
3. CONAMA Resolutions		
3.1 CONAMA Resolution 01/86	1986	Contains an important provision which provides an overview of the environmental assessment system
3.2 CONAMA Resolution 06/86	1986	Provision of guidelines and forms to obtain environmental licenses
3.3 CONAMA Resolution 09/87	1987	Provision for involvement of private citizens and public consultation in the EIA process
3.4 CONAMA Resolution 237/97	1997	Revision of the environmental licensing system and EIA guidelines

b. Laws and Regulation pertaining to EIA in Amazonas State

Similar to other states in Brazil, in Amazonas State EIA is included in the process to obtain environmental licensing. The major laws and regulations in Amazonas State pertaining to environmental licenses and the EIA system are given below.

Table 1-27: Major Laws and Ordinances related to the EIA System in Amazonas State

Regulation	Year Enacted	Description
1. State Basic Environmental Law (n. 1,532/82)	1982	Provision for basic policy of Amazonas State related to pollution control and management, environmental improvement and restoration, and natural resource conservation

[1] This paragraph contains reference to the following, particularly in regards to federal regulations: "Report on Trade Protections of OECD Member Countries Concerning Environmental Problems Part II Environmental Regulations in Implementing Countries, February 2007, Global Environmental Forum

2. State Environmental License Decree (n. 10,028/87)	1987	Provision for the license system in Amazonas State pertaining to activities which have potential impact on the environment

c. Environmental Impact Assessment (EIA) and Simplified Environmental Study (EAS) in Amazonas State

When a proponent applies for an environmental license, IPAAM in Amazonas requires that an environmental impact assessment (EIA) or simplified environmental study (EAS) is conducted, depending on the environmental impact of the project. After conducting EIA and EAS, the proponent must submit either an Environmental Impact Report (RIMA) or Simplified Environmental Report (RAS) respectively in order to obtain a license.

The Environmental Impact Report (RIMA) is prepared after the EIA. RIMA reflects the conclusion of EIA in an objective way and should be written in easy language and be accessible to the public in order to guarantee the knowledge of its content by interested parties.

Simplified Environmental Study (EAS) and Simplified Environmental Report (RAS) are applied when the activity does not require EIA, but it appears a local or specific part of the development that is sensitive to the environmental and requires additional procedures.

The EIA and RIMA, besides assisting the principles and objectives of the Environmental National Policies, will be operated according to the guidelines and general and specific procedures arisen from the competent federal organizations and IPAAM.

The EIA will be prepared considering environmental diagnosis of the area of the project, complete description and analysis of the environmental resources and their interactions, just as they exist, in order to characterize the environmental situation of the area, before the implantation of the project, considering:

a) The physical environment: soil, water, air and climate, highlighting the mineral resources, topography, types and aptitudes of the soil, surface water and groundwater, hydrological and atmospheric conditions.

b) The biological environment and the natural ecosystems (fauna and flora), highlighting the species of the environmental quality, holding scientific and economic value, rare and endangered and permanent preservation areas;

c) The socio-economic environment: use and occupation of soil, uses of water bodies and social economy, highlighting the archeological, historical and cultural sites and monuments, the dependence relations in local society, the environmental resources and the potential future use of those resources;

d) Analysis of the environmental impacts of the project and of its alternatives, through identification, forecast the magnitude and interpretation of the importance of probable relevant impacts, discriminating: the positive and negative impacts (beneficial and adverse), direct and indirect, immediate and medium and long terms, temporary and permanent; its reversibility degree; its cumulative and synergic properties; the distribution of the obligations and social benefits;

e) Definition of measures which mitigate the negative impacts, among them the control equipments and discharge treatment systems, evaluating the efficiency of each one of them;

f) Elaboration of positive and negative impacts, follow up program, indicating the factors and parameters to be considered.

When determining the execution of the Environmental Impact Study, IPAAM will identify the degree of ecological unbalance or pollution and will define the level of complexity of the study by providing necessary instructions for the peculiarities of the project and the environmental characteristics of the area.

The Environmental Impact Study will be accomplished by a multidisciplinary qualified team, not direct or indirectly dependent on the proponent of the project and that will be technically responsible for the results, necessary instructions, particularities of the project and environmental characteristics of the area.

The proponent will afford all the expenses and costs of the project regarding the accomplishment of the environmental impact study, such as: collection and acquisition of data and information; field works and inspections; laboratory analyses; technical and scientific studies and follow up and monitoring of the impacts; elaboration of the RIMA and provide at least 5 (five) copies; publications in the press.

The Environmental Impact Report (RIMA) will reflect the conclusions of the environmental impact study and it will contain at least:

- The objectives and justifications of the project, its relation and compatibility with the sectorial policies, plans and governmental programs;
- The description of the probable environmental impacts of the implantation and operation of the activity, considering the project, its alternatives, the length of time of the impacts incidence, indicating the methods, techniques and criteria adopted for its identification, quantification and interpretation;
- The characterization of the future environmental quality of the influence area, comparing the different situations of the adoption of the project and its alternatives, as well as the hypothesis of its non-accomplishment;
- The description of the expected effect in the mitigating measures foreseen in relation to the negative impacts, mentioning those that could not be avoided, and the expected alteration degree;
- The follow up and monitoring program of the impacts;
- Recommendation of the most favorable alternatives (general conclusions and comments).

RIMA should be presented in an objective and appropriate way for its understanding. The information should be translated into an accessible language, illustrated with maps, pictures, graphs and other visual communication techniques, so that one can understand the advantages and disadvantages of the project, as well as all the environmental consequences of its implementation.

The RIMA will be accessible to the public and organizations or interested parties can have copies for consultation in IPAAM.

d. Projects which require EIA

In Brazil, there is some difference in the projects which require EIA at the federal and state levels. Also, there is no standardized or uniform system between the two since the requirements (EIA/RIMA, EAS/RAS, etc) vary greatly depending on the jurisdiction of the body overseeing the environmental licensing process.

d.1 Federal Level

The projects which require EIA at the federal level are listed in the table below. These projects are listed in CONAMA Resolutions 01/86 and 05/87. However, a provision in CONAMA Resolution 237/97, Article 10, states that a business operator and the environmental agency will discuss the necessity of conducting EIA at a preliminary stage, so it is possible that the environmental agency could require EIA for projects other than those shown in the table below.

Table 1-28: Projects which require EIA at the Federal Level

Sector	Activity
Roads	Two-lane or above
Railways	
Ports	Mineral, petroleum and chemical products ports and terminals
Airports	Airports
Pipelines	Oil-pipelines, gas-pipelines, mine-ducts, sewerage systems
Power Transmission	Power transmission lines over 230KV
Hydraulic Works	Development of hydraulic works (hydroelectric dam of 10MW or greater, portable waters, irrigation, opening of ship passages, water source rectification, dredging rifts and estuaries, conversion of basins, embankments, etc;)
Fossil Fuel Extraction	petroleum, coal, etc
Mineral Extraction	
Waste	Sanitary landfills, processing and final destination of toxic or hazardous wastes
Power Plants	Primary energy source; 10MW or greater
Factories	Industrial and agro-industrial facilities (petro-chemicals, metallurgical, chlorine chemicals, alcohol distilleries, coal, extraction and cultivation of water sources)
Industrial Districts	Industrial districts and zones
Lumber	Forest stewardship activities, economic exploration of wood or firewood, in areas larger or smaller than 100 hectares, when it reaches significant areas in percentage terms or important from the environmental point of view.
Urban Projects	Above 100 hectares or in smaller areas holding relevant environmental interest, at the discretion of SEMA and competent municipal and state organizations;
Fuel	Any activity which uses or produces wood coal, in amount of 10 tons a day or greater
Agriculture	Agriculture or dairy projects 1,000 hectares or greater, or less when significant from the environmental point of view.
Archeological Sites	Projects with potential environmental impact in areas with ruins or relics

d.2 Amazonas State

The projects which require EIA in Amazonas State are listed in the table below. Those projects are defined in Decree No. 10,028/87.

Table 1-29: Projects which Require EIA at the State Level

No.	Activity
I	Roads
II	Railways
III	Mineral, petroleum and chemical products ports and terminals
IV	Airports, as defined by incise 1, article 48, of Law-Decree n. 32, of 18.11.66
V	Oil-pipelines, gas-pipelines, mine-ducts, collecting trunks and wastewater discharging systems
VI	Power transmission lines over 230KV
VII	Hydraulic works for the exploration of hydro resources such as: dam for hydroelectric, sanitation or irrigation purposes, opening of channels for navigation, drainage and irrigation, rectification of water sources, opening of bedsteads and passages, conversion of basins, embankments;
VIII	Extraction of fossil fuel (petroleum, schist, coal)
IX	Minerals extraction, including Class II, defined in the Mining Code;
X	Sanitary landfills, processing and final destination of toxic or hazardous wastes
XI	Power plants, any primary energy source
XII	Industrial and agro-industrial facilities (petro-chemicals, metallurgical, chlorine chemicals, alcohol distilleries, coal, extraction and cultivation of water sources)
XIII	Industrial districts and strictly industrial zones - ZEI
XIV	Forest stewardship activities, economic exploration of wood or firewood, in areas larger or smaller than 100 hectares, when it reaches significant areas in percentage terms or important from the environmental point of view.
XV	Urban projects, above 100 hectares or in smaller areas holding relevant environmental interest, at the discretion of SEMA and competent municipal and state organizations;
XVI	Any activity which uses or produces vegetable coal, in amount superior to two tons a day

e. EIA Approval Procedures

e.1 Federal Level

Once the required environmental licenses are determined, the required studies are decided, such as EIA/RIMA, RAS and so on. Basically, for projects that require EIA are those given in CONAMA Resolutions 01/86 and 05/87, but as stated in CONAMA Resolution 237/97, Article 10, the governing body has the authority to stipulate the required studies and reports, so that body will determine the type of reporting required. The process to acquire an environmental license is stipulated in CONAMA Resolution 237/97, Article 10. This process is shown in the flowchart below.

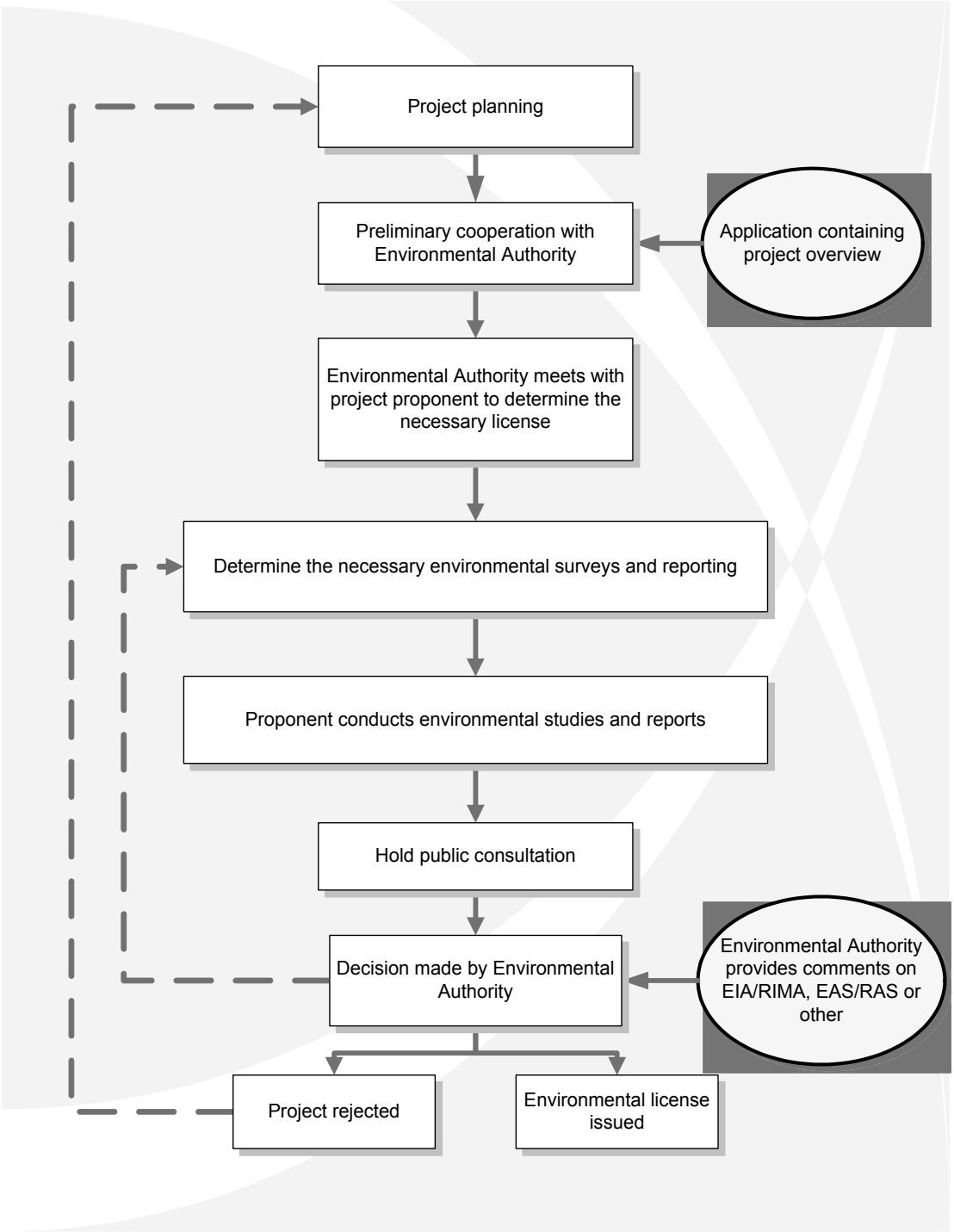
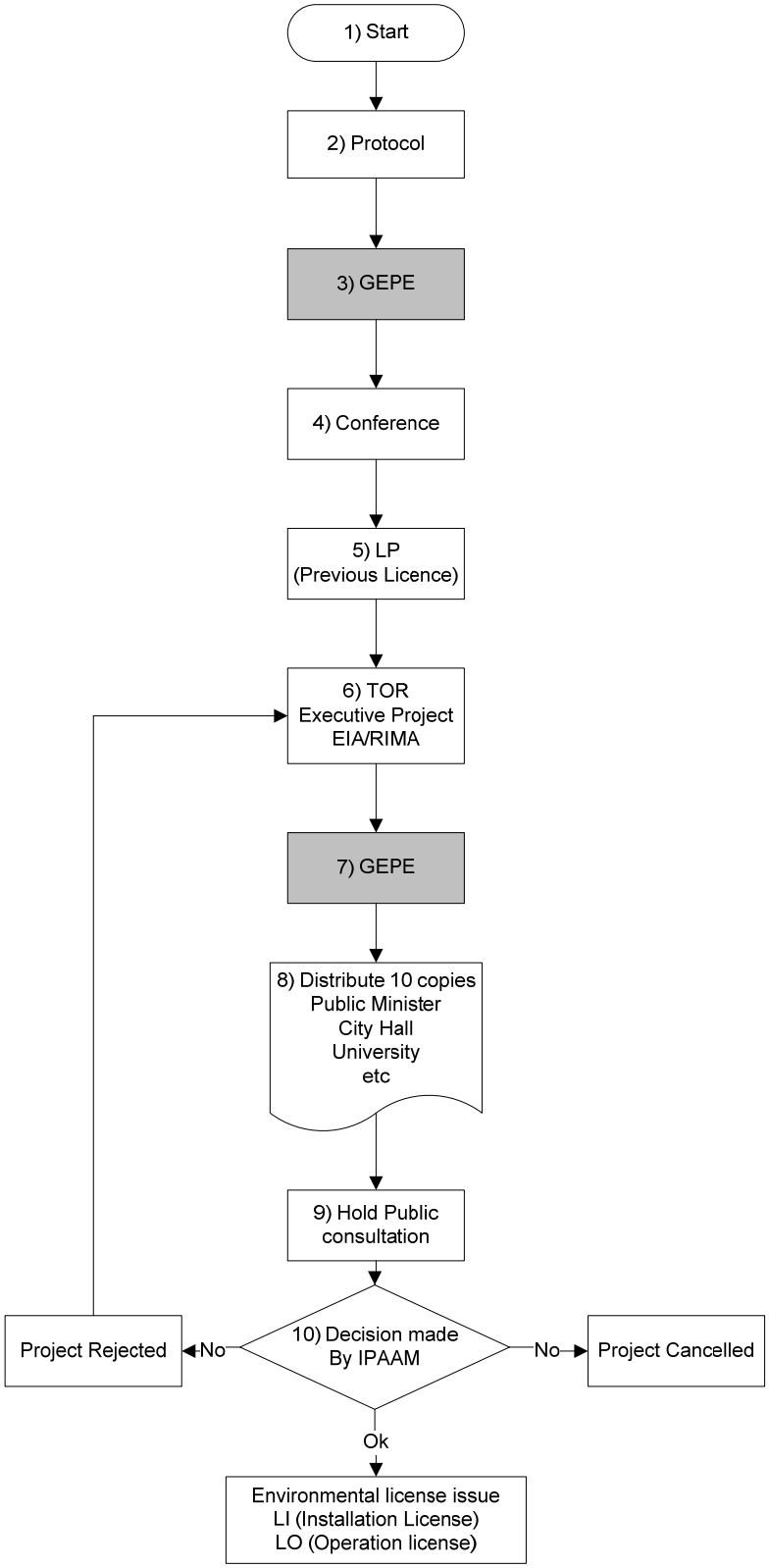


Figure 1-17: Flowchart showing Acquisition of Environmental License in Federal Level

e.2 Amazonas State

The environmental licensing system of Amazonas State significantly differs from it of Federal level in the period of validity of each license. It is much shorter than the federal one and the periods of validity of Previous License (PL), Installation License (IL) and Operation License (OL) are one, two and two respectively.

The process of EIA and acquisition of environmental license is shown in the flowchart below.



(GEPE) SPECIAL PROJECTS MANAGEMENT

RIMA – Summary report of Project for Public consultation

Figure 1-18: Flowchart showing EIA and Acquisition of Environmental License in Amazonas State

f. Publication of EIA Report

Release of project data and EIA reporting is stipulated in CONAMA Resolution 09/87, which states, "IBAMA will issue the previous license after the EIA/RIMA is published in the official daily gazette or newspaper for 30 days, should there be no comment from local residents."

The process of public announcement of the EIA report and each environmental study report is also the same in Amazonas State.

g. EIA Public Consultation

Public consultation for a project is stipulated in CONAMA Resolution 09/87 as follows:

The proponent will hold public consultation concerning the impact of the project before the EIA is concluded

To hold a public consultation, it will be implemented upon application by a public organization, agency or body of 50 members or greater.

In the event public comment is offered, IBAMA will hold a public consultation after the disclosure period is over, after the 15th day, and append the PL with advisory based on the results of the discussion.

The procedures for the public consultation conducted by IBAMA (federal) or IPAAM (Amazonas State) are the same as contained in the CONAMA Resolutions.

In Amazonas State, there is no additional legislation to address this issue.

The public participation is set in the environmental licensing process with the objective of:

- Guaranteeing the divulgation of information about the projects to be licensed, specially about the possible risks towards the environmental quality of the influence areas of the project or activity and the mitigating measures meant to reduce such effects;
- Collect the expectations and concerns of the affected populations and allow the managing organization to collect the manifestations and interests of different social groups.

IPAAM, when determining the accomplishment of the Environmental Impact Study and presentation of the RIMA, will set the period to receive the comments to be made by the public organizations and other interested stakeholders and, whenever it is judged as necessary, it will promote the celebration of public information meetings on the project, the impact and discussion of the RIMA.

The public consultation is basically held with the participation of four groups of actors:

- IPAAM, which coordinates the event and registers the relevant issues arisen for further decision means;
- The proponent which organizes the event, answers the inquiries concerning the intended implantation and pays for the corresponding costs;
- The team in charge of the elaboration of the RIMA, which presents its conclusions, responds technically for its content and answers the inquiries concerning the studies; and
- The audience, which presents its doubts and inquiries.

The proponent will announce in the official journal of the State and in a newspaper of wide circulation, the news of the request for the Environmental Impact Study and respective period for presentation, as well as the delivery of the RIMA within the period set by IPAAM for comments.

h. Relevant Agencies and Organizations (Application Structure)

The body that will inspect and approve the environmental license, based on the scale, sector and potential environmental impact of the project, will be the federal (IBAMA), state or municipal agency.

The body responsible for EIA is stipulated in the corresponding sections of Federal Law 7,804/90 and CONAMA Resolution 237/97 as shown in the following table.

Table 1-30: Stipulation of Organizations responsible for EIA

Related Orgs	Projects targeted for Review and Approval
IBAMA	• A project located in any of the following: (1) both Brazil and neighboring countries, (2) within Brazil's territorial waters, (3) within the continental shelf or special economic zone, (4) within a Indio reservation or federal conservation area. • A project is located in two or more states. • Environmental impact of a project affects outside of Brazil or out of State. • A project is related to research, development, production, processing, transportation, storage of radioactive material, or is intended for the application/utilization of nuclear energy (in such cases, it is necessary to seek advice from the Brazilian National Commission for Nuclear Energy (CNEN)) • A project that has been considered for application to military base construction or military use (in such cases, it must in principal comply with special military regulation)
State Organizations	• A project that takes place in one state • A project that takes place in two or more municipalities (including villages and towns), or in an area under federal protection • A project that takes place in a forest designated under Law 4,771/ 65 or other related ordinance, or in a Permanent Preservation Natural Vegetation zone • Environmental impact of a project affects two or more municipalities (including villages or towns) • The Federal government (i.e. Union) has delegated authority to a State or Federal Territory
Municipal Environmental Office	• The Federal or State government has granted authority for approval by law or contract, or by the Federal Territory environmental authority

1.4.5 Management of Hazardous Materials

The Ministry of Environment (MMA) is implementing a project in preparation to introduce PRTR (Pollutant Release and Transfer Register)[1] with technical assistance by the World Bank.[2] The World Bank project for hazardous chemical material risk management as part of

[1] In Brazil, this is referred to as, Registro de Emissão e Transferência de Poluentes (RETP).
[2] According to the Brazil Ministry of Environment homepage and "Kick –off Workshop to launch a PRTR Projects for Latin America and the Caribbean NCPCs, June 2008".

their "Environmental Sustainability Agenda" is a component of this project, which includes the following activities.

- Definition of the types of information and data of the emissions of correlate elements.
- Identification of criteria for the selection of priority pollutants
- Proposal of guidelines for the companies and factories obligated to report using PRTR
- Proposal of guidelines for the declaration of emissions and transfers using PRTR.

This project to implement a PRTR system was initiated in 2008, and the proposal for the system was set for March 2009. In the project, the PRTR system will be used mainly by the chemical industries to manage harmful chemical substances. The chemical industry in Brazil is composed mainly of inorganic chemical manufacturing (soda manufacturing, nitric acid production, phosphorus, fertilizer manufacturing, and industrial gas manufacturing), and organic chemical goods manufacturing (petrochemical and plastic resin manufacturing), agrochemical manufacturing, paints, solvents, ink manufacturing, catalyst agents, additive manufacturing, and so on, with 7,263 offices throughout the country in 2005 (about 13% of the total number of offices in Brazil).

1.4.6 Current Environmental Awareness, Environmental Education and Factory-Citizen Communication

In December 1994 the Presidency of the Republic created the National Program of Environmental Education (PRONEA) due to the Federal Constitution of 1988 and the international commitments made with the Conference of Rio. This program was executed by the Coordination of Environmental Education of the Ministry of Education and by the corresponding departments of the Ministry of Environment, in charge of the actions meant for the education system and the environmental administration, respectively. PRONEA foresaw three components: qualification of managers and educators, development of educational actions and development of instruments and methodologies.

The instruments comprise seven action lines, which are: (1) environmental education through formal teaching, (2) education in the process of environmental administration, (3) campaigns of environmental education for users of natural resources, (4) cooperation with communication means and social communicators, (5) community articulation and integration, (6) intra- and inter-institutional articulation and (7) a network of centers specialized in environmental education in all States.

In 1997, during the 1st Conference of Environmental Education, held in Brasília, the document "Letter of Brasília for Environmental Education" was produced, containing five thematic areas: environmental education and the outfit of sustainable development, formal environmental education, roles, challenges, methodologies and training, education in the process of environmental administration (methodology and training, environmental education) and public policies (PRONEA, hydro resources, urban, agriculture, science and technology policies).

In April 1999, Law no. 9.795.99, the National Policies of Environmental Education, was approved. In 2001, recognizing the importance of the environmental educators' articulation and their institutions in horizontal organization models, the Ministry of the Environment began action for the structuring and strengthening of Environmental Education Networks (REBEA) and the Network of São Paulo for Environmental Education (REPEA). In June of

2002, Law no. 9.795/99 was regulated by Ordinance no. 4.281, which defines, among other things, the composition and the competences of the Ruling Organization of the National Program of Environmental Education (PNEA).

The actions of PNEA aim for assuring, in the educational extent, the balanced integration of the multiple dimensions of sustainability--environmental, social, ethics, cultural, economical, space and political--for the development of the country, resulting in a better quality of life for the whole Brazilian population, through the involvement and social participation in the environmental protection and the conservation and maintenance of those conditions in the long term, and the following guidelines are assumed:

- Transversally: aims for creating spaces of bilateral and multiple dialogue in order to internalize environmental education;
- Strengthening of National System for Environment (SISNAMA) and the Education systems so that PNEA may be executed in synergy with the other federal policies;
- Sustainability: introducing opportunities to emphasize the good example of the successful practices and experiences;
- Space and institutional decentralization: privileges the democratic involvement of the actors and institutional sectors in the construction and implementation of the environmental education policies and programs in the different levels and instances of social representation in the country;
- Participation and social control: permeate strategies and actions through the generation and availability of information which allow the social participation in discussions, formulations, implementations, monitoring and evaluations of the environmental policies meant for the construction of cultural values committed to environmental quality and social justice;
- Support to society in the search for a sustainable socioeconomic model.

The mission of the National Program of Environmental Education is to stimulate the increase and deepening of the environmental education in all municipalities, sectors of the country and education systems, contributing to the construction of sustainable territories. The principles are:

- Respect for freedom and consideration for tolerance;
- Humanist, holistic, democratic, participative and emancipating focus;
- Conception on environment in its totality, considering the interdependence between the natural and built up socioeconomic and cultural, physical and spiritual environment, under the sustainability focus;
- Link among ethics, aesthetics, educational, working and social practices;
- Freedom to learn, teach, research and publish the culture, thought, art and knowledge;
- Information democratization and interactivity;
- Valorization of school and extra-school experiences;
- Pluralism of ideas and pedagogic conceptions;
- Continuity and permanence guarantee of the educational process;
- Permanent critical and constructive evaluation of the educational process;

- Equality of conditions for the access and permanence in school;
- Articulated approach of local, regional, national, trans-frontier and global environmental issues;
- Recognition and respect for the plurality and genetic diversity of species, ecosystems, individuals and cultures;
- Strive for excellence in internal and external actions;
- Coherence among thinking, feeling and doing;
- Transparency and dialogue;
- Commitment to the active environmental citizenship;
- Transversally built from an inter- and trans-discipline perspective.

The City Hall of Manaus acts through its general offices in environmental projects and programs within the principles established in the extent of the federal legislations providing the citizens with incentive, community participation, preservation of natural and environmental disasters by holding free courses, seminars, lectures, workshops and reuse of recyclable materials.

Many factories and companies considered of large scale established in the Industrial Districts have within their action program activities for personnel awareness and environmental education, such as Motor Honda, Musashi, Sony, and others.

1.4.7 Current Effects on the Environment

Based on available data the following effects of industrial waste on the environment are identified.

a. Water Pollution

Social and Environmental Program for the Igarapes in Manaus (PROSAMIM) financed by Inter-American Development Bank (IDB) is being carried out in the Study Area. “Industrial Pollution Prevention and Control Plan (PCCI)” is conducted as one of the components of PROSAMIM project. PCCI described the water quality of Igarape 40 of which catchment area covers Industrial District (DI) 1 and 2, as follows:

- The water quality of Igarape 40 is very bad due to domestic wastewater from population in the catchment area as well as industrial waste water from DI 1 and 2.
- Coliform index ranges from 250,000/100ml to 1,400,000/100ml. (Concremat, 2004)
- Dissolved Oxygen (DO) ranges from 0.4 to 3.0 mg/l. (Concremat, 2004)
- The water quality of Igarape 40 is contaminated by heavy metals of industrial wastewater such as copper, manganese, iron, zinc, nickel, cadmium, chromium and Lead. Its concentration is above the discharge standard established by the CONAMA Resolution 20/86.

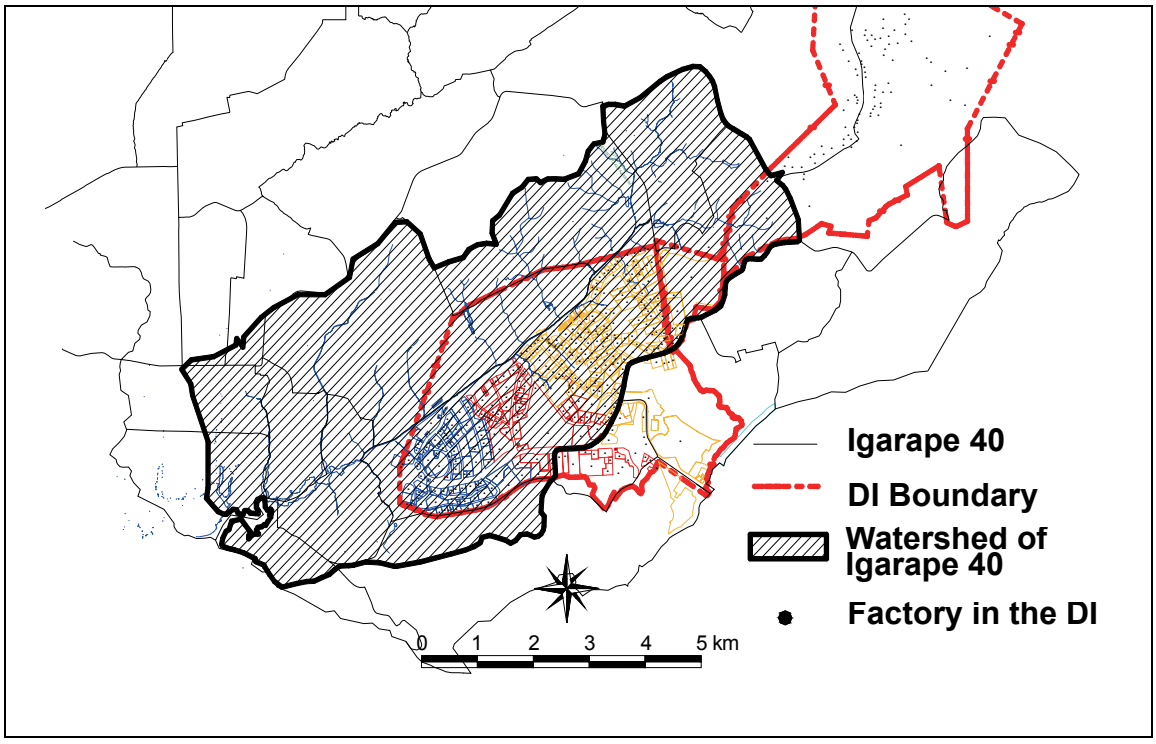


Figure 1-19: Industrial District (DI 1 & 2) and Igarape 40

b. Illegal Dumping of Industrial Waste

In order to understand the situation concerning the illegal dumping of industrial waste, the Study Team investigated 16 illegal dumping sites in DI 1 & 2 in the beginning of April 2009. 15 sites, except one site located in DI 2, are cleaned and restored by SEMULSP. The waste illegally dumped at the site was health-care waste. A collection company is doubtful for dumping the waste because of health-care waste and the dump site location, i.e. far inside of the DI 2.

Cleaned and Restored Dump Site in DI 1

Illegally Dumped Health-care Waste in DI 2

1.4.8 Other Donors

Several donors are cooperating environment and waste management sectors in the Study area. Those donors and their activities are summarized in the table below.

Table 1-31: Donors and Their Activities in the Environment and Waste Management

Sector in the Study Area

Donor	Description
IDB	Inter-American Development Bank (IDB) provides a loan to the "Socio-Environmental Program of Manaus Igarapés River Bank" (PROSAMIM). The main objective of PROSAMIM is to promote the improvement of the quality of life of Manaus population and mainly for people who live in risk area of the igarapés river banks, prioritizing the Bacia do Educandos, most affected population area by the social degradation, environmental and town planning of the city. The works in "Educandos Basin", that comprise the igarapés of Manaus, Bittencourt, Mestre Chico, Quarenta and Cachoeirinha, are contributed from resources of the order of US$ 200 million, and US$ 140 million are a loan from IDB and US$ 60 million are from the Amazonas Government's resources.
Greenpeace (NGO)	Works for a new development model for the Amazon which combines social responsibility and environmental protection and exploration of forest resources in a rational way, providing quality of life for the 20 million inhabitants of the area. Greenpeace has exposed the unscrupulous cutting of trees done by the logging industry in the Amazon and has demanded efficient control and monitoring instruments from governmental authorities. The campaign also seeks to educate consumers by motivating them to choose forest products having ecologically sustainable origin, such as FSC-certified wood.
WWF (international organization)	WWF-Brazil/Manaus develops activities to support research, legislation and public policies, environmental education and communication. Also, there are projects to make conservation units feasible, by stimulating sustainable economical alternatives involving and benefiting local communities.
International Conservation (NGO)	Private non-profitable organization dedicated to the conservation and sustainable use of biodiversity. Founded in 1987, in a few years it grew and became one of the most efficient environmentalist organizations of the world. Now, it works to preserve endangered ecosystems in more than 30 countries distributed in four continents. The organization uses a variety of scientific, economical and environmental understanding tools, besides strategies that help identify alternatives which will not harm the environment.

1.5 State of Waste Management

1.5.1 Waste-related Laws and Regulations

a. Federal Level

a.1 National Agency of Sanitary and Environmental Surveillance - ANVISA

Resolution RDC no. 306, of December 07, 2004, on health establishment waste management.

a.2 Environment National Council - CONAMA

- Resolution CONAMA no. 275/2001 that establishes the code of colors for the different types of wastes to be adopted to identify collectors and transporters, as well as in the informative campaigns for selective collection;
- Resolution CONAMA no. 009/1993 that establishes definitions and it makes obligatory the withdrawal and appropriate destination of used or polluted lubricating

oil;

- Resolution CONAMA no. 005/1993 that establishes guidelines for solid waste management;
- Resolution CONAMA no. 237/1997 that seeks for the need of revision of the procedures and criteria used in environmental licensing, in order to execute the use of the licensing system as an instrument of environmental management, instituted by the Environmental National Policies;
- Resolution CONAMA no. 257/1999 about the negative impact caused to the environment by the inadequate disposal of used batteries, as well as appropriate procedure for the final disposal of those wastes;
- Resolution CONAMA no. 258/1999 about the abandoned or inadequately disposed tires, as well as the risk to the environment and public health, establishing the need to carry out a final destination in an appropriate, safe and environmental way;
- Resolution CONAMA no. 307/2002 that establishes guidelines, criteria and procedures for the administration of construction wastes;
- Resolution CONAMA no. 04/1995 that establishes the properties neighboring airfields and the air traffic control facilities are subject to special restrictions.
- Resolution, CONAMA no. 358, of April 29, 2005, on treatment and final disposal of health-care waste and other measures;

a.3 Normative Instructions and Others

- Normative Instruction no. 36/2006, that establishes the operational procedures of the International Agricultural Surveillance;
- Normative Instruction no. 17/2006, presents the National Plan for the Prevention of Bird Influenza and Control and Prevention of Newcastle Disease;
- Normative Instruction no. 4/2005, establishes the import or export of any animal, vegetable, their products and sub-products, as well as every raw material and input used in agriculture and livestock, when regulated or susceptible of carrying plagues or diseases, should be monitored by the Agricultural Surveillance System of the Ministry of Agriculture, Livestock and Provisioning and presents what should the appropriate conditions be for the operation of inspection services and agricultural monitoring, meant for releasing cargo and luggage, in import and export.
- ISPM No. 15 (Portuguese: NIMF 15) are 2002 FAO guidelines for regulating wood packaging material for goods in international trade meant to establish phytosanitary measures against the introduction of organisms harmful to plants or plant products and against their spread within the community to prevent forest plagues;
- Decree no. 5.940, from October 25, 2006, that institutes the separation of the recyclable solid waste disposed by the organizations and entities of direct and indirect federal public administration, in the generating source, and its destination to the waste pickers associations and cooperatives of recyclable materials and taking other measures;
- Law 6.938/1981, Law of the Environmental National Policy;
- Law 9.605/1998, Law of the Environmental Crimes.
- Resolution RDC no. 345, December 16, 2002, that approves the Technical Regulation

for the Authorization of Operation of companies interested in rendering services holding interest to public health in terrestrial vehicles that operate passengers collective international transportations, boats, aircrafts, fluvial transportation terminals, organized ports, airports, border stations and customs facilities.

a.4 Brazilian Technical Regulations

- ABNT, NBR no. 7501/2005: Land transportations of hazardous products. Terminology;
- ABNT, NBR n. 8843/96: Airports - Management of solid wastes;
- ABNT, NBR n. 8849/85: Presentation of Projects for Controlled Domestic Solid Wastes Landfills;
- ABNT, NBR n. 9191/2002: Plastic bags for waste packaging - Requirements and analysis methods;
- ABNT, NBR n. 10004/87: Solid wastes. Classification;
- ABNT, NBR n. 11174/1990: Storage of waste, Class II, non-inert and Class III, inert;
- ABNT, NBR n. 11175/1990: Incineration of hazardous solid wastes. Performance patterns;
- ABNT, NBR n. 12235/1992: Storage of hazardous solid waste;
- ABNT, NBR n. 12809/1993: Handling of health establishment waste;
- ABNT, NBR n. 12810/1993: Collection of health establishment wastes;
- ABNT, NBR n. 14652/2001: Collection-transport of health establishment waste. Construction requirements and inspection. Group A waste;
- ABNT, NBR n. 7500/2001: Risk symbols for handling, transport and storage of materials.
- ABNT, NBR n. 13221/1994: Transport of waste;
- ABNT, NBR n. 13463/1995: collection of solid waste;
- ABNT, NBR n. 1000/1987: Sampling of waste.

b. State Level

In the extent of state legislation, Law n. 2.712, from December 28, 2001, establishes the Water Sources State Policy and the Water Sources System and the State System of Resources Management.

c. Municipal Level

The Municipality of Manaus presents legislation on solid wastes. In general, the legislation acts to forecast urban cleaning public services, postures and the precautions where appropriate in order not to jeopardize the water resources and the environment.

The main legal instrument is the Organizational Law, promulgated on April 05, 1990 which, in Article 80, paragraph f, establishes that the Municipality is in charge of public cleansing, collection, treatment and disposal of waste. Clause VI of Article 229, establishes the items which are mandatory to be taken into account: definition and maintenance of public cleansing systems, including the collection, treatment and final disposal aspects of the waste.

The Municipal Master Plan of November 04, 2002 Law no. 671, regulated the Urban and

Environmental Master Plan, establishing guidelines for the development of the city of Manaus. The issue of solid waste is described in Article 7, Paragraphs f) and g); articles 52, 53 and 126.

The Municipality of Manaus is elaborating its Master Plan for Municipal Solid Wastes.

1.5.2 Waste-related National and Regional Plans

The regulating milestones at the federal level which became programs and projects that contribute to the improvement of solid waste management, in execution and course in chronological order are:

- 2001: Statute of the Cities: Law no. 10.257 that regulates Art. 192 and 183 of the Federal Constitution, establishes general guidelines of urban policy and other measures;
- 2004: Kyoto Protocol Ratification: Russia concludes the process and goes into force on February 16, 2005;
- 2005: National Law of Public Consortia: Law no. 11.107/05, sanctioned on April 06, 2005. Prepare general rules for the Country, State, Federal Districts and Municipalities to hire public consortia for the accomplishment of common interest objectives and takes other measures. Regulation of this Law on January 17, 2007: This law allows the regionalization in sustainable steps for the operation and accomplishment of the services, reduction of costs; improvement of the administration capacity, management, public partnerships and increases sanitary landfill sites in potentially appropriate way for SWM projects;
- 2005: Decree no. 6.017, of January 17, 2007 that establishes rules for the execution of Law no. 11.107/2005;
- 2007: National law of Basic Sanitation, Law no. 11.445/07, which establishes national guidelines for basic sanitation.
- Bill of the National Policy of Solid Waste being evaluated from 1991 to 2007 and being forwarded by the Executive to the Congress. The main aspects of this law are: induction to the protection of public health and the environmental quality, promotion of the 3Rs (reduce, reuse, recycle) incite the treatment and appropriate environmental final disposal, integrated management of solid waste. Plans of Integrated Management of Solid Waste as a condition for the access to resources for urban cleaning and solid waste management, operational and financial sustainability of the services, transparency and social participation, social inclusion of the recyclable materials (waste pickers), respect for local and regional diversities, establishment of associated or shared solutions, reverse logistics--direction of the waste towards its productive chain or productive chains of other generators and attribution of the generator;
- 2009: Regulation of Law no. 11.445/07 in public consultation.

Also highlighted is the Growth Acceleration Program (PAC) projected for 2007-2010. It is a development program which promotes the acceleration of the economical growth; employment increase and improvement of living conditions of the Brazilian population. It consists of a group of measures for motivating private investment, increasing public investment in infrastructure and removing obstacles to growth (bureaucratic, administrative, normative, juridical and legislative aspects).

1.5.3 Industrial Waste Management related Governmental Institutions

a. Federal Level

a.1 Ministry of Environment (MMA)

The Brazilian Ministry of the Environment (MMA) was established in 1992. It's mission is to promote the adoption of principles and strategies for the protection and restoration of the environment; for the sustainable use of natural resources; for the valuing of environmental services; and for the inclusion of sustainable development in public policies, in a participative, democratic and transversal way, at all levels and instances of government and society.

The Ministry is responsible for addressing the following issues:

- A national policy for the environment and for water resources;
- A policy for the preservation, conservation and sustainable use of ecosystems, biodiversity and forests;
- Proposing strategies, mechanisms and economic and social instruments for improving environmental quality and for the sustainable use of natural resources;
- Policies for integrating production and the environment;
- Environmental policies and programmes for the Legal Amazon; and
- Ecological and economic territorial zoning.

The Ministry of the Environment is structured as follows:

1) Offices for direct and immediate assistance to the Minister:

a) Minister's Office

- Press Office
- Office for Parliamentary Affairs

b) Executive Secretariat

- Sub-secretariat of Planning, Budget and Administration
- Department of Strategic Management
- Department for Coordination of Policies for the Amazon and Control of Deforestation
- Department for Promotion of Sustainable Development
- Department for Support of the National Council for the Environment

c) Office for International Affairs

d) Legal Advisory

2) Secretariats

a) Secretariat of Climate Change and Environmental Quality (SMCQ)

b) Secretariat of Biodiversity and Forests

c) Secretariat of Water Resources and Urban Environment (SRHU)

d) Secretariat of Extractivism and Sustainable Rural Development (SEDR)

e) Secretariat of Institutional Coordination and Environmental Citizenship

3) Councils

a) National Council for the Environment (Conama)

b) National Council for Legal Amazon (Conamaz)

c) National Council for Water Resources

d) Deliberative Council for the National Environment Fund

e) Genetic Heritage Management Council

f) Public Forest Management Commission

g) National Commission for Forests (Conaflor)

The Secretariat of Climate Change and Environmental Quality's duties include proposing policies and defining strategies referring to all types of pollution, environmental degradation and environmental risks; to residues which are harmful to health and to the environment; to the evaluation of environmental impacts and to environmental licensing; to the promotion of chemical safety; to monitoring of the quality of the environment; and to the development of new instruments for environmental management and an environmentally adequate energy matrix.

This secretariat contains three departments: the Department of Environmental Quality in the Industry, the Department of Licensing and Environmental Evaluation and the Department of Climate Change. The first two departments are related with industrial waste and licensing issues.

The Department of Environmental Quality in the Industry of the Secretariat of Climate Change and Environmental Quality is responsible for the management of industrial and hazardous waste. Currently, is dealing with the management of waste from health services, ports and airports, used lubricating oils, mercury, PCBs, tires, batteries, lamps, electronics, and contaminated areas and import and export of waste. It is also responsible for implementing the national inventory for Industrial solid waste.

The Department of Environmental Quality in the Industry has 9 technicians that work in this sector under the direction of a manager.

In the figure below shows the organization chart of MMA including the Secretariat of Climate Change and Environmental Quality.

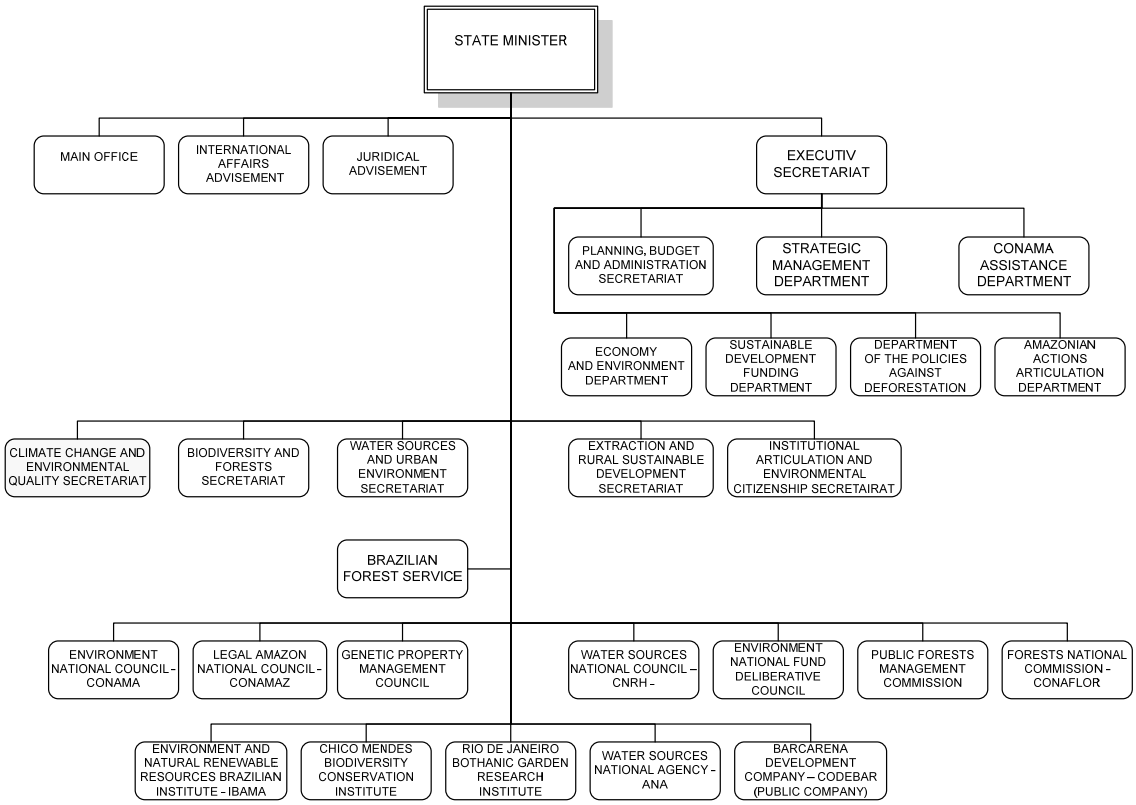


Figure 1-20: Organization Structure of the Ministry of Environment (MMA)

a.2 Brazilian Institute for the Environment and Natural Resources (IBAMA)

The Brazilian Institute for the Environment and Natural Resources (IBAMA) was created by Law No. 7735 of 22 February 1989. IBAMA was formed by the merger of four Brazilian institutions working in the environmental area: Department of the Environment (SEMA), the Superintendence of Rubber (SUDHEVEA), the Superintendent of Fishery (SUDEPE), and the Brazilian Institute for Forestry Development (IBDF).

In 1990, it established the Department of the Environment of the Presidency (SEMAM) linked to the Presidency, and IBAMA as the agency for the environmental management, responsible for formulating, coordinating, implementing and executing the National Policy on the Environment and the preservation, conservation and rational use, monitoring, control and promotion of renewable natural resources.

IBAMA's work with the Federal Government stands out the creation of the following protected areas: national parks, biological reserves, ecological reserves, ecological stations, protected areas and areas of ecological interest. In states and municipalities concern focused on watershed protection and green belts around industrial sites.

The Brazilian Institute for the Environment and Renewable Natural Resources (IBAMA) is structured as follows:

- Presidency
- Attorney-General (Proge)
- Audits
- Advisories

- Cabinet
- Superintendencies
- Directorate of Planning, Administration and Logistics (Diplan)
- Directorate of Environmental Quality (Diqua)
- Directorate of Licensing (Dilic)
- Directorate of Environmental Protection (Dipro)
- Directorate of Sustainable Use of Biodiversity and Forests (Dbflo)

Thematic areas of IBAMA are:

- Environmental emergencies
- Supervision
- Wildlife
- Forest fire
- Environmental information
- Environmental licensing
- Environmental monitoring
- Attorney general
- Environmental quality
- Forest resources
- Human resources
- Fisheries resources
- Environmental zoning

The organization structure of IBAMA is shown in the following figure:

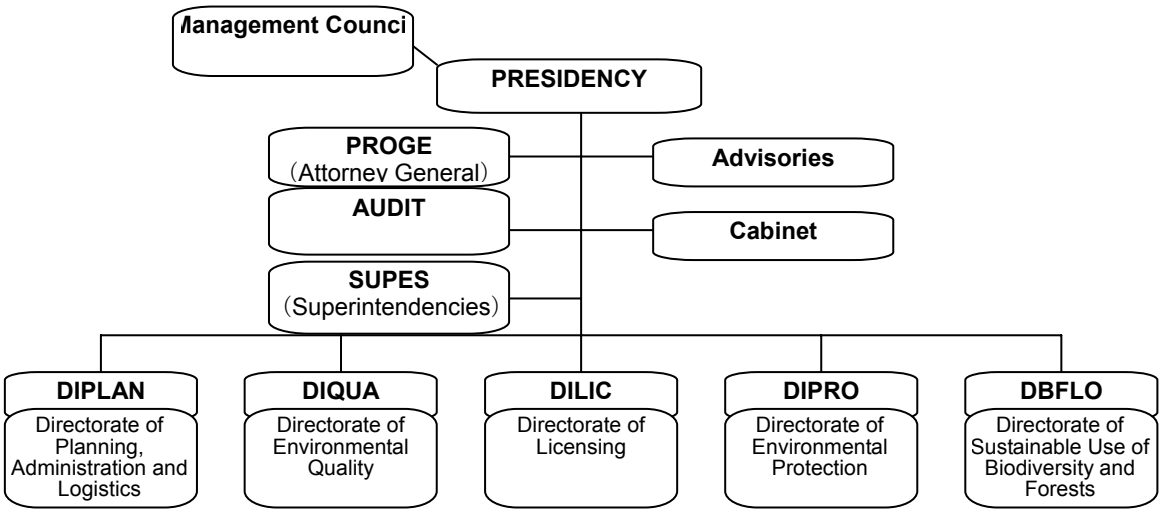


Figure 1-21: Organization Chart of IBAMA

One of the challenges of IBAMA is to anticipate and prevent environmental problems such as pollution, degradation and misuse of environmental resources. In consideration, the organization of IBAMA has been restructured considering the improvements and actions to the demands of progress of the country, focusing its activities in the evaluation, licensing, control and inspection of products and potentially polluting activities and the appropriate use of natural resources.

In that sense, the Department of Environmental Quality was created in March of 2006, to carry out the policies to prevent situations of environmental emergencies or to minimize its impacts.

The responsibility of Department of Environmental Quality (DIQUA) is to coordinate, manage, supervise, regulate, monitor and guide the implementation of federal actions regarding the proposal of criteria, standards, parameters and indicators of environmental quality, and potentially polluting activities or users of the environmental resources.

This department is responsible for waste management with the following responsibilities:

- To coordinate, manage, supervise, regulate, monitor and guide the implementation of federal actions relating to proposal of criteria, standards, parameters and indicators of environmental quality;
- To establish indicators, standards, criteria and methodologies for assessing environmental quality and for prevention, mitigation and remediation of environmental damage and to evaluate, manage and control sources of pollution and environmental contamination at a regional, national and international levels;
- To manage federal technical register of activities and instruments for environmental defense and potentially polluting activities or users of environmental resources;
- To prepare the report of environmental quality, whose goal is to inform the status of the environmental quality of several Brazilian ecosystems and their environmental resources;
- To coordinate the National Program of Education and Control of Noise Pollution;

- Provide consent prior to import and export of substance and hazardous or potentially hazardous;
- Control emissions from mobile sources through the control program of air pollution by motor vehicles;
- To carry out environmental assessment and registration of pesticide products and remedial wood preservatives, and
- Participate in various international environmental agreements

Currently, DIQUA works with 94 employees.

a.3 National Council for the Environment (CONAMA)

The Environment National Council (CONAMA) is the consulting and deliberation organization of the Environment National System (SISNAMA), it was instituted by Law 6.938/81, about the Environment National Policy, regulated by Decree 99.274/90.

CONAMA is formed by the Plenary, CIPAM (Independent Company for Environmental Policy), Consulting Groups, Technical Chambers and Working Groups. The Council is presided over by the Environment Ministry and its Executive Secretariat is managed by the Environment Ministry Executive Secretary.

The Council is a representative collegiate from five sectors: federal, state and municipal organizations, business sector and civilian society.

In Technical Chambers (TC) and Working Groups (WG) there are two chambers: Technical Chamber of Control and Environmental Quality and the Technical Chamber of Health, Environmental Sanitation and Waste Management that deal with waste. Especially, the later chamber includes the following waste-related Working Groups (WG):

- WG Electro-electronics. Electro-electronic equipment waste.
- WG mercury lamps. Final disposal for mercury lamp waste.
- WG micronutrients. Use of industrial waste indicated as raw material for manufacture of supply products of micronutrients used as farm input.

b. State Level

b.1 Institute of Amazonas Environmental Protection (IPAAM)

The mission of the Institute of Amazonas Environmental Protection (IPAAM) is "to execute Policies of Environmental Control of the State of Amazons" seeking for the sustainable development of the region.

The activities of environmental control in the State of Amazon began in 1978 in the State Secretariat of Planning and General Coordination-SEPLAN, executed by the Development Commission of the State of Amazon (CODEAMA).

In IPAAM, industrial waste management is charge of the Environmental Monitoring Management (Gerência de Monitoramento Ambiental - GMAM).

The objective of GMAM is to take preventive and corrective actions of industrial activities with potential environmental impact. The main tasks are:

- Surveys monitoring;
- Evaluation of the performance of licensed activities;
- Implementation of measures necessary to correct irregularities

GMAM has eight (8) technicians: 3 chemicals, 2 biologists, 1 civil engineer, 1 economist and 1 fishing engineer. They have the following qualifications: 1 doctor, 3 masters, 2 specialized and 2 graduates.

The Figure below shows the organization chart of IPAAM and the Environmental Monitoring Management under the Directorate of Technical Management.

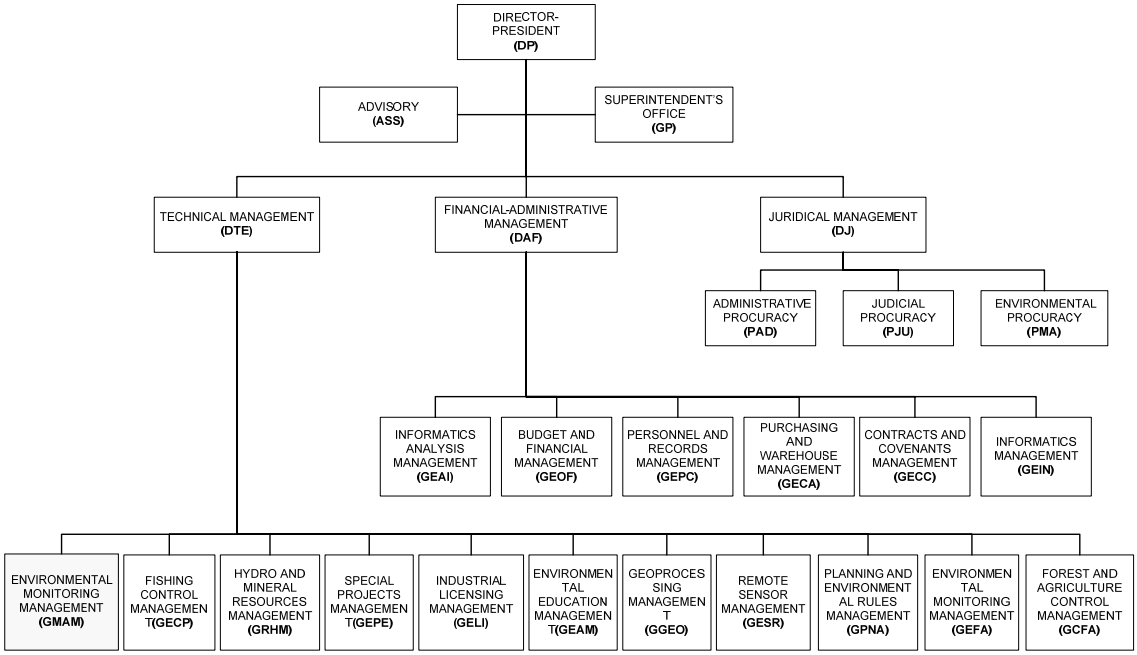


Figure 1-22: Organization Chart of IPAAM

b.2 SUFRAMA

There is no unit at SUFRAMA in charge of industrial waste management. However, as an output of this study, preparations are underway for the establishment of a special waste unit under Industrial Projects Analysis General Coordination (CGPRI) of SAP in 2010 in order to put into effect the master plan (M/P) that has been formulated for the improvement of industrial waste management.

c. Municipal Level

c.1 SEMULSP

Waste management in the city of Manaus is the jurisdiction of Municipal Secretariat of Urban Cleansing and Public Services (SEMULSP). This organization owns and operates its own final disposal site, which in addition to municipal solid waste (MSW), also accepts industrial (manufacturing) waste, health-care waste, and construction waste.

Under Law No 1314 of 04 March 2009, the Municipal Secretariat of Urban Cleansing and Public Services (SEMULSP) integrates the Direct Administration of Manaus Prefecture, as body implementation of policies and public services for with the following purposes:

Formulation and implementation of public cleansing policy through conventional and selective collection methods in the municipal areas and its final disposal.

Maintenance of gardens, public parks and cemeteries, preserving public health and the environment.

In order to accomplish its purposes SEMULSP provides:

- Formulation, administration and implementation of public cleansing policy;
- Coordination, implementation and control of services that compete to administrative units required to implement the activities;
- Guidance and supervision in accordance with laws, rules and regulations, the deployment and implementation of management plans, health services waste and construction waste.
- Keeping of summarized records allowing to obtain data of operation efficiency, economic, financial, sanitary and environmental for urban cleansing municipal services, with a view to authorization by decision makers and mainly to evaluate the performance of their services in front of the potential impacts generated by urban solid waste;
- Formulation, planning, administration and implementation of the deployment, administration and maintenance of cemeteries and necropolis.
- Formulation, planning, administration and implementation of the deployment, administration and maintenance of parks and gardens;
- Promotion of educational programs didactic and informative, showing the importance urban sanitation in contributing to the well-being, health and environmental preservation, as well as the importance of participation, allocation and responsibility of the community in conservation and maintaining the cleanliness of public spaces.

c.2 Operation Structure of SEMULSP

The decree that provides the operational structure of the Municipal Secretariat of Cleansing and Public Services (SEMULSP) is No. 0146 of June 5, 2009, which was published on the Official Gazette of the Municipality, issued on 5/06/2009.

The organization chart of SEMULSP is presented in the following figure:

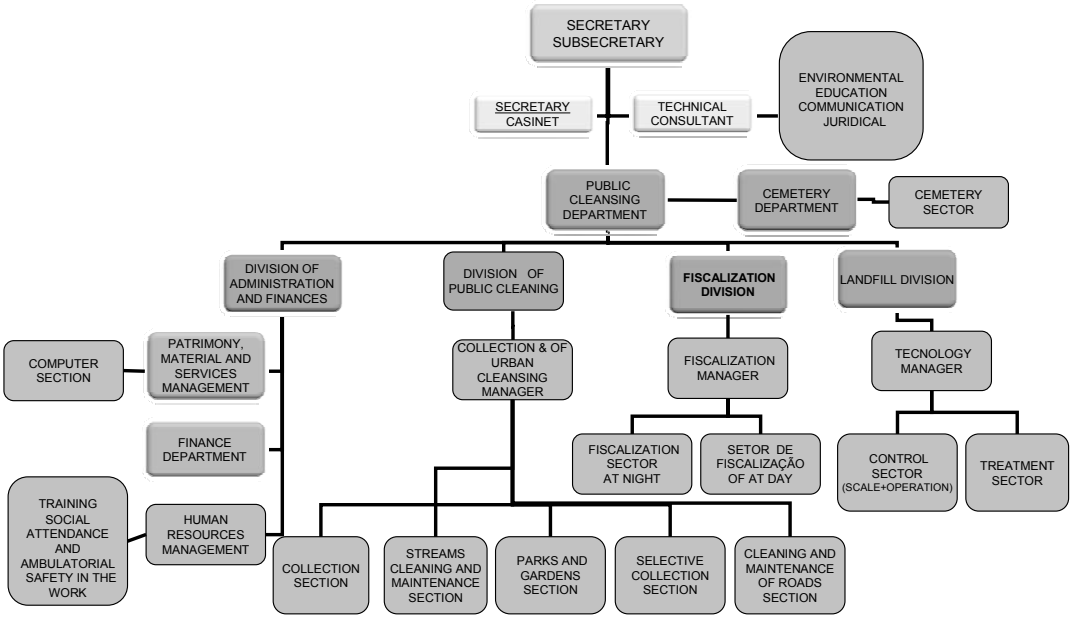


Figure 1-23: Organization Chart of SEMULSP

SEMULSP is headed by a Municipal Secretary, with the aid of a secretary, and consists of the following operational structure:

1	Board of Assistance and Advisory
	- Office of the Secretary
	- Technical Advisory
2	Supporting Bodies for Management
	1. Division of Administration and Finance
	1.1 Heritage Management, Material and Services 1.2 IT Management 1.3 Department of Social Work and Ambulatory
3	Operation Bodies
	a) Department of Public Cleaning
	- Division of day-time Supervision - Division of night-time Supervision - Management of cleansing Igarapes - Management of public cleaning maintenance
	b) Division of Landfill
	- Scale Management
	c) Department of Cemeteries
	- Management for Cemeteries support

Table 1-32: Commissioned Charge

No.	Charge	Symbols	Number of persons
1	Municipal secretary	-	1
2	Sub-secretary	-	1
3	Department Director	DAS-3	2
4	Division Chief	DAS-2	4
5	Technical Advisor II	DAS-2	2
6	Manager	DAS-1	5
		CAD-3	1
7	Technical Advisor III	DAS-1	5
8	Advisor I	CAD-3	2
9	Advisor II	CAD-2	8
10	Advisor III	CAD-1	6
	Total	-	35

Table 1-33: Gratified Charges

No.	Charge	Symbols	Number of persons
1	Sector Chief	FG-2	1
2	Sector Chief	FG-1	13
	Total	-	14

Currently, in the Manaus municipal landfill is not permitted to dispose and receive industrial waste or hazardous waste. However, since there are no authorized landfills, private companies discharge non-hazardous industrial waste in SEMULSP landfill. These discharges represent about 10 to 15% of the total waste discharged in the landfill. The SEMULSP grant a license to use the landfill by third parties.

SEMULSP has no specialized section for industrial waste. However, considering changes in the structure of the Secretariat, the current Administration is intended to align the new waste management policy, and create a special section for industrial and hazardous waste management, whose management must be performed by trained professionals.

1.5.4 Administration of Waste Service Companies

a. Registration System

a.1 Registration System for Waste Service Companies in the State of Amazonas

Registration of waste service companies is handled by the Institute of Amazonas Environmental Protection (IPAAM). However, IPAAM does not register the companies themselves, but instead registers the environmental license of the waste service companies. The primary activity of IPAAM for environmental administration is to issue and manage environmental licenses, monitoring, and inspection; in this way, waste service companies are managed through the approval and issuance of environmental licenses.

a.2 Environmental Licensing

In the State of Amazonas, an environmental license must be obtained for any activity (industry) that could potentially impact the environment (Derecto No 10028 de 04 de Febreiro de 1987). These licenses are required not only for the installation and operation of factories, but for most activities where environmental impact is likely, including construction projects, agricultural, medical and so on.

There are three types of environmental licenses, as shown below. Business activities require three types of license be obtained.

- Previous License (PL): Granted at the preliminary stage of the enterprise or activity. It is granted for up to one year, after which the license must be reissued. In order to obtain the PL license, the place and activity must be approved in accordance with local government guidelines.
- Installation License (IL): Authorizes the construction of a factory and installation of a facility, with a maximum term of 2 years; it is necessary to extend the license prior to expiration.
- Operation License (OL): Authorizes the operation of the activity or enterprise, with a maximum term of 2 years; it is necessary to extend the license prior to expiration.

a.3 IPAAM List of Waste Service Companies (WSCs)

IPAAM environmental licensing covers all industries that impact the environment using a 4-digit code (01**). The first two digits designate the major division of industries into 32 classes, and the last two digits further divide these into sub-classes. The study team used this classification system to compile a list of waste related activities, as shown in the table below.

Table 1-34: Waste Service related Codes of IPAAM for Environmental Licensing

Code	Class	Code	Sub-Class	
				Impact
22＊＊	Commerce and Services	2217	Incineration	High
		2218	Co-processing of wastes	High
		2219	Agrochemical Collection Center	Moderate
24＊＊	Other Services (including provision of electricity and water)	2407	Solid Industrial Waste Collection and/or Treatment	High
		2408	Municipal Waste Final Destination	High
		2410	Collection and Transport of Inert Solid Waste	Minimal
		2411	Collection and/or Storage and/or Commercialization of Solid Waste (e.g. recycling)	Moderate
		2412	Collection and/or Treatment of Hazardous Liquid Industrial Waste	High
		2417	Industrial Waste Disposal in Landfill	High
26＊＊	Transportation	2615	Transport and Storage of Hazardous Solid Industrial Waste	High
30＊＊	Waste Treatment and Recycling	3001	Treatment and Recycling of Solid Industrial Waste without chemicals	Moderate
		3002	Treatment and Recycling of Industrial Liquid Waste	Moderate

		3003	Treatment and Recycling of Solid Industrial Waste without Chemicals	High
		3004	Treatment and Recycling of Palettes	Moderate
		3005	Paper and Cardboard Recycling	Moderate
		3006	Treatment and Recycling of Mineral Waste (Waste Re-processing)	Moderate

(Source) Classificacao das Fontes Poliudoras IN 001;06 Publicada em (3/12/2007)

b. Current Administration Conditions

In the same way that other industrial activities that must obtain environmental licenses, IPAAM manages waste service companies through the renewal of maximum 2-year Operation Licenses. Although the IPAAM environmental licenses have been digitized, the following issues were identified:

The database server is old and does not function sufficiently. Furthermore, the database system is used for file management (to track where certain files are located), and thus is not set up for license management.

Other information about IPAAM activities is mixed with the environmental license data and managed in the same database, making it extremely difficult to extract the license information needed.

As shown in Table 1-34: Waste Service related Codes of IPAAM for Environmental Licensing, waste service companies are registered by codes for various related activities.

It became evident that not all of the waste service companies were shown in the IPAAM WSC List because it only lists those companies which have a code for waste service related activities. Also, once a list was compiled of the companies that are no longer in business or ceased their waste service related activities, it was not possible to identify them in the IPAAM WSC List, suggesting that licenses are not properly renewed and pointing to the need for a series of improvements to be made.

IPAAM indicated that improvements will be made to their registration system for waste service companies so it will be more effective. Furthermore, those companies without environmental licenses will be encouraged to register, and the system reinforced by updating the database of IPAAM waste service companies—which will be constructed during this study.

c. Current Condition of Waste Service Companies

Present conditions are similar to those mentioned above in that it is not possible to clarify the number of waste service companies in the study area or in what activities they are engaged. Moreover, it is reasonable to say that there are a number of parties engaged in waste services without having obtained the appropriate environmental license. In the very least, this study was able to recognize 23 companies after carrying out a survey of waste service companies.

The following table shows the business sector of companies that have environmental licenses based on an examination by the study team with support from the local consultant of the licenses of 67 waste service companies.

Table 1-35: Categorization of Waste Services of 67 Companies with Environmental Licenses

Possession of Environmental License	Collection / Transportation	Intermediate Treatment	Final Disposal	Reuse / Recycling	Unable to categorize*1	Total
With EL	26	24	0	21	4	75

Note: *1: An actual visual check of the licenses was unable to confirm the corresponding work conducted by the WSCs; the content of the licenses were as follows: 1. Distribution and supply of water (2companies), 2. Spray and cleaning with insecticide, 3. Retailer of wood products

1.5.5 Waste Manifest System (WMS)

a. General Information

The waste manifest system (WMS) was implanted in almost all Brazilian states without following a mandatory national standard. The recent "Reference Term for the Elaboration of Wastes Manifest" proposed by IBAMA – Environment Brazilian Institute, of the Environment Ministry, which defines as so:

> WASTES MANIFEST SYSTEM – waste control system which, using its own form, known as a *waste manifest*, allows one to know and control the destination given by the generator, transporter and receptor of the wastes.

Ordinarily, the WMS comprises: a) the above-mentioned waste manifest form, sometimes referred to as a Waste Transport Manifest (WTM); b) a periodic newsletter of the wastes generator for the Environmental Authority (EA) which granted it the license, thus consolidating the issued manifests; c) similar newsletter from the receptor for the environmental authority which granted it the license; d) similar newsletter from the transporter for the environmental authority in the states where they are subject to licensing; e) the record of the information in the generating, receptor and transporter enterprises, and in the environmental authority.

Due to the lack of a clear and comprehensive regulation, several environmental authorities (EA) understand the WMS is restricted to the flow of the waste transport manifest, or simply waste manifest (WM), and some fail to establish a standardized model format and issue specific serial numbers for each generator--two essential elements for control--and leave these to the discretion of the client.
The link of a generator to the WMS, or the simple obligation of issuing the WM, is defined by the EA according to the expected environmental risk. Very often, it is mandatory that they are linked to the industrial and health-care waste generators, recently extending to construction wastes. Public and domestic wastes are not included.

To serve as record and control of each participant of the origin-transport-destination cycle, as well as the EA, the five sheets form, reduced to 4 sheets in order to avoid the accumulation of paper in the EA and, recently, the information in the internet and the electronic registration.

In any hypothesis, the WM is issued by the generator, which signs it, identifying the waste, its package, weight and volume, the cargo receptor and transporter, which also sign in order to identify their responsibilities – and providing other data foreseen by the EA.

b. Integrated Control of the Wastes Destination-Origin Flow

The WMS integrates the Licensing System by the EA, and its information enables the easy surveillance of the wastes stream and the control of the licensed activities, besides the continuous updating and confrontation of the Wastes Inventory.

Prior to the issuance of a Manifest, an extremely important phase should be fulfilled by the EA for the efficiency of the administration of the wastes and, as important as that, as a technical support for the waste generators, receptors and transporters. That phase comprehends the verification or proposal of the generator to dispose its wastes, and the answer from the EA authorizing it or, otherwise, stimulating it to consider other options. Just like the WMS, that phase was established and evolves in every state as the knowledge and technical resources develop the regulation and the consequent services market.

Next are presented two examples which illustrate the considerations set forth herein.

b.1 WMS and Authorizations in the State of Rio de Janeiro

In the State of Rio de Janeiro, the WMS was introduced by the first time in Brazil, as part of the Pollutant Activities Licensing System (PALS), enforced by decree 1633 from 1977. The WMS was enforced by Policy DZ 1310, and the WM was issued in 5 sheets, for the generator, transporter, and receptor – two sheets returned with the certification of the three of them, to the generator, which sent one of them to the EA. After that, the 5th sheet was eliminated, being sufficient to leave the 4th one, identical, available for monitoring in the generating enterprise. Successive updating resulted in the seventh revision (R-7) of the Policy in 2004, and last year the electronic system was initiated with the WM and the information in the internet – still operating optionally, until they are incorporated by the participants, and then updated.

Aiming for the correct destination of wastes, guidance for the generators and control, every waste destination operation should be previously informed to the EA, with the proper technical base, which, by means of a technical analysis, would authorize it or not,. As time went by, two facts allowed a radical simplification of that procedure: a) the best technical knowledge of the generator and the awareness of its responsibility for the wastes it generates, and b) the consequent growth of the market of specialized services authorized by the EA.

Today the WM fulfills the control needs by the EA, once the document shows the licenses of the receptor, generator and transporter – obviously, a mistaken destination leads to the punishment of the involved parties.

It is meant to notice the procedure will be different when the receptor or generator is out of the jurisdiction of the EA of the State of Rio de Janeiro, and that will involve the authorization of the EA to take the waste to the licensed receptor in the other state, presenting it an acceptance letter of that receptor, plus the authorization of the EA from its state to receive the said waste. If the receptor is based in Rio de Janeiro, it will request from the EA the authorization to receive the waste generated in the other state; once such authorization is granted, it will give the generator its acceptance letter plus the authorization, which will serve as basis for the authorization request of the generator to the EA of its state, according to local procedures.

The authorization of the EA does not exempt the use of the manifest by the generator located in Rio de Janeiro, which will be issued for each load being transported, while the authorization may comprehend several loads of the same waste for a period set by the EA and as long as the license of the receptor is valid.

b.2 Equivalent documents in the State of São Paulo

In the state of São Paulo, two decades ago, two instruments fulfilled an objective similar to the WMS and the destination preliminary authorizations: the Approval Certificate for the Destination of Industrial Wastes – CADRI, and the Authorization Certificate for the Transportation of Industrial Wastes - CATRI. Later on the CATRI was abolished, keeping the regular information of the generators for the EA about the transported wastes and their receivers.

The CADRI should be requested by the generator, informing the characteristics of the waste, the proposed destination and the approval of the receptor (it is mandatory that the enterprise be licensed for such), which is granted after a favorable evaluation by the EA. The receptors should inform the EA, on regular basis, the received and sent wastes, their quantities and origin.

When the receptor is located in another state, out of the jurisdiction of the EA, the generator (mandatorily licensed by it) will request the CADRI, attaching a letter to it, in which the receptor agrees to receive the wastes and declares to be licensed by the EA of its state for such reception; together with that, the receptor will request and will receive the authorization from the EA of its jurisdiction to receive the specified wastes from that generator; the operation may go into effect after the issuance of the CADRI.

If the generator is out and the receptor is in the state territory, it will be in charge of requesting a Technical Evaluation from the EA which, if favorable, will grant it the authorization to receive the wastes. Such favorable evaluation will be presented by the generator to the EA of its state, which, as per its procedures, will then authorize the removal of the waste for the pre-accepted destination.

In both situations the WM must be used for each transporter, always issued by the generator, which at the end of the origin-transport-destination cycle, will send a copy of the document to the EA or will keep it for itself in case it is requested.

Recently, Law 12,300/2006 set the Solid Wastes State Policy, which determines the use of WM for the transportation of hazardous wastes (art.39, § Sole Paragraph), as well as the obligation, for generators, transporters and receptors, to inform the EA on annual basis about the quantities of managed wastes, besides other data (art.46 and 47), what constitutes the Annual Declaration System. Because of that, the Environment Secretariat created a Technical Group to elaborate a Reference Term related to this new System, which will include the electronic CADRI.

c. WM Issuance, Content and Flow

Not every waste must be transported with a WM, not every generator, receptor or transporter, although they may be *subject* to linkage, it is mandatory that they are linked to a waste manifest system (WMS). The EA will be in charge of defining such linkage and what class of waste it applies to. In general, the solid domestic and public wastes are excluded, and the industrial and health care enterprises are linked to the WMS, comprehending the off-site management of the hazardous and non-inert wastes.

In most states the EA sets an exclusive WM model so it may include the desired data in order to facilitate their transfer into the data base of the institution. Aiming for fraud control and prevention, the EA provides a series of WM numbers, particularly for each generator linked to the WMS.

The WM is issued by the generator, even if there is a manager hired to manage the service; it

should be specific for every type of waste, even if several types are transported in a single transportation; it should be specific for each load, even if several loads of a same waste are transported, either by a same transporter or to the same receptor.

Every origin-transport-destination flow involved participant has legal responsibilities subject to pre-set sanctions. Essential and obvious responsibilities such as:

a) Responsibilities of the Generator -

- Be sure about the qualification and skills of the receptor and transporter to carry out the respective tasks.
- Complete the WM, except by the fields concerning the date and signature of the transporter and receptor.
- Provide the transporter with the Emergency Plan, when the waste is hazardous.
- Archive its copy, properly signed by the transporter, handing in the other ones to the transporter; afterwards, receive from the receptor the copies which attest the origin-transport-destination cycle, with the due signatures, archiving one copy and, if there is, hand in the other copy to the EA.

b) Responsibilities of the Transporter and Receptor

- Check the data written by the generator, clarifying any eventual divergences.
- Write the date and sign the received copies, archiving one of them and handing in the other ones to the next addressee (receptor or generator).

The archiving deadline should be set by the EA. In Rio de Janeiro it is 05 years for the generator and the receptor, and 03 years for the transporter.

WM Model and its Flow in the State of Rio de Janeiro

The model and procedures for its use have been set by Policy DZ-1310-R7, whose non-fulfillment is subject to sanctions set by Law 3467/2000. The standard form is issued in four sheets, which should be archived by the Generator (1st and 4th sheets, this last one at the disposal of the EA), Transporter (2nd sheet) and Receptor (3rd sheet).

1.5.6 State of Domestic Solid Waste

a. State of Domestic Solid Waste in Brazil

According to the National System of Information on Sanitation (SNIS), data from on the diagnosis of solid wastes in Brazil show that:

- The average collection coverage is 94.4% of the urban population, with a collection frequency average of two or three times a week;
- One fourth of the municipalities dispose their solid health-care wastes outside of their territory;
- More than 60% of the municipalities carry out selective collection of solid wastes, predominantly door to door collection;
- The informal selective collection, carried out by waste pickers, is present in 85% of the sampled municipalities;
- In 61% of the municipalities, in which waste pickers are working, aggregation

organizations exist, as well as cooperatives and associations;

- The selection of recyclable materials takes advantage of the average amount of 3.13 kg per urban inhabitant a year;
- 0.2 km of urban inhabited roads and public areas are swept;
- The sweeping is carried out at an average productivity of 1.33km per employee a day;
- The sampled municipalities generate jobs at a rate of 1.65 workers per each 1,000 inhabitants, without considering the temporary ones;
- Compactor trucks are 50% of the collection trucks;
- This fleet is predominantly private (80%) and reasonably new, with 60% of the vehicles less than five years old;
- 36% of the municipalities (in general the small-sized ones) do not charge for urban cleaning services;
- In those which do charge, the average municipal revenue raised from urban cleaning services is R$15 per urban inhabitants a year;
- These expenses reach 5% of the total expenditures of the city halls, corresponding to an average annual per capita cost of R$32.83;
- The average cost of the outsourced collection service is R$51.81 per ton;
- 36% of the total number of services are operated by the city halls;
- 47% of services operate without any type of environmental license and 1.7% with previous licenses, whereas 42% have operation licenses;
- About 15% of the units receive wastes from another municipality;
- 49% of the soil disposal units (dumping sites, controlled landfills and sanitary landfills) do not have base water proofing and 11% do not use cover soil;
- 27% of them re-circulate waste water;
- There are waste pickers living in 11.5% of dump sites.

b. State of Municipal Solid Waste

Through the Municipal Ordinance no. 7.312, from May 18, 2004, the public services of Solid Wastes Management and Public Cleansing started being coordinated, administered and executed by SEMULSP, part of which is carried out the by Direct Administration and part of which is outsourced.

SEMULSP directly executes the services of grass cutting, gardening, sweeping, pruning, curb painting, Igarapés cleaning and cleaning of terminals and public bathrooms. The services of collection and transport of domestic, commercial and health solid wastes, construction and diversified waste, pruning and cutting of trees, selective collection of recyclable materials, wastes from the sweeping of roads and public areas, areas of limited access, weeding, clearing, collective efforts, programs of environmental education and special services of igarapés/streams cleaning in the whole urban area of the Municipality of Manaus, as well as the operation of the current public sanitary landfill is carried out by two concessionary companies: Tumpex Empresa Amazonense de Coleta de Lixo, Ltda and Enterpa Engenharia Ambiental, Ltda.

Collection and transport services of solid wastes are executed almost entirely by the two

concessionaries and are subdivided according to the concession contract, in six modalities: domestic collection, hospital collection, mechanical removal, manual removal and selective collection. Another smaller part of the waste collected in Manaus comes from third parties, in other words, outsourced companies, such as dumping companies, builders, and industries, among others, which request authorization to dispose wastes in the Manaus landfill.

The disposal operation consists of the arrangement of the waste's layers; the first layer is placed in the dike and formed through a mechanized process and after dispersed they are compacted by the tractor on mats, which should be able to drive along the domestic collection wastes and others after the application of the clay layer. This service is carried out by the concessionaries and eight officials are responsible for the daily surveillance of SEMULSP, who verify the final disposal operation.

The water proofing system is constituted by a 40cm layer of compacted soil on which a 1mm blanket of DPE is applied. There are three wastewater contention ponds. At the entrance of the contention ponds system, there is an inspection box with a "Parshall Gutter" flow meter, whose flows should constantly be monitored. CPRM writes a quarterly report about the physiochemical characteristics of superficial and ground water of the surrounding area of the Landfill, in 27 monitoring wells.

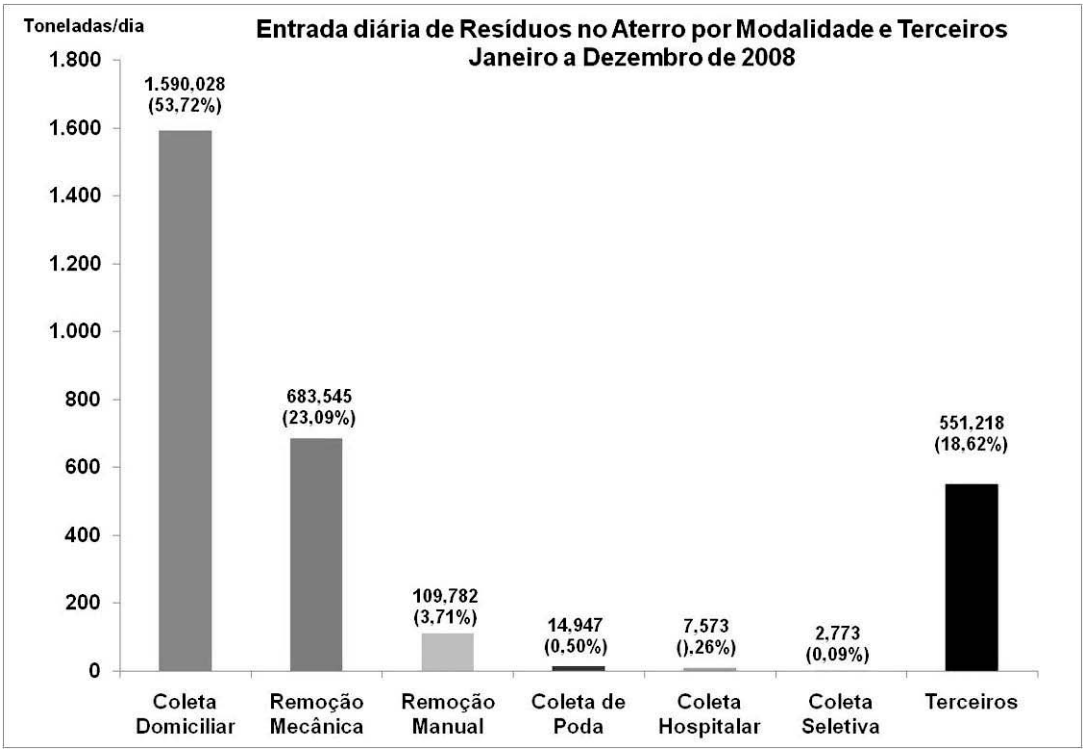
The historical series of the waste amount and composition of the municipality is shown in Table 9 and it highlights a high percentage of organic waste generated in the last few years.

Table 1-36: Waste Composition of the City of Manaus (Percentage)

Category of Waste	1982	1992	2001	2006
Organic material	51.12	58.69	45.20	35.84
Paper and cardboard	29.01	18.94	18.90	21.18
Plastic	2.83	8.62	18.50	29.34
Metal	6.78	4.31	3.60	3.47
Wood	2.14	2.93	3.60	1.44
Glass, soil and stone	4.67	3.42	6.60	3.87
Fabric, leather and rubber	3.45	3.09	3.60	4.87
TOTAL	100.00	100.00	100.00	100.00

Source: (*) Lima, L.M.Q, 1982 (adapted), (*) Andrade, BL Schalch, V.1992 (adapted) , (***) Stroski, A.A. 2001 (adapted) and (****) SEMULSP (adapted)

The following Figure illustrates the amount of waste disposed in the landfill of Manaus city in 2008.



Source: SEMULSP

Figure 1-24: Incoming Solid Wastes in the Landfill in 2008

The solid wastes received in the municipal landfill have three destinations: recycling, compost and waste filling. In recycling, the wastes from selective collection carried out by the two concessionaries are sent to the four waste sorting centers for segregation and commercialization purposes.

Composting was first implemented in 2005, and the service aims to take advantage of the remains of animal and vegetal wastes collected in the city, to be transformed into organic fertilizer and be used in the municipal gardening. About 2,820 tons of composting have been produced and distributed since the program was implemented.

Considering the last five years of disposal, the accumulated volume above 5,000,000 tons is a source of great interest for methane gas production. The initial numbers indicate a concentration more than 50% of methane gas for the flow of the current operation. A flow of 8,000 m³ per hour is estimated for a first phase. The power generator to be installed, once the numbers of the tests are confirmed, points out a minimum of 10 MW.

Data of the project:

- Estimated flow of 800 m³/h or approximately 500 pes³/min
- Average methane CH4 concentration of 57%
- Blower power of 5HP
- Operates with five horizontal collectors of 120m each

2. Supplement Studies on Current Conditions

2 Supplement Studies on Current Conditions

The first step in formulating the master plan for waste generated in the Industrial Pole of Manaus (PIM) is to gauge the characteristics and amount of that waste. An essential and most fundamental method to grasp the actual conditions of waste management is to produce a flowchart diagram, such as the one shown below. The key to producing this flowchart is to first divide the waste stream into two large categories: "on-site" management at the source of generation, and "off-site" management handled by waste management companies (WMCs).

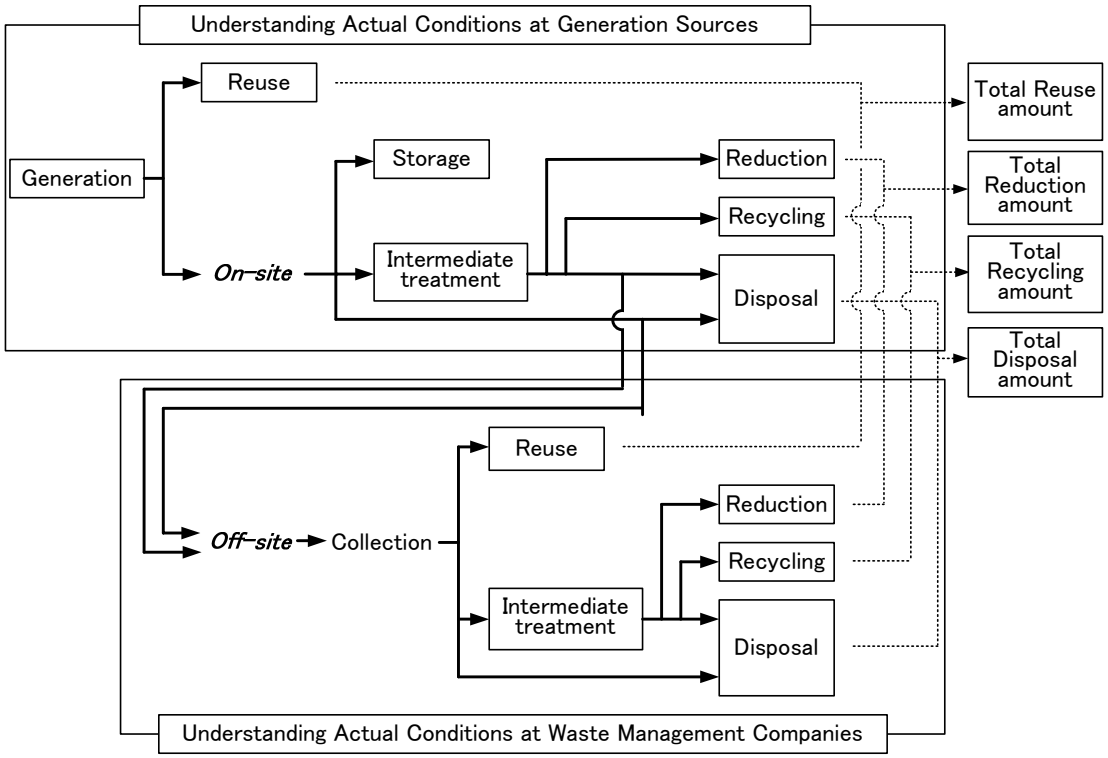


Figure 2-1: Flowchart of Waste Treatment

The following supplemental studies were carried out in order to understand the current waste management conditions at the PIM generation sources, i.e. on-site management.

- Factory Survey
- Medical Institutions Survey
- Construction Waste Survey
- Radioactive Waste Survey

Furthermore, a supplemental study to survey waste management companies was conducted to grasp the current conditions of off-site management.

2.1 Study of Waste Management Companies

2.1.1 Outline of the Study

a. Study Objective

The study aims to survey the stream of PIM generated waste which is outsourced to waste management companies for collection and transport, treatment (reuse, recycle, rendering waste harmless, etc.) and final disposal. These results will be checked against the survey of generation sources, mentioned below, in order to clarify the waste stream after it is discharged from the PIM.

b. Study Method

A local consultant (OPCA: Olavo Branga & Paulo Farias Consultores Ambientais Ltda) was consigned to conduct the study. The local consultant visited and conducted interviews with waste management companies using a questionnaire form made by the study team.

The study team produced a draft of the questionnaire form to use as the basis for discussion with the C/P. Revisions were made based on that discussion, and then members of the study team accompanied the local consultant initially on a trial basis to further modify the questionnaire that was used in the full-scale survey. The following items were included in the questionnaire:

- General company information, number of employees, annual sales amount
- Types and amount of industrial waste handled
- Condition of equipment and facilities for collection and transportation, treatment (reuse, recycle, making harmless, etc.) and final disposal
- Industrial waste clients
- Approach toward and actual conditions of system and equipment for appropriate waste management
- Operational and environmental problems waste management companies are facing
- Demands related to government administration
- Other

c. Study Schedule

A local consultant (OPCA) was consigned to conduct the study on 6 April 2009. Beginning in late April, after preparations for the survey were made, the local consultant began the survey and completed interviews with 90 companies by the end of July. This data was to be compiled by the end of August, however, there were delays due to a necessity to clarify and add a number of companies not contained on the list received from IPAAM. Consequently, the interview survey has been conducted by the end of September and compilation of the results has been completed in November 2009.

2.1.2 Selection of Target Waste Management Companies

a. Registration System for Waste Management Companies in the State of Amazonas

Registration of waste management companies is handled by the Institute of Amazonas Environmental Protection (IPAAM). However, IPAAM does not register the companies themselves, but instead registers the environmental license of the waste management companies. The primary activity of IPAAM for environmental administration is to issue and manage environmental licenses, monitoring, and inspection; in this way, waste management companies are managed through the approval and issuance of environmental licenses.

b. Environmental Licensing

In the State of Amazonas, an environmental license must be obtained for any activity (industry) that could potentially impact the environment (Derecto No 10028 de 04 de Febreiro de 1987). These licenses are required not only for the installation and operation of factories, but for most activities where environmental impact is likely, including construction projects, agricultural, medical and so on. There are three environmental permits, as follows: previous permit, installation permit and operation permit.

c. IPAAM List of Waste Management Companies (WMCs)

IPAAM environmental licensing covers all industry that impacts the environment using a 4-digit code (01**). The first two digits designate the major division of industries into 32 classes, and the last two digits further divide these into sub-classes. The study team used this classification system to compile a list of waste related activities, as shown in the table below.

Table 2-1: Waste Management related Codes of IPAAM for Environmental Licensing

Code	Class	Code	Sub-Class	
				Impact
22＊＊	Commerce and Services	2217	Incineration	High
		2218	Co-processing of wastes	High
		2219	Agrochemical Collection Center	Moderate
24＊＊	Other Services (including provision of electricity and water)	2407	Solid Industrial Waste Collection and/or Treatment	High
		2408	Municipal Waste Final Destination	High
		2410	Collection and Transport of Inert Solid Waste	Minimal
		2411	Collection and/or Storage and/or Commercialization of Solid Waste (e.g. recycling)	Moderate
		2412	Collection and/or Treatment of Hazardous Liquid Industrial Waste	High
		2417	Industrial Waste Disposal in Landfill	High
26＊＊	Transportation	2615	Transport and Storage of Hazardous Solid Industrial Waste	High
30＊＊	Waste Treatment and Recycling	3001	Treatment and Recycling of Solid Industrial Waste without chemicals	Moderate

		3002	Treatment and Recycling of Industrial Liquid Waste	Moderate
		3003	Treatment and Recycling of Solid Industrial Waste without Chemicals	High
		3004	Treatment and Recycling of Palettes	Moderate
		3005	Paper and Cardboard Recycling	Moderate
		3006	Treatment and Recycling of Mineral Waste (Waste Re-processing)	Moderate

Source: Classificacao das Fontes Poliudoras IN 001;06 Publicada em (3/12/2007)

IPAAM and the study team agreed that the companies with the above sub-class codes would be the targets for the survey of waste management companies. As a result, IPAAM supplied a list of 84 companies (below, IPAAM WMC List) that had obtained environmental licenses for operation, as well as a 2-page summary for each company's environmental license.

d. Selection of Target Companies for the Survey

A local consultant (OPCA) was hired to conduct the study using the IPAAM list of waste management companies to contact the companies and ask them to participate in the survey. As shown in the table below, the survey was carried out with 35 companies.

Table 2-2: Results of Survey Participation using IPAAM WMC List

Survey Results		No. of Companies
1	Conducted survey	35
2	Companies with multiple environmental licenses	8
3	Target companies that could not be identified *1	17
4	Declined to participate	18
5	Target company does not exist, or ceased waste management operations	4
6	Target company not involved in waste management	2
Total		84

Note: *1: These companies could not be found when visiting the location as indicated on the environmental license, nor could it be identified via the phonebook, Internet, etc.

2.1.3 Execution of the Survey

a. Execution of the Survey

Of the companies on the IPAAM WMC List, only 35 could be surveyed. Then, the local consultant identified 55 waste service companies based on interviews with factories and waste service companies so that, as of September 30, 90 waste service companies were surveyed. The table below shows which of these companies currently has an environmental license for operation.

Table 2-3: Operating License Ownership (of 85 Waste Management Companies)

Operating License Ownership	No. of Companies
Has license	67[*1]
Does not have license	23[*2]
Total	90

Note: *1: Of these 67 companies, 35 were identified on the IPAAM WMC List, and 32 were identified by the local consultant.

*2: These 23 companies were identified by the local consultant

b. Issues Identified from the Survey

Although the IPAAM environmental licenses have been digitized, the following issues were identified:

- The database server is old and does not function sufficiently. Furthermore, the database system is used for file management (to track where certain files are located), and thus is not set up for license management.
- Other information about IPAAM activities is mixed with the environmental license data and managed in the same database, making it extremely difficult to extract the license information needed.
- As shown in Table 2-1: Waste Management related Codes of IPAAM for Environmental Licensing, waste management companies are registered by codes for various related activities.

It became evident that not all of the waste management companies were shown in the IPAAM WMC List because it only lists those companies which have a code for waste management related activities. Also, once a list was compiled of the companies that are no longer in business or ceased their waste management related activities, it was not possible to identify them in the IPAAM WMC List, suggesting that licenses are not properly renewed and pointing to the need for a series of improvements to be made.

IPAAM indicated that improvements will be made to their registration system for waste management companies so it will be more effective. Furthermore, those companies without environmental licenses will be encouraged to register, and the system reinforced by updating the database of IPAAM waste management companies—which will be constructed during this study.

2.1.4 Results of the Survey

The results from these responses are as follows.

a. General Information

Q.3. Location of the company

		Base:	**90**	
		Answer	***90***	**100%**
			Answer	%
1	Industrial District 1		15	17%
2	Industrial District 2		13	14%
3	Outside of Industrial District, but inside of Manaus City Zone		59	66%
4	Outside of Manaus City Zone		3	3%
		Total	**90**	**100%**

Q.4.Share Capital.

		Base:	**90**	
		Answer	***82***	**91%**
			Answer	**%**
1	Less than 10,000		15	18%
2	10,000 - 100,000		30	37%
3	100,000 - 1,000,000		23	28%
4	more than 1,000,000		14	17%
		Total	**82**	**100%**

Q.6. Number of Employee

		Base:	**90**	
		Answer	***87***	**97%**
			Answer	**%**
1	Less than 10		32	37%
2	10 - 50		39	45%
3	50 - 100		7	8%
4	more than 100		9	10%
		Total	**87**	**100%**

		Base:	**90**			
		Answer	***86***	**96%**	***86***	**96%**
			OM	**%**	**Admin**	**%**
1	Less than 10		41	48%	67	78%
2	10 - 50		33	38%	15	17%
3	50 - 100		4	5%	2	2%
4	more than 100		8	9%	2	2%
		Total	**86**	**100%**	**86**	**100%**

Q.7. Environmental License

Do you have Environmental Operation License granted by IPAAM

		Base:	**90**	
		Answer	***90***	**100%**
			Answer	%
1	Yes		67	74%
2	No		23	26%
		Total	**90**	**100%**

If YES, please write License Number and CNPJ/CPF	
License number	***63***
CNPJ/CPF	***66***

Q.8. Annual Sales Amount

		Base:	**90**	
		Answer	***76***	**84%**
			Answer	%
1	Less than 100,000		26	34%
2	100,000 - 1,000,000		24	32%
3	1,000,000 - 10,000,000		18	24%
4	more than 10,000,000		8	11%
		Total	**76**	**100%**

Q.10. Local Company /International Company

		Base:	**90**	
		Answer	***85***	**94%**
			Answer	%
1	1. Main shareholders are Brazilian companies		82	96%
2	2. Main shareholders are international companies		3	4%
		Total	**85**	**100%**

Q.11.Date of establishment of the company

		Base:	**90**	
		Answer	***86***	**96%**
			Answer	%
1	before year 1990		21	24%
2	1990 - 2000		19	22%
3	later 2000		46	53%
		Total	**86**	**100%**

Q.12. Total Area

		Base:	90			
		Answer	83	92%	82	91%
			Total	%	Plant	%
1	less than 1,000		28	34%	39	48%
2	1,000 - 10,000		31	37%	38	46%
3	10,000 or more		24	29%	5	6%
		Total	83	100%	82	100%

Q.13 Reasons why you set up your business activities in the MFZ

		Base:	90	
		Answer	55	61%
			Answer	%
1	Tax Incentives		7	13%
2	Opportunity to attend the local market		29	53%
3	Income source and opportunity to contribute with environment and society		14	25%
4	Others		5	9%
		Total	55	100%

Q.14. Operation

		Base:	90	
		Answer	89	99%
Operation hours (hour/day)			**Answer**	**%**
1	less than 8 hours		2	2%
2	8 - 16		76	85%
3	16-24		11	12%
		Total	89	100%

		Base:	90	
		Answer	86	96%
Operation hours (day/year)			**Answer**	**%**
1	less than 300 days		62	72%
2	More than 300 days		24	28%
		Total	86	100%

Q.15. Location (UTM Coordination or Latitude and Longitude)

	Base:	90	
	Answer	74	82%

Q.16. Type of Business

		Base:	90		
		Answer	90	100%	
			Answer	%	
1	Collection, transportation and storage of industrial wastes		46	51%	
2	Collection, transportation and storage of health-care wastes		4	4%	D
3	Collection, transportation and storage of construction wastes		8	9%	
4	Treatment of industrial wastes		9	10%	
5	Treatment of health-care wastes		2	2%	E
6	Treatment of construction wastes		1	1%	
7	Final disposal of industrial wastes		7	8%	
8	Final disposal of health-care wastes		3	3%	F
9	Final disposal of construction wastes		6	7%	
10	Reuse/Recycle/Recover of industrial wastes		58	64%	
11	Reuse/Recycle/Recover of health-care wastes		0	0%	G
12	Reuse/Recycle/Recover of construction wastes		2	2%	
		Total	146		

(Note: multiple answers are allowed)

		Base:	90	
		Answer	90	100%
	Survey Answer			
			Answer	%
D	Collection, transportation and storage of industrial wastes		48	53%
E	Treatment of industrial wastes		9	10%
F	Final disposal of industrial wastes		10	11%
G	Reuse/Recycle/Recover of industrial wastes		60	67%
		Total	127	

(Note: multiple answers are allowed)

Answer 7D, 7E, 7F, 7G Licence per type of business

			Answer	%
D	Collection, transportation and storage of industrial wastes		26	29%
E	Treatment of industrial wastes		24	27%
F	Final disposal of industrial wastes		0	0%
G	Reuse/Recycle/Recover of industrial wastes		21	23%
		Total	71	

Answer 7D, 7E Final, 7F, 7GFinal

			Answer	%
D	Collection, transportation and storage of industrial wastes		25	28%
E	Treatment of industrial wastes		7	8%
F	Final disposal of industrial wastes		0	0%
G	Reuse/Recycle/Recover of industrial wastes		32	36%
		Total	64	

				Waste Stream data	
	Type of business from survey answer	**Total**	**%**	***Yes***	***%***
D	Collection, transportation and storage of industrial wastes	48	53%	39	81%
E	Treatment of industrial wastes	9	10%	7	78%
F	Final disposal of industrial wastes	10	11%	6	60%
G	Reuse/Recycle/Recover of industrial wastes	60	67%	49	82%
	Total	**127**			

b. Common Questions

Q 1. Problems and Issues

Do you have or feel problems and/or issues in terms of your waste business or waste management in this area, please specify as follows

Q1-1 Legal system

		Base:	**90**	
		Answer	***85***	**94%**
			Answer	**%**
1	Legal framework is complicated		48	56%
2	Inspection and monitoring system of industrial waste is insufficient		55	65%
3	Government policy for industrial waste management is vague and unclear		52	61%
4	Law, regulation and resolutions are stringent		41	48%
5	Others		8	9%
		Total	**204**	

(Note: multiple answers are allowed)

Q1-2 Incoming wastes

		Base:	**90**	
		Answer	***72***	**80%**
			Answer	**%**
1	Amount of incoming wastes generated in this area is small		47	65%
2	There are some wastes that are difficult to treat, final dispose and recycle in this area		32	44%
3	You feel that waste management in the generator (mainly factory) is not good.		31	43%
4	Others		1	1%
		Total	**111**	

(Note: multiple answers are allowed)

Q1-3 Price (Waste fee)

		Base:	**90**	
		Answer	***79***	**88%**
			Answer	**%**
1	The fee the client is prone to low		69	87%
2	Informal agents render their services at very low prices		56	71%
3	Others		6	8%
		Total	**131**	

(Note: multiple answers are allowed)

Q1-4 Processing Cost

		Base:	**90**	
		Answer	***79***	**88%**
			Answer	**%**
1	Price of materials and chemicals is high		48	61%
2	Labor cost is high		35	44%
3	Utilities (water, electricity etc) cost is high		63	80%
4	Cost of environmental countermeasures is a burden		33	42%
5	Availability of materials is low		30	38%
6	The availability of technology is low		39	49%
7	Others		3	4%
		Total	**251**	

(Note: multiple answers are allowed)

Q1-5 Equipment & Technology

		Base:	**90**	
		Answer	***64***	**71%**
			Answer	**%**
1	Procurement of waste management equipments and facilities is difficult in this area.		47	73%
2	Education and training for labors regarding appropriate waste management is a problem.		45	70%
3	Others		3	5%
		Total	**95**	

(Note: multiple answers are allowed)

Q1-6 Utility (water, electricity etc)

		Base:	**90**	
		Answer	***26***	**29%**
			Answer	**%**
1	Availability of utilities (water, electricity etc) are low		24	38%
2	Others		3	5%
		Total	**27**	

Q1-7 Competition

	Base:	**90**	
	Answer	***84***	**93%**
		Answer	**%**
1	Competition of your business is very keen	61	73%
2	Because transportation to other parts of Brazil is costly in this area, it is difficult to carry out the services in connection with other companies.	59	70%
3	Waste management companies without license are competitors and a problem	45	54%
4	Others	0	0%
	Total	**165**	

(Note: multiple answers are allowed)

Q1-8 Funding/Financial

	Base:	**90**	
	Answer	***76***	**84%**
		Answer	**%**
1	It is difficult to find funding source for waste management equipments and facilities.	49	64%
2	Public financial support for pollution control equipments and facilities is practically naught or limited	63	83%
3	Others	2	3%
	Total	**114**	

(Note: multiple answers are allowed)

Q1-9 Environment

	Base:	**90**	
	Answer	***88***	**98%**
		Answer	**%**
1	Environmental consciousness regarding waste management is low in the society.	79	90%
2	Sewage network does not cover all the Industrial Districts and Manaus City Zone	58	66%
3	Illegal dumping of wastes is a problem	77	88%
4	Manifest does not operate efficiently for tracking the stream of wastes	30	34%
5	It is difficult to find reliable analysis laboratory	43	49%
6	Others	3	3%
	Total	**290**	

(Note: multiple answers are allowed)

Q1-10 Others

No answer

Q 2 Promotion of waste management industry

Q 2-1 Do you think which matters are necessary for promotion of waste management industry in the Manaus area?

		Base:	**90**	
		Answer	***88***	**98%**
			Answer	**%**
1	Legal system, if yes go to Q 2-2		78	89%
2	Financial support, if yes go to Q 2-3		65	74%
3	Business environment, if yes go to Q 2-4		72	82%
4	Others		5	6%
		Total	**220**	

(Note: multiple answers are allowed)

Q 2-2 Legal System

		Base:	**90**	
		Answer	***85***	**94%**
			Answer	**%**
1	Formulation of comprehensive law and regulation of waste management		44	52%
2	Formulation of law and regulation regarding Reuse/Recycle/Recover of waste		43	51%
3	Formulation of waste management plan in PIM area		41	48%
4	Improvement or speeding of environmental licensing system		68	80%
5	Improvement of waste tracking system (Manifest system)		50	59%
6	Improvement of classification of hazardous and non-hazardous wastes		52	61%
7	Enhancement of public administration capacity regarding waste management		64	75%
8	Tightening of regulations for unlicensed waste management companies		45	53%
9	Easing of control and regulation		41	48%
10	Others		3	4%
		Total	**451**	

(Note: multiple answers are allowed)

Q 2-3 Financial Support

		Base:	**90**	
		Answer	***66***	**73%**
			Answer	**%**
1	Provision of public financial support for equipping of waste management equipments and facilities		41	62%
2	Provision of tax privilege for equipping of waste management equipments and facilities		60	91%
3	Provision of public financial support for equipping of environmental protection and control equipments and facilities		45	68%
4	Provision of tax privilege for equipping of environmental protection and control equipments and facilities		54	82%
5	Others		5	8%
		Total	**205**	

(Note: multiple answers are allowed)

Q 2-4 Business Environment

		Base:	**90**	
		Answer	***79***	**88%**
			Answer	**%**
1	Appropriate understanding of waste management business by both public administration, generator and local people		54	68%
2	Appropriate understanding of waste management fee by generators		52	66%
3	Promotion of environmental education regarding waste management for both public administration, generator and local people		73	92%
4	Establishment of information system of wastes and generators		72	91%
5	Increasing of reliable laboratories		53	67%
6	Price reduction of electricity, fuel and water		69	87%
7	Establishment of business chain regarding waste management of Reuse/Recycle/Recover		69	87%
8	Developing of consensus-building systems for establishment of waste management facilities		54	68%
9	Others		2	3%
		Total	**498**	

(Note: multiple answers are allowed)

Q3 Question in terms of waste tracking system (the manifesto system)

Q.3-1 Dose your company has the manifesto document which can give chase to waste stream?

		Base:	**90**	
		Answer	***89***	**99%**
			Answer	**%**
1	Yes		29	33%
2	No		60	67%
		Total	**89**	**100%**

Q 4.Good Practice

Do you have “Good Practice” in terms of your waste business or waste management, please specify as follows

		Base:	**90**	
		Answer	***82***	**91%**
			Answer	**%**
1	Yes		74	90%
2	No		8	10%
		Total	**82**	**100%**

Q5. Future Plan

Q5.1 Do you have expansion plans for your facilities?

		Base:	90	
		Answer	89	99%
			Answer	%
1	Yes		56	63%
2	No		33	37%
	Total		89	1

Q5.2 Do you have plan of commencement of new waste business?

		Base:	90	
		Answer	89	99%
			Answer	%
1	Yes		24	27%
2	No		65	73%
		Total	89	100%

Q5-3 Do you have any other plans related to waste business?

		Base:	90	
		Answer	71	79%
			Answer	%
1	Yes		5	7%
2	No		66	93%
		Total	71	100%

Q 6. Environmental measures

Q 6-1 Do you have wastewater treatment facility?

		Base:	90	
		Answer	89	99%
			Answer	%
1	Yes (Go to Q 6-2 to the question Q 6-11)		18	20%
2	No (Go to Q 6-12)		71	80%
		Total	89	100%

Q 6-2 Which type of wastewater treatment plant do you have?

		Base:	18	
		Answer	18	100%
			Answer	%
1	Domestic wastewater treatment plant		10	56%
2	Industrial wastewater treatment plant		4	22%
3	Both domestic wastewater treatment plant and industrial wastewater treatment plant		4	22%
		Total	18	100%

Q 6-3 Please select following alternatives

	Base:	**18**	
	Answer	***13***	**72%**
		Answer	**%**
1	Industrial wastewater together with domestic waste water are treated in the wastewater plant	5	38%
2	Industrial wastewater and domestic waste water are separately treated in the wastewater plants	5	38%
3	In the treatment of both effluents done in one waste water plant	3	23%
	Total	**13**	**100%**

Q 6-4 What is the capacity of the wastewater plant?

No answer

Q 6-5 To where is effluent of wastewater plant discharging?

	Base:	**18**	
	Answer	***18***	**100%**
		Answer	**%**
1	To sewerage network	4	22%
2	To canal, ditch and valley nearby	1	6%
3	To Igarape or main rivers of the Negro river and the Amazon river	9	50%
4	Others	4	22%
	Total	**18**	**100%**

Q.6-6 Average quantities of effluents treatment sludge

No answer

Q 6-7 Where do you treat and/or dispose the effluents treatment sludge?

	Base:	**18**	
	Answer	***14***	**78%**
		Answer	**%**
1	On-site	5	36%
2	Off site	9	64%
	Total	**14**	**100%**

Q 6-8 Do you monitor the quality of the water in the effluents treatment network?

	Base:	**18**	
	Answer	***18***	**100%**
		Answer	**%**
1	Yes	18	100%
2	No	0	0%
	Total	**18**	**100%**

Q6.9 What type of monitoring?

		Base:	18	
		Answer	18	100%
			Answer	%
1	Continuous monitoring		2	11%
2	Batch monitoring		16	89%
		Total	18	100%

Q 6-10 How often do you collect and analyze samples?

		Base:	18	
		Answer	18	100%
			Answer	%
1	Every day		2	11%
2	Others		16	89%
		Total	18	100%

Q 6-11 What parameters do you analyze the samples?

No answer

Q 6-12 Reason why you do not install the wastewater treatment facility (Note: multiple answers are allowed)

		Base:	71	
		Answer	68	96%
			Answer	%
1	I believe that the wastewater treatment is not necessary		49	72%
2	Installation cost is high		6	9%
3	Others		17	25%
		Total	72	

(Note: multiple answers are allowed)

Q6.13 Does you set up air emission control facility?

		Base:	90	
		Answer	88	98%
			Answer	%
1	Yes (Go to Q 6-14 to Q.6-18)		17	19%
2	No (Go to Q 6-19)		71	81%
		Total	88	100%

Q 6-14 What type of air emission control facilities do you establish?

		Base:	17	
		Answer	16	94%
			Answer	%
1	Electrical dust collector		0	0%
2	Filter bag		5	31%
3	Cyclone		4	25%
4	Gas washing (scrubber)		9	56%
5	Others		4	25%
		Total	22	

(Note: multiple answers are allowed)

Q 6-15 Does you conduct air quality monitoring of exhaust gas of air emission control facility?

		Base:	17	
		Answer	16	94%
			Answer	%
1	Yes		9	56%
2	No		7	44%
		Total	16	100%

Q6.16 What type of monitoring

		Base:	17	
		Answer	12	71%
			Answer	%
1	Continuous monitoring		2	17%
2	Batch monitoring		10	83%
		Total	12	100%

Q 6-17 How often do you take and analyze samples?

		Base:	17	
		Answer	13	76%
			Answer	%
1	Every day		2	15%
2	Others		11	85%
		Total	13	100%

Q 6-18 What parameters do you analyze the samples?

No answer

Q 6-19 Reason why you do not install the air emission control facility.

		Base:	**71**	
		Answer	***71***	**100%**
			Answer	**%**
1	I believe that the wastewater treatment is not necessary		59	83%
2	Installation cost is high		7	10%
3	Others		7	10%
		Total	**73**	

(Note: multiple answers are allowed)

Q 6-20 Do you have odor control equipment?

		Base:	**90**	
		Answer	***85***	**94%**
			Answer	**%**
1	Yes (answer question Q6.21)		2	2%
2	No		83	98%
		Total	**85**	**100%**

Q6.21 What kind of odor control equipment do you use and what is the place of establishment?

		Base:	**2**	
		Answer	***1***	**50%**
			Answer	**%**
1	Please specify		**1**	100%

Q6.22 Do you have spill prevention control measures of oils, solvents chemical liquids and other liquids?

		Base:	**90**	
		Answer	***87***	**97%**
			Answer	**%**
1	Yes		25	29%
2	No		62	71%
		Total	**87**	**100%**

Q 6-23 What kind of spill prevention control measures?

		Base:	**25**	
		Answer	***25***	**100%**
			Answer	**%**
1	Please specify		**25**	100%

Q7. Introduction of Management System

Q7.1 Do you introduce quality management system of ISO 9000 series?

	Base:	**90**	
	Answer	***90***	**100%**
		Answer	**%**
1	Already acquired	17	19%
2	Will acquire within a year	43	48%
3	No plan to acquire	30	33%
	Total	**90**	**100%**

Q7.2 Do you introduce environmental management system of ISO 14000 series?

	Base:	**90**	
	Answer	***90***	**100%**
		Answer	**%**
1	Already acquired	11	12%
2	Will acquire within a year	42	47%
3	No plan to acquire	37	41%
	Total	**90**	**100%**

Q8 Employee Training

Q8.1 Do you provide employee training in terms of waste management?

	Base:	**90**	
	Answer	***90***	**100%**
		Answer	**%**
1	Yes (Go to Q 8-2 to Q 8-3)	80	89%
2	No	10	11%
	Total	**90**	**100%**

Q 8-2 What are subject of training courses?

	Base:	**80**	
	Answer	***80***	**100%**
		Answer	**%**
1	Safety management of waste handling	72	90%
2	Response of troubles and incidents in waste handling	56	70%
3	Pollution control measures in waste handling	52	65%
4	Technical education of waste handling	59	74%
5	Others	2	3%
	Total	**241**	

(Note: multiple answers are allowed)

Q 8-3 How often do you provide employee training in terms of waste management?

		Base:	80	
		Answer	80	100%
			Answer	%
1	Once a year		43	54%
2	More than once a year		37	46%
		Total	80	100%

Q 9 Response of troubles and incidents

Q 9-1 Do you have system (manual, information system etc.) of response of troubles and incidents?

		Base:	90	
		Answer	87	97%
			Answer	%
1	Yes (Specify) (Go to Q9-2)		21	24%
2	No		66	76%
		Total	87	100%

Q 9-2 What kind of measures do you prepare for response of troubles and incidents.

		Base:	21	
		Answer	21	100%
			Answer	%
1	Emergency contact network		16	76%
2	Emergency medical care		12	57%
3	Manual of emergency management		17	81%
4	Others		3	14%
		Total	48	

(Note: multiple answers are allowed)

Q 10 Waste analysis

Q 10-1 Do you analyze characteristic of incoming wastes?

		Base:	90	
		Answer	87	97%
			Answer	%
1	Always (Go to Q 10-2 to Q 10-3)		40	46%
2	Sometime (Go to Q 10-2 to Q 10-3)		7	8%
3	Not necessary to analyze the samples		40	46%
		Total	87	54%

Q 10-2 What parameters do you analyze incoming wastes?

		Base:	47	
		Answer	45	96%

Q 10-3 Do you have waste quality analysis laboratory in your company?

		Base:	47	
		Answer	47	100%
			Answer	%
1	Yes		9	19%
2	No		38	81%
		Total	47	100%

Q11 Measurement of volume or weight of incoming wastes

Q11.1 Do you measure volume or weight of incoming wastes?

		Base:	90	
		Answer	87	97%
			Answer	%
1	Yes (Go to Q 11-2)		69	79%
2	No (Go to Q 11-3)		18	21%
		Total	87	100%

Q 11-2 How do you measure volume or weight of incoming wastes?

		Base:	69	
		Answer	69	100%
			Answer	%
1	By track scale		5	7%
2	Others		64	93%
		Total	69	100%

Q 11-3 How do you confirm volume or weight of incoming wastes

		Base:	18	
		Answer	10	56%

Q 12 Types of Vehicles

		Base:	48	
		Answer	39	81%
			Answer	%
1	Ordinary track without cover		11	28%
2	Ordinary track with cover		6	15%
3	Tanker		8	21%
4	Truck with loading equipment		7	18%
5	Others		31	79%
		Total	63	

(Note: multiple answers are allowed)

Q 13 Waste that is not possible to handle in your company

This question was removed from analysis due to the fact that almost no responses were received. It is possible that the question was not clearly asked or the respondent did not understand the purpose of the question.

Q14. Do you storage your handling wastes? (Y/N)

		Base:	**48**	
		Answer	***36***	**75%**
			Answer	**%**
1	Yes		28	78%
2	No		8	22%
		Total	**36**	**100%**

Q15 Stream of the wastes

		Base:	**48**		
		Answer	***39***	**81%**	
					ton/day
			Licenses		
Type	Waste Code	Waste	No	Yes	Grand Total
HW	HW03	Alkalis	0.17		0.17
	HW04	Toxic Compounds	0.31		0.31
	HW07	Organic Compounds	40.54	0.90	41.44
	HW09	Fuel, Oil and Grease	2.69	21.30	24.00
	HW11	Treatment Sludge	0.02		0.02
	HW14	Other Hazardous substance (besides HW01-HW13)	0.96	30.24	31.20
	HW15	Hazardous materials from Non-production process	0.00		0.00
HW Total			**44.70**	**52.45**	**97.15**
NH	NH01	Kitchen waste (include waste from animal such as bone, skin, hair)	0.01	1,650.00	1,650.01
	NH02	Wood	304.57	13.33	317.90
	NH03	Paper	0.27	125.03	125.30
	NH04	Plastic or polymers and resins	1.61	2.60	4.21
	NH06	Animal oil, vegetable oil	0.03		0.03
	NH09	Metals and metal alloys such as iron, aluminum, copper, bronze	4.33	198.61	202.94
	NH10	Ceramic & Glasses		0.20	0.20
	NH12	Mixed waste (This code shall be applied in case wastes are discharged without separation.)	32.00	300.00	332.00
	NH13	Others	7.43	605.64	613.07
NH Total			**350.25**	**2,895.41**	**3,245.67**
Grand Total			**394.96**	**2,947.86**	**3,342.82**

Q16 Information of the treatment operation

Q16.1 Select treatment code of incineration

		Base:	**9**	
		Answer	***4***	**44%**
			Answer	**%**
1	Yes		3	75%
2	No		1	25%
		Total	**4**	**100%**

Q 16-2 What type of incinerator do you have and what is the capacity?

		Base:	**9**	
		Answer	***4***	**44%**
			Answer	**%**
1	1. Stoker		2	50%
2	2 Fluidized bed		0	0%
3	3. Kiln		1	25%
4	4. Fixed grate batch		1	25%
5	5. Others		1	25%
		Total	**5**	**50%**

Q16-3 Do you have exhaust gas treatment including dust disposal?

		Base:	**9**	
		Answer	***5***	**56%**
			Answer	**%**
1	1. Yes		3	60%
2	2 No		2	40%
		Total	**5**	**100%**

Q16-4 How do you dispose the ash?

		Base:	**9**	
		Answer	***3***	**33%**

Q16-5 Do you conduct air emission monitoring of exhaust gas

		Base:	**9**	
		Answer	***4***	**44%**
			Answer	**%**
1	1. Yes		3	75%
2	2 No		1	25%
		Total	**4**	**100%**

Q 17 Waste that is not possible to handle

No answer

Q 18 Stream of the wastes

			Base:	**9**	
			Answer	***7***	**78%**
					ton/day
				Licenses	
Type	Waste Code	Waste	No	Yes	Grand Total
HW	HW03	Alkalis	0.17		0.17
	HW07	Organic Compounds		40.53	40.53
	HW09	Fuel, Oil and Grease		0.07	0.07
	HW10	Fine Chemicals and Biocides		0.02	0.02
	HW11	Treatment Sludge		1.13	1.13
	HW14	Other Hazardous substance (besides HW01-HW13)		0.09	0.09
	HW15	Hazardous materials from Non-production process		0.01	0.01
HW Total			**0.17**	**41.86**	**42.02**
NH	NH02	Wood	0.20	201.50	201.70
	NH04	Plastic or polymers and resins	0.10	35.17	35.27
	NH07	Rubbers and Leather		10.00	10.00
	NH09	Metals and metal alloys such as iron, aluminum, copper, bronze		3.19	3.19
	NH12	Mixed waste (This code shall be applied in case wastes are discharged without separation.)		5.50	5.50
	NH13	Others	0.40	10.27	10.67
NH Total			**0.70**	**265.63**	**266.33**
Grand Total			**0.87**	**307.49**	**308.35**

Q 19 Information of the disposal operation

Q 19-1 Do you pre-treat the wastes before disposal using solidification, fixation or another process?

		Base:	**10**	
		Answer	***6***	**60%**
			Answer	**%**
1	1. Yes (go to Q19.2)		2	33%
2	2 No		4	67%
		Total	**6**	**100%**

Q 19-2 If you have answered yes to the above, describe the process

	Base:	**2**	
	Answer	***1***	**50%**

Q 19-3 Does your disposal site treat leachate from the landfill?

		Base:	10	
		Answer	4	40%
			Answer	%
1	Yes (go to Q19.2)		0	0%
2	No		4	100%
		Total	4	100%

Q 19-4 If you have answered yes to the above, describe the process

No answer

Q 19-5 Does your disposal site have leachate quality monitoring?

		Base:	10	
		Answer	4	40%
			Answer	%
1	Yes		0	0%
2	No		4	100%
		Total	4	100%

Q19-6 Does your disposal site have landfill gas collection and exhausting or utilization?

		Base:	10	
		Answer	4	40%
			Answer	%
1	Yes		0	0%
2	No		4	100%
		Total	4	100%

Q19-7 Do you have a monitoring system for the water and/or soil, in the outskirts of your landfill?

		Base:	10	
		Answer	2	20%
			Answer	%
1	Yes		1	50%
2	No		1	50%
		Total	2	100%

Q.19-8 If you have answered yes to the above, describe such system and cite the parameters being monitored

No answer

Q19-9 Do you characterize or demand chemical characterization of the wastes going into your

landfill?

		Base:	**10**	
		Answer	***2***	**20%**
			Answer	**%**
1	Yes		1	50%
2	No		1	50%
		Total	**2**	**100%**

Q19-10 What are the restrictions so wastes may be accepted into your landfill?

No answer

Q19-11 Please specify name of the landfill and its remaining capacity

Name of the landfill and its remaining capacity

No answer

Q 20 Waste that is not possible to handle

No answer

Q 21 Stream of the wastes

		Base:	**10**		
		Answer	***6***	**60%**	
					ton/day
			Licenses		
Type	Waste Code	Waste	No	Yes	Grand Total
HW	HW12	Ash from incinerator	0.00		0.00
	HW14	Other Hazardous substance (besides HW01-HW13)	8.00		8.00
HW Total			**8.00**		**8.00**
NH	NH01	Kitchen waste (include waste from animal such as bone, skin, hair)	1,650.00		1,650.00
	NH12	Mixed waste (This code shall be applied in case wastes are discharged without separation.)	300.00		300.00
	NH13	Others	300.05		300.05
NH Total			**2,250.05**		**2,250.05**
Grand Total			**2,258.05**		**2,258.05**

Q 22 Waste that is not possible to handle

No answer

Q 23 Information of the Reuse/Recycle/Recover operation.

No answer

Q 24 Stream of the wastes

			Base:	**60**		
			Answer	***49***	**82%**	
						ton/day
				Licenses		
Type	Waste Code	Waste		No	Yes	Grand Total
HW	HW04	Toxic Compounds			0.14	0.14
	HW07	Organic Compounds		0.30	0.68	0.98
	HW09	Fuel, Oil and Grease		9.63		9.63
	HW14	Other Hazardous substance (besides HW01-HW13)		0.37		0.37
HW Total				**10.31**	**0.82**	**11.12**
NH	NH02	Wood		0.73	1.43	2.17
	NH03	Paper		4.37	81.80	86.17
	NH04	Plastic or polymers and resins		6.00	9.08	15.08
	NH06	Animal oil, vegetable oil		0.93		0.93
	NH09	Metals and metal alloys such as iron, aluminum, copper, bronze		9.13	53.33	62.46
	NH12	Mixed waste (This code shall be applied in case wastes are discharged without separation.)		0.00		0.00
	NH13	Others		1.00	0.00	1.00
NH Total				**22.16**	**145.65**	**167.82**
Grand Total				**32.47**	**146.47**	**178.94**

2.1.5 Questionnaire of Waste Management Company Survey

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Questionnaire Survey of Waste Management Companies

1_Introduction of the Survey

"The Study for the Development of an Integrated Solution related to Industrial Waste Management in the Industrial Pole of Manaus" is being carried out by JICA Study Team with the cooperation of SUFRAMA , for whose objective a waste management companies survey questionnaire was elaborated.

The purpose of this survey is to understand the waste management practices of the waste management companies in the PIM in terms of storage, reuse/recycle, discharge, collection, intermediate treatment and final disposal.

In this questionnaire the target waste are industrial waste, health-care waste and construction waste. The industrial waste is classified into the Non-Hazardous Industrial Waste (Non-HIW) and

Hazardous Industrial Waste (HIW).: The results of this survey, together with other engineering investigations, will be used for the formulation of waste stream (Waste Stream) for PIM.
The questionnaire should be answered by the person responsible for the company and he should take about 1-2 hours to complete. All answers are confidential and your help is greatly appreciated.

1. Definition of Waste generation source, Waste, Reuse, and Recycle

A. Waste generation source

The waste generation sources in a factory are classified into following two categories.

1. **Non-production processes source:** The waste generation source, excluding the production process and storage area, such as canteens, administration area and so on.
2. **Production process source:** Is the wastes generation source which is related to the production of final products of a factory, including treatment plants, maintenance and sweeping of the industrial areas.

B. Waste

In this questionnaire, the waste generated in a factory is called as industrial waste, which is classified into the following two categories:

1. **Non-Hazardous Industrial Waste (Non-HIW):** Non- HIW generated from both non-production and production processes as listed in Table 1.
2. **Hazardous Industrial Waste (HIW):** HIW generated from both non-production and production processes as listed in Table 2.

Accordingly, Industrial waste can be classified into four categories as follows.

- Non-HIW generated from Non-production process
- HIW generated from Non-production process
- Non-HIW generated from Production process
- HIW generated from Production process

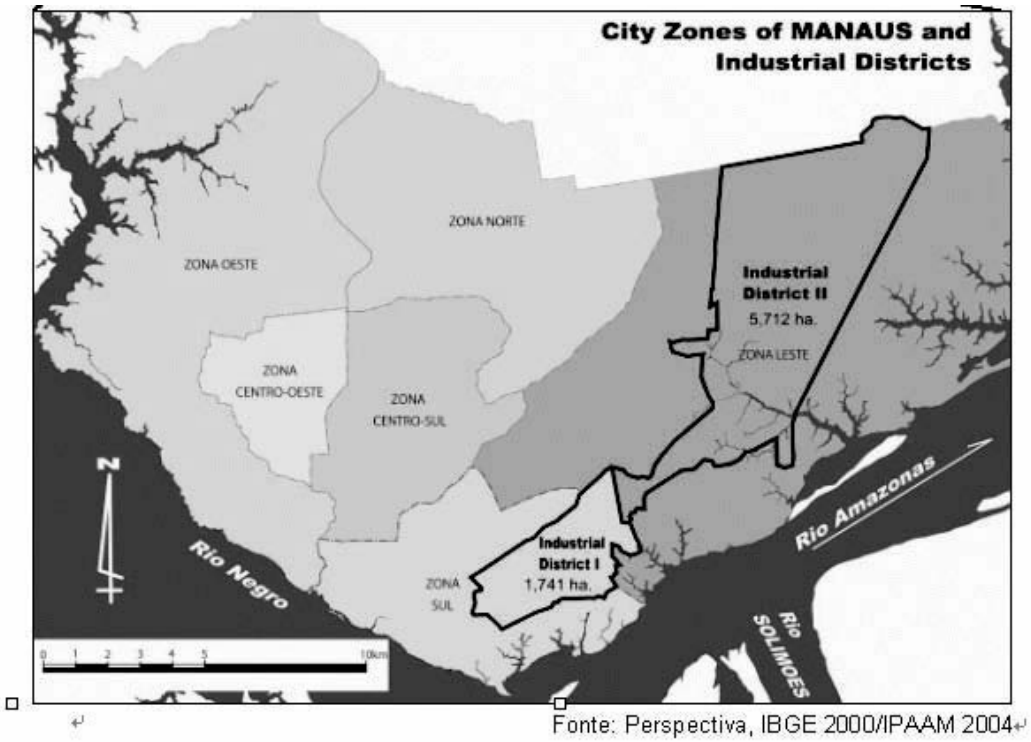
C. Reuse

To use waste again, or repeatedly, without processing, or only with simple treatment (e.g. use a used bottle after rinsing).

D. Recycle

To use waste again as raw material (including as energy source) with chemical, physical and/or biological processing (e.g. producing compost from food waste, manufacturing cement using wastewater sludge).

3. Percentage from Industrial District; Industrial District I, II. See following figure



4. Questionnaire Survey Sheet for Collection, Transportation, Storage, Treatment, Disposal and Reuse/Recycle/Recover companies of the Target Wastes

No._____

(A) General Information

1. Name of Company			
2. Address			
3. Location	[ ] 1. Industrial District 1 [ ] 2. Industrial District 2 [ ] 3. Outside of Industrial District, but inside of Manaus City Zone [ ] 4. Outside of Manaus City Zone		
4. Share Capital			R$
5. Contact information	Name		
	Tel/Fax		
	E-mail		
6. Number of Employee	Operation and Maintenance		Persons
	Administration		Persons
	Total		Persons
7. Environmental License	Do you have Environmental License granted by IPAAM [ ] 1.YES [ ] 2. NO.		
	If YES, please write License Number and CNPJ/CPF License number ..... CNPJ/CPF		
8. Annual Sales Amount			R$
9. Organization	Please provide of organization chart of your company (attach in ANNEX)		

10. Local company /International company	Please specify if the main shareholders are Brazilian or from international companies. [ ] 1. Main shareholders are Brazilian companies [ ] 2. Main shareholders are international companies		
11. Date of establishment of the company			
12. Area	Total: m² Plant area: m²		
13. Reasons why you set up your business activities in the MFZ			
14. Operation	Daily operation: hours/day		
	Annual operation; days/year		
15. Location (UTM Coordination or Latitude and longitude)	Northing/Southing		
	Easting/Westing		
16. Type of Business	Business		Mark *
	1	Collection, transportation and storage of industrial wastes	
	2	Collection, transportation and storage of health-care wastes	
	3	Collection, transportation and storage of construction waste	
	4	Treatment of industrial wastes	
	5	Treatment of health-care wastes	
	6	Treatment construction waste	
	7	Final disposal of industrial wastes	
	8	Final disposal of health-care wastes	
	9	Final disposal of construction waste	
	10	Reuse/Recycle/Recover of industrial waste	
	11	Reuse/Recycle/Recover of health-care wastes	
	12	Reuse/Recycle/Recover of construction waste	

Note *: Multiple answers allowed. You should check all your waste management businesses.

(B) Interviewee

1. Interviewee	1. Name :
	2. Position :
3. Interviewer	1. Name :
	2. Position
	Signature Date:

(C) Common Questions

Q 1. Problems and Issues

Do you have or feel problems and/or issues **in terms of your waste business or waste management** in this area, please specify as follows. (Note: Multiple answers allowed)

Category	Problems and Issues

Q1-1 Legal system	[ ] 1.	Legal framework is complicated
	[ ] 2.	Inspection and monitoring system of industrial waste is insufficient
	[ ] 3.	Government policy for industrial waste management is vague and unclear
	[ ] 4.	Law, regulation and resolutions are stringent
	[ ] 5.	Others, please specify
Q1-2 Incoming wastes	[ ] 1	Amount of incoming wastes generated in this area is small
	[ ] 2.	There are some wastes that are difficult to treat, final dispose and recycle in this area
	[ ] 3.	You feel that waste management in the generator(mainly factory) is not good.
	[ ] 4.	Others, please specify
Q1-3 Price (Waste fee)	[ ] 1.	The fee the client is prone to low
	[ ] 2.	Informal agents render their services at very low prices
	[ ] 3.	Others. Please specify.
Q1-4 Processing Cost	[ ] 1.	Price of materials and chemicals is high
	[ ] 2.	Labor cost is high
	[ ] 3.	Utilities (water, electricity etc) cost is high
	[ ] 4.	Cost of environmental countermeasures is a burden
	[ ] 5.	Availability of materials is low
	[ ] 6.	The availability of technology is low
	[ ] 7.	Others. Please specify.
Q1-5 Equipment & Technology	[ ] 1.	Procurement of waste management equipments and facilities is difficult in this area.
	[ ] 2.	Education and training for labors regarding appropriate waste management is a problem.
	[ ] 3.	Others, please specify
Q1-6 Utility (water, electricity etc)	[ ] 1.	Availability of utilities (water, electricity etc) are low
	[ ] 2.	Others, please specify
Q1-7 Competition	[ ] 1.	Competition of your business is very keen
	[ ] 2.	Because transportation to other parts of Brazil is costly in this area, it is difficult to carry out the services in connection with other companies.
	[ ] 3.	Waste management companies without license are competitors and a problem
	[ ] 4.	Others, please specify
Q1-8 Funding/Financial	[ ] 1.	It is difficult to find funding source for waste management equipments and facilities.
	[ ] 2.	Public financial support for pollution control equipments and facilities is practically naught or limited
	[ ] 3.	Others, please specify
Q1-9 Environment	[ ] 1.	Environmental consciousness regarding waste management is low in the society

	[ ] 2.	Sewage network does not cover all the Industrial Districts and Manaus City Zone
	[ ] 3.	Illegal dumping of wastes is a problem
	[ ] 4.	Manifest does not operate efficiently for tracking the stream of wastes
	[ ] 5	It is difficult to find reliable analysis laboratory
	[ ] 6.	Others, please specify
Q1-10 Others	[ ] 1.	Others, please specify

Q 2 Promotion of waste management industry

Q 2-1 Do you think which matters are necessary for promotion of waste management industry in the Manaus area? (Multiple answers allowed)

[ ] 1. Legal system, if yes go to Q 2-2

[ ] 2. Financial support, if yes go to Q 2-3

[ ] 3. Business environment, if yes go to Q 2-4

[ ] 4. Others, please specify

Q 2-2 Legal System	[ ] 1.	Formulation of comprehensive law and regulation of waste management
	[ ] 2.	Formulation of law and regulation regarding Reuse/Recycle/Recover of waste
	[ ] 3	Formulation of waste management plan in PIM area
	[ ] 4.	Improvement or speeding of environmental licensing system
	[ ] 5.	Improvement of waste tracking system (Manifest system)
	[ ] 6.	Improvement of classification of hazardous and non-hazardous wastes
	[ ] 7.	Enhancement of public administration capacity regarding waste management
	[ ] 8.	Tightening of regulations for unlicensed waste management companies
	[ ] 9.	Relaxation of control and regulation
	[ ] 10.	Others, please specify
Q 2-3 Financial Support	[ ] 1.	Provision of public financial support for equipping of waste management equipments and facilities
	[ ] 2.	Provision of tax privilege for equipping of waste management equipments and facilities
	[ ] 3.	Provision of public financial support for equipping of environmental protection and control equipments and facilities
	[ ] 4	Provision of tax privilege for equipping of environmental protection and control equipments and facilities

	[ ] 5.	Others, please specify
Q 2-4 Business Environment	[ ] 1.	Appropriate understanding of waste management business by both public administration, generator and local people
	[ ] 2.	Appropriate understanding of waste management fee by generators
	[ ] 3.	Promotion of environmental education regarding waste management for both public administration, generator and local people
	[ ] 4.	Establishment of information system of wastes and their generators and outsourcers.
	[ ] 5.	Increasing of reliable laboratories
	[ ] 6.	Price reduction of electricity, fuel and water
	[ ] 7.	Establishment of business chain regarding waste management of Reuse/Recycle/Recover
	[ ] 8.	Developing of consensus-building systems for establishment of waste management facilities
	[ ] 9.	Others, please specify

Note: Multiple answers allowed

Q3 Question in terms of waste tracking system (the manifesto system)

Q.3-1 Dose your company have the manifesto document which can give chase to waste stream?

[ ] 1. Yes

[ ] 2. No

If Yes, please attach the manifesto document to answer of this questionnaire

Q 4.Good Practice

Do you have "Good Practice" in terms of your waste business or waste management, please specify as follows.

(For examples Good Practice of Energy saving, Cost saving, High efficiency of recycling, Reduction of environmental load and so on). ----------

Q 5. Future Plan

Q 5-1. Do you have expansion plans for your facilities?

[ ] 1. Yes

[ ] 2. No

If Yes, please specify your plan briefly

Q 5-2. Do you have plan of commencement of new waste business?

[ ] 1. Yes

[ ] 2. No

If YES, please specify your plan briefly

Q 5-3 Do you have any other plans related to waste business?

[ ] 1. Yes

[ ] 2. No

If YES, please specify your plan briefly

Q 6. Environmental measures

Q 6-1 Do you have wastewater treatment facility?

[ ] 1. Yes

[ ] 2. No

If YES please answer the Question Q 6-2.

If No, please answer the Question Q 6-12.

Q 6-2 Which type of wastewater treatment plant do you have?

[ ] 1. Domestic wastewater treatment plant

[ ] 2. Industrial wastewater treatment plant

[ ] 3 Both domestic wastewater treatment plant and industrial wastewater treatment plant

Q 6-3 Please select following alternatives.

[ ] 1. Industrial wastewater together with domestic waste water are treated in the wastewater plant

[ ] 2. Industrial wastewater and domestic waste water are separately treated in the wastewater plants.

[ ] 3. Is the treatment of both effluents done in one waste water plant.

Q 6-4 What is the capacity of the wastewater plant?

Industrial effluents: ---- m^3/day ---- m^3/month

Domestic effluents: m^3/day ---- m^3/month

Q 6-5 To where is effluent of wastewater plant discharging?

[ ] 1. To sewerage network

[ ] 2. To canal, ditch and valley nearby

[ ] 3. To Igarape or main rivers of the Negro river and the Amazon river

[ ] 4. Others, please specify ----

Q 6-6 Cite the average quantities of effluents treatment sludge.

Industrial: ..... m³/day ..... m³/month

Domestic: m³/day ..... m³/month

Q 6-7 Where do you treat and/or dispose the effluents treatment sludge?

[ ] 1. In-site

[ ] 2. Off-site

Q 6-8 Do you monitor the quality of the water in the effluents treatment network?

[ ] 1. Yes

[ ] 2. No

Q 6-9 What type of monitoring?

[ ] 1. Continuous monitoring

[ ] 2. Batch monitoring

Q 6-10 How often do you collect and analyze samples?

[ ] 1. Every day

[ ] 2. Other. Please specify.

Q 6-11 What parameters do you analyze the samples? Please specify.

Go to Q.6-13

Q 6-12 Reason why you do not install the wastewater treatment facility (Note: multiple answers are allowed)

[ ] 1. I believe that the wastewater treatment is not necessary.

[ ] 2. Installation cost is high

[ ] 3. Others (Please specify)

Q 6-13 Do you set up air emission control facility?

[ ] 1. Yes

[ ] 2. No

If Yes please answer the Question Q 6-14

If No, please answer the Question Q 6-19

Q 6-14 What type of air emission control facilities do you establish? (Note: multiple answers are allowed)

[ ] 1. Electrical dust collector

[ ] 2. Filter bag

[ ] 3. Cyclone

[ ] 4. Gas wash

[ ] 5. Others (please specify)

Q 6-15 Do you conduct air quality monitoring of exhaust gas of air emission control facility?

[ ] 1. Yes

[ ] 2. No

Q 6-16 What type of monitoring?

[ ] 1. Continuous monitoring

[ ] 2. Batch monitoring

Q 6-17 How often do you take and analyze samples?

[ ] 1. Every day

[ ] 2. Others, please specify

Q 6-18 What parameters do you analyze the samples? Please specify.

Go to Q 6-20

Q 6-19 Reason why you do not install the air emission control facility. (Note: multiple answers are allowed)

[ ] 1. I believe that the air emission control is not necessary.

[ ] 2. Installation cost is high

[ ] 3. Others ,Please specify

Q 6-20 Do you have odor control equipment?

[ ] 1. Yes

[ ] 2. No

If YES, please answer Question Q 6-21.

Q 6-21 What kind of odor control equipment do you use and what is the place of establishment? Please specify.

Note; e.g. place of the equipment; in the storage of incoming wastes

Q 6-22 Do you have spill prevention control measures of oils, solvents chemical liquids and other liquids?

[ ] 1. Yes

[ ] 2. No

If YES, please answer Question Q 6-23.

Q 6-23 What kind of spill prevention control measures? Please specify.

Q 7. Introduction of Management System

Q 7-1 Do you introduce quality management system of ISO 9000 series?

[ ] 1. Already acquired (posting certification document in the company)

[ ] 2. Will acquire within a year

[ ] 3. No plan to acquire

Q 7-2 Do you introduce environmental management system of ISO 14000 series?

[ ] 1. Already acquired (posting certification document in the company)

[ ] 2. Will acquire within a year

[ ] 3. No plan to acquire

Q 8 Employee Training

Q 8-1. Do you provide employee training in terms of waste management?

[ ] 1. Yes

[ ] 2. No , go to Q.9

If YES, please answer question Q 8-2

Q 8-2 What are subject of training courses? (Note: Multiple answers are allowed)

[ ] 1. Safety management of waste handling

[ ] 2. Response of troubles and incidents in waste handling

[ ] 3. Pollution control measures in waste handling

[ ] 4. Technical education of waste handling

[ ] 5. Others

Q 8-3 How often do you provide employee training in terms of waste management?

[ ] 1. Once a year

[ ] 2. More than once a year

Q 9 Response of troubles and incidents

Q 9-1 Do you have system (manual, information system etc.) of response of troubles and incidents? (Y/N)

[ ] 1. Yes (If YES, specify)

[ ] 2. No , go to Q 10

If YES, please answer question Q 9-2

Q 9-2 What kind of measures do you prepare for response of troubles and incidents. (Note: multiple

answers are allowed)

[ ] 1. Emergency contact network

[ ] 2. Emergency medical care

[ ] 3. Manual of emergency management

[ ] 4. Others (please specify)

Q 10 Waste analysis

Q 10-1 Do you analyze characteristic of incoming wastes?

[ ] 1. Always

[ ] 2. Sometime

[ ] 3. Not necessary to analyze the samples (Go to Q11)

Those who answer 1 and 2, please answer question Q 10-2.

Q 10-2 What parameters do you analyze incoming wastes? (Please specify)

Q 10-3 Do you have waste quality analysis laboratory in your company?

[ ] 1. Yes

[ ] 2. No

Q 11 Measurement of volume or weight of incoming wastes

Q 11-1 Do you measure volume or weight of incoming wastes?

[ ] 1. Yes, Go to Q 11-2

[ ] 2. No, Go to Q 11-3

Q 11-2 How do you measure volume or weight of incoming wastes?

[ ] 1. By track scale

[ ] 2. Others, please specify

Q 11-3 How do you confirm volume or weight of incoming wastes?

- If you select the transportation and storage of industrial wastes, health-care wastes or construction wastes, please go to sheet D and fill questions.
- If you select the treatment of industrial wastes, health-care wastes or construction wastes, please go to sheet E and fill questions.
- If you select the final disposal of industrial wastes, health-care wastes or construction wastes, please go to sheet F and fill questions.
- If you select the Reuse/Recycle/Recover of industrial wastes, health-care wastes or construction wastes, please go to sheet G and fill questions.

(D) Questionnaire for Collection, Transportation and Storage Companies of the Wastes

The method code (Storage, Treatment, Final disposal and Reuse/Recycle/Recover) are based on CONAMA. Please follow waste code and method code which are attached.

Q 12 Type of Vehicles

How many vehicles and equipment by type do you have?

[ ] 1. Ordinary track without cover cars

[ ] 2. Ordinary track with cover cars

[ ] 3. Tanker cars

[ ] 4. Truck with loading equipment cars

[ ] 5. Others (specify) cars

Multiple answers allowed.

Q 13 Waste that is not possible to handle in your company

If you have or know that specific wastes are not handled in your company, please specify as follows.

	Waste code	Waste description	Reason why there is no handling
1			
2			
3			
4			

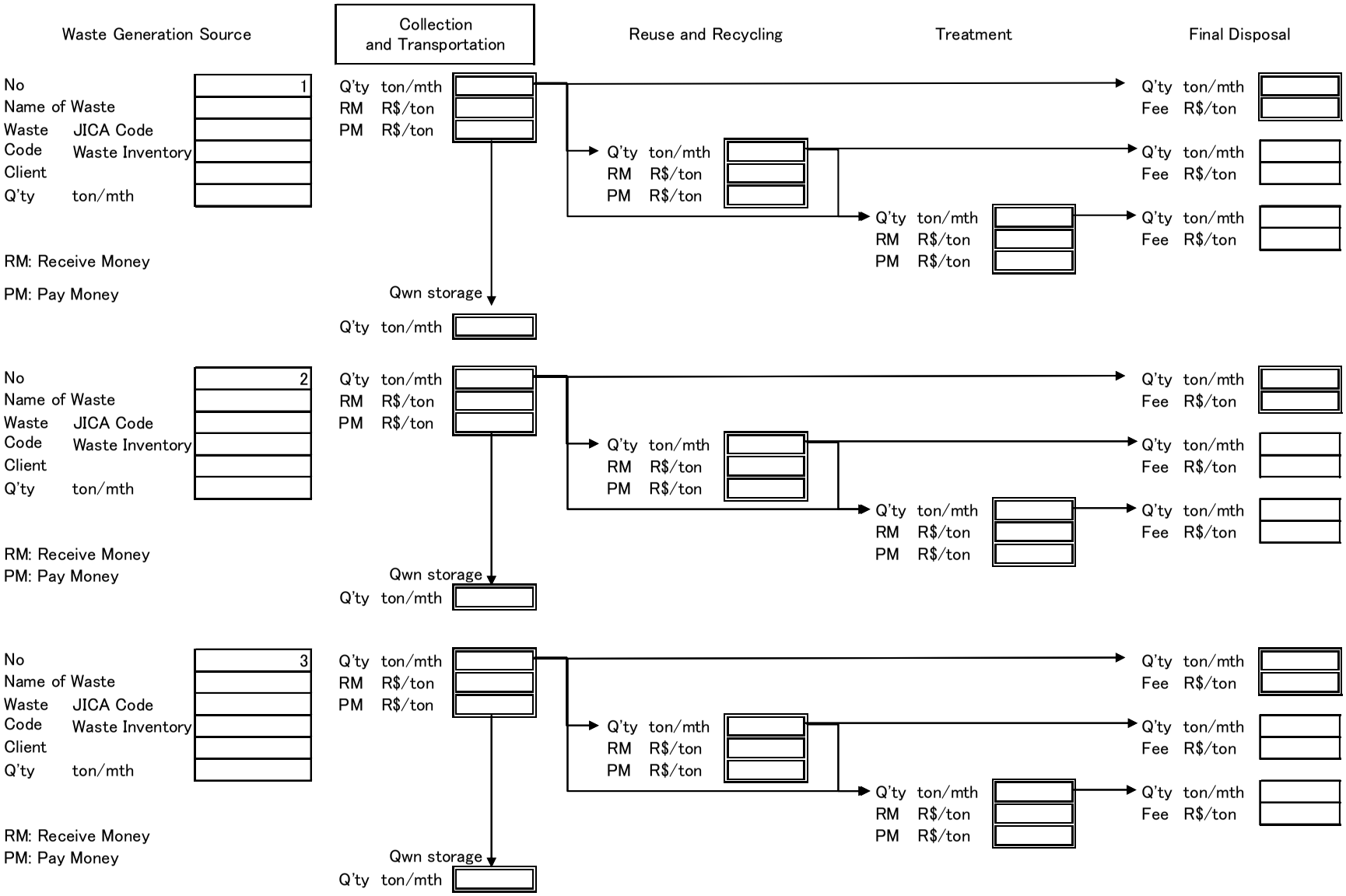
Q14. Do you storage your handling wastes? (Y/N)

[ ] 1. Yes

[ ] 2. No

Q15 Stream of the wastes

Please fill in the following table regarding your handling wastes.


Waste Generation Source
Collection and Transportation
Reuse and Recycling
Treatment
Final Disposal
No 1
Name of Waste
Waste Code JICA Code
Waste Inventory
Client
Q'ty ton/mth
RM: Receive Money
PM: Pay Money
Q'ty ton/mth
RM R$/ton
PM R$/ton
Fee R$/ton
Qwn storage
No 2
No 3

(E) Questionnaire for Treatment Companies of the Wastes

The method code(Storage, Treatment, Final disposal and Reuse/Recycle/Recover) are based on CONAMA. Please follow waste code and method code which are attached.

Q 16 Information of the treatment operation

Please inform your treatment operation, if you have incinerators.

Q16-1 Select treatment code of incineration

[ ] 1. T01

[ ] 2. T02

	Information		
.	Q 16-2	What type of incinerator do you have and what is the capacity? Type / Capacity(ton/h or another unit) [ ] 1. Stoker ---------- [ ] 2. Fluidized bed ---------- [ ] 3. Kiln ---------- [ ] 4. Fixed grate batch ---------- [ ] 5. Others ----------	
	Q16-3	Do you have exhaust gas treatment including dust disposal?	[ ] 1. Yes [ ] 2. No
	Q16-4	How do you dispose the ash? Please specify	
	Q16-5	Do you conduct air emission monitoring of exhaust gas ?	[ ] 1. Yes [ ] 2. No

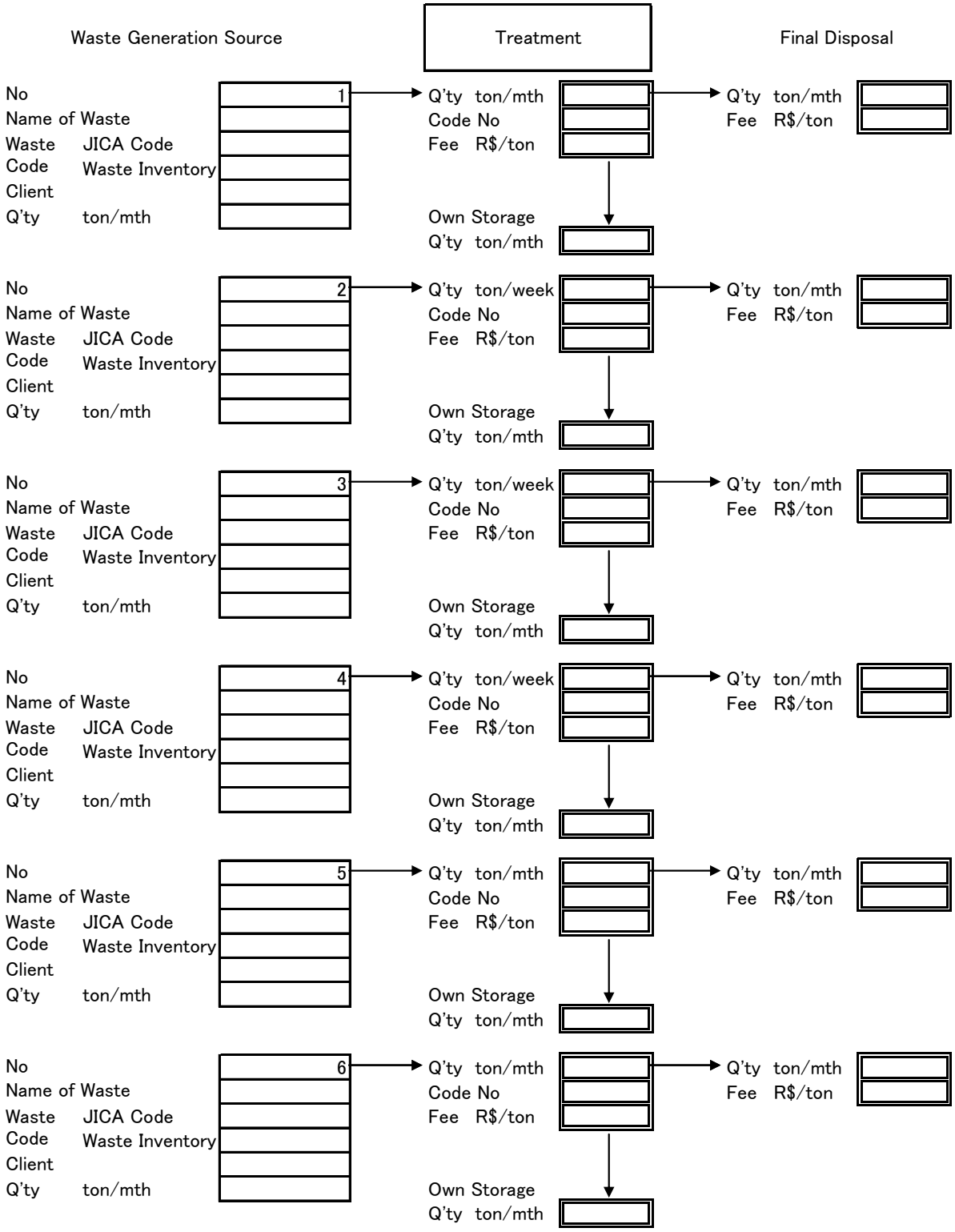
Q 17 Waste that is not possible to handle

If you have or know that specific wastes are not handled in your company, please specify as follows.

	Waste code	Waste description	Reason why there is no handing
1			
2			
3			
4			

Q 18 Stream of the wastes

Please fill in the following table regarding your handling wastes.


Waste Generation Source
Treatment
Final Disposal
No
Name of Waste
Waste Code
JICA Code
Waste Inventory
Client
Q'ty ton/mth
Q'ty ton/week
Code No
Fee R$/ton
Own Storage
Q'ty ton/mth
Fee R$/ton
1
2
3
4
5
6

.

(F) Questionnaire for Wastes Final Disposal (Landfill) Companies

The method code(Storage, Treatment, Final disposal and Reuse/Recycle/Recover) are based on CONAMA. Please follow waste code and method code which are attached.

Q 19 Information of the disposal operation

Please inform your disposal operation

Final Disposal Method (Code)	Information		
	Q 19-1	Do you pre-treat the wastes before disposal using solidification, fixation or another process?	[ ] 1. Yes [ ] 2. No
	Q 19-2	If you have answered yes to the above, describe the process:	
	Q 19-3	Does your disposal site treat leachate from the landfill?	[ ] 1. Yes [ ] 2. No
	Q 19-4	If you have answered yes to the above, describe the process:	
	Q 19-5	Does your disposal site have leachate quality monitoring ?	[ ] 1. Yes [ ] 2. No
	Q 19-6	Does your disposal site have landfill gas collection and exhausting or utilization?	[ ] 1. Yes [ ] 2. No
	Q 19-7	Do you have a monitoring system for the water and/or soil, in the outskirts of your landfill?	[ ] 1. Yes [ ] 2. No
	Q. 19-8	If you have answered yes to the above, describe such system and cite the parameters being monitored.	
	Q. 19-9	Do you characterize or demand chemical characterization of the wastes going into your landfill?	[ ] 1. Yes [ ] 2. Não
	Q. 19-10	What are the restrictions so wastes may be accepted into your landfill?	
	Q 19-11	Please specify name of the landfill and its remaining capacity Name of the landfill ---------- Remaining capacity ----------	

Q 20 Waste that is not possible to handle

If you have or know that specific wastes are not handled in your company, please specify as follows.

	Waste code	Waste Description	Reason why there is no handling
1			
2			
3			
4			

Q 21 Stream of the wastes

Please fill in the following table regarding your handling wastes.

Receive from			Final Disposal	
No		1	Q'ty ton/mth	
Name of Waste			Code No	
Waste Code	JICA Code		Fee R$/ton	
	Waste Inventory			
Client				
Q'ty	ton/mth			

No		2	Q'ty ton/mth	
Name of Waste			Code No	
Waste Code	JICA Code		Fee R$/ton	
	Waste Inventory			
Client				
Q'ty	ton/mth			

No		3	Q'ty ton/mth	
Name of Waste			Code ton/mth	
Waste Code	JICA Code		Fee R$/ton	
	Waste Inventory			
Client				
Q'ty	ton/mth			

No		4	Q'ty ton/mth	
Name of Waste			Code No	
Waste Code	JICA Code		Fee R$/ton	
	Waste Inventory			
Client				
Q'ty	ton/mth			

No		5	Q'ty ton/mth	
Name of Waste			Code No	
Waste Code	JICA Code		Fee R$/ton	
	Waste Inventory			
Client				
Q'ty	ton/mth			

(G) Questionnaire for Reuse, Recycling and Recovering Companies of the Wastes

The method code(Storage, Treatment, Final disposal and Reuse/Recycle/Recover) are based on CONAMA. Please follow waste code and method code which are attached.

Q 22 Waste that is not possible to handle

If you have or know that specific wastes are not handled in your company, please specify as follows.

	Waste code	Waste Description	Reason why there is no handling
1			
2			
3			
4			

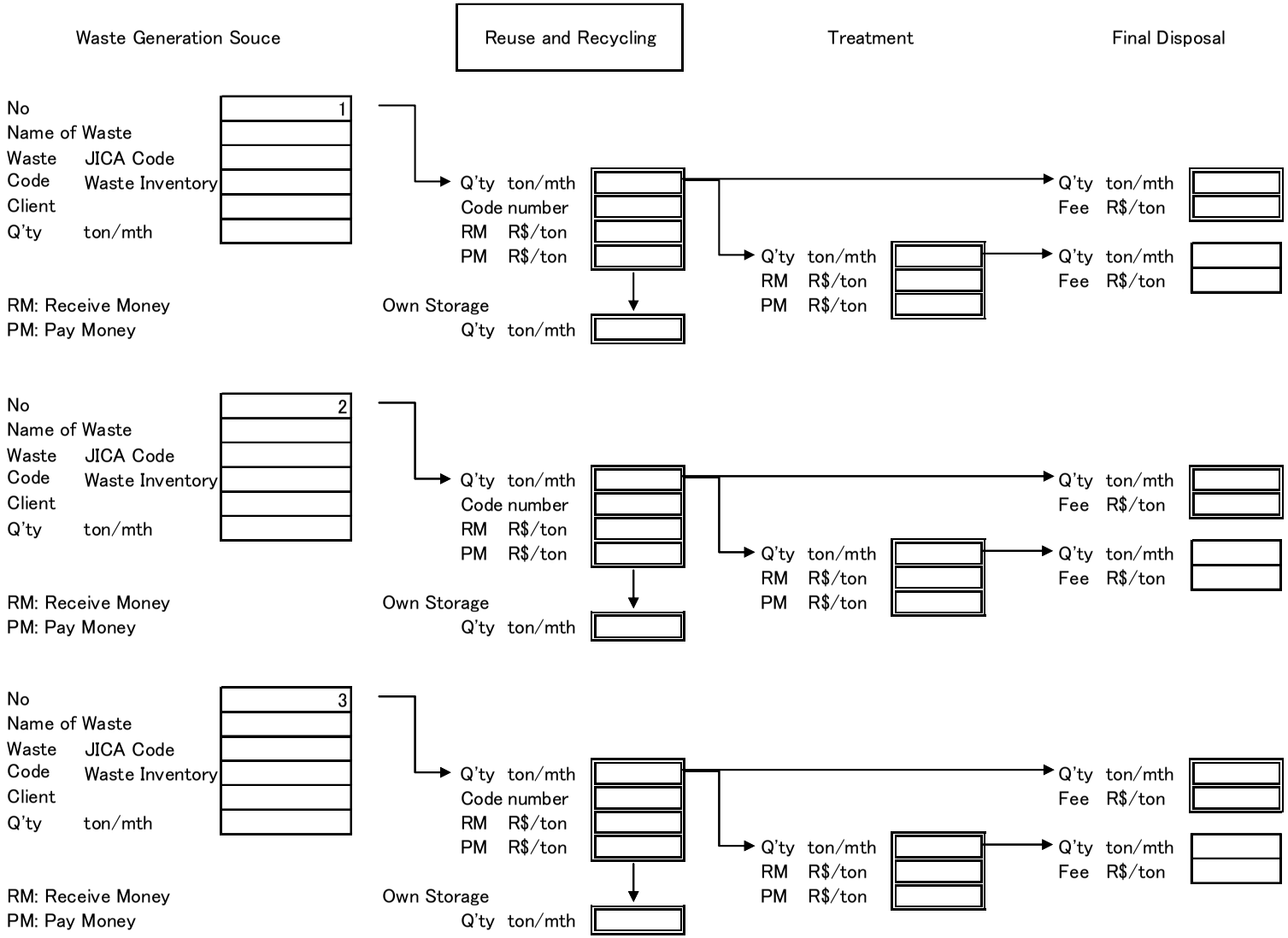
Q 23 Information of the Reuse/Recycle/Recover operation. (Note: multiple answers are allowed)

Please inform your main equipment and capacity

	Code	Description of method	Main Equipment	Capacity
Q 23-1	R01	Utilization in industrial furnace (except cement kiln)		
Q 23-2	R02	Utilization in boiler		
Q 23-3	R03	Utilization (Incorporation in cement kiln)		
Q 23-4	R04	Blending of wastes for further treatment, such as utilizat in cement kiln		
Q 23-5	R09	Reuse of solvent (Distillation etc)		
Q 23-6	R10	Refining of waste oils		
Q 23-7	R12	Scrap		

Q 24 Stream of the wastes

Please fill in the following table regarding your handling wastes.


Waste Generation Souce
Reuse and Recycling
Treatment
Final Disposal
No
1
Name of Waste
Waste Code
JICA Code
Waste Inventory
Client
Q'ty ton/mth
RM: Receive Money
PM: Pay Money
Q'ty ton/mth
Code number
RM R$/ton
PM R$/ton
Own Storage
Q'ty ton/mth
Q'ty ton/mth
RM R$/ton
PM R$/ton
Q'ty ton/mth
Fee R$/ton
Q'ty ton/mth
Fee R$/ton
No
2
Name of Waste
Waste Code
JICA Code
Waste Inventory
Client
Q'ty ton/mth
RM: Receive Money
PM: Pay Money
Q'ty ton/mth
Code number
RM R$/ton
PM R$/ton
Own Storage
Q'ty ton/mth
Q'ty ton/mth
RM R$/ton
PM R$/ton
Q'ty ton/mth
Fee R$/ton
Q'ty ton/mth
Fee R$/ton
No
3
Name of Waste
Waste Code
JICA Code
Waste Inventory
Client
Q'ty ton/mth
RM: Receive Money
PM: Pay Money
Q'ty ton/mth
Code number
RM R$/ton
PM R$/ton
Own Storage
Q'ty ton/mth
Q'ty ton/mth
RM R$/ton
PM R$/ton
Q'ty ton/mth
Fee R$/ton
Q'ty ton/mth
Fee R$/ton

<ANNEX>

Table 1 : **Team Code and CONAMA code**

Team code	Description of the waste	CONAMA Code code	Description of the waste
NH01	Kitchen waste (include waste from animal such as bone, skin, hair)	A001	Residues of restaurant (food remaining portions)
		A024	Bagasse of sugar cane
		A499	Carnaça
		A599	Residues organic of process (tallow, serum, bones, blood, others of the nourishing industry, etc)
		A699	Rind of rice
		A999	Residues of fruits (bagasse, must, rind, etc.)
NH02	Wood	A009	Residues wooden I contend not toxic substances
NH03	Paper	A006	Residues of paper and cardboard
NH04	Plastic or polymers and resins	A007	Polymerized pstic residues of process
		A107	Bombonas of plastic not contaminated
		A108	Etil acetate residues vinila (EVA)
		A207	Plastic films and small packings
		A208	Polyurethane residues (PU)
NH05	Textile and fiber	A010	Residues of têxteis materials
NH06	Animal oil, vegetable oil		
NH07	Rubbers and Leather	A008	Rubber residues
		A299	Caleadas shavings of skins
		A399	Atanado leather shavings, remnants
NH08	Ash/dust from coal-fired power plants, etc.	A111	Leached ashes of boiler
NH09	Metals and metal alloys such as iron, aluminum, copper, bronze	A004	Ferrous metal scrap iron
		A005	Not ferrous metal scrap iron (brass, etc.)
		A011	Not metallic mineral residues
		A012	Slag of aluminum casting
		A013	Slag of iron production and steel
		A014	Slag of brass casting
		A015	Slag of zinc casting
		A016	Sand of casting
		A104	Metallic packings (empty cans)
		A105	Not ferrous metal packings (empty cans)
		A204	Tambores metallic
NH10	Ceramic & Glasses	A017	Refractory ceramic residues and material
		A025	Fibre glass
		A117	Glass residues
		A799	Atanado leather Serragem, bran and dust
NH11	Stone, sand or material that have composition of soil such as tile, brick, gypsum, cement		
NH12	Mixed waste (This code shall be applied in case wastes are discharged without separation.)	A002	Generated residues outside of the industrial process (office, packings, etc.)
NH13	Others	A003	Residues of varrição of plant
		A018	Solid residues not toxic metal composites
		A019	Solid residues of stations of treatment of effluent I contend material biological not toxic
		A021	Solid residues of stations of treatment of effluent I contend not toxic substances
		A022	Pastosos residues of stations of treatment of effluent I contend not toxic substances
		A023	Pastosos residues I contend limy
		A026	Slag of jateamento I contend not toxic substances
		A027	Used catalysers I contend not toxic substances
		A028	Residues of system of control of not toxic gaseous emission I contend substance (sleeve precipitadores, filters, among others)
		A029	Products are of the specification or are of the validity stated period contend not dangerous substances
		A099	Other not dangerous residues
		A199	Salty shavings
		A308	Foam
		A899	Silt of the caleiro

Table 2 : Hazardous Industrial Waste (Class I waste)

Type of HIW	HIW Code	Example of HIW
Inorganic acid	HW01	Sulfuric acid (H_2SO_4), Hydrochloric acid (HCl), Nitric acid (HNO_3), Phosphoric acid (H_3PO_4), Other inorganic acids
Organic acid	HW02	Acetic acid (CH_3COOH), Formic acid (HCOOH), Other organic acids
Alkalis	HW03	Caustic soda (NaOH), Ammonia (NH_3), Sodium carbonate (Na_2CO_3), Other alkaline materials
Toxic Compounds	HW04	including Hg, As, Cd, Pb, Cr, CN
Inorganic Compounds	HW05	Plating wastes, Picking waste, Sulphides, etc.
Other Inorganic	HW06	Asbestos, Slug, etc.
Organic Compounds	HW07	Reactive chemical wastes (Oxidizing agents, Reducing agents, etc), Solvents etc.
Polymeric Materials	HW08	Epoxy resin, Chelate resin, Polyurethan resin, Latex rubber etc.
Fuel, Oil and Grease	HW09	Fats, Waxes, Kerosene, Lubricating oil, Engine oil, Grease etc
Fine Chemicals and Biocides	HW10	Pesticides, Medicine, Cosmetic, Drugs, etc.
Treatment Sludge	HW11	Inorganic sludge, Organic sludge, Septic tank sludge, etc.
Ash from incinerator	HW12	---
Dust and Air pollution control (APC) products	HW13	Soot and dust waste from incineration facilities, treating exhaust gas
Other Hazardous substance (besides HW01-HW13)	HW14	HIWs other than the above
Mixed waste	HW15	---
Hazardous materials from Non-production process	HW16	Fluorescent tubes, Thermometer (use mercury), Batteries, Pesticides (Household use), etc.

Table 3 : Comparison of Team Code and CONAMA code

CONAMA code	Description	Team code
C001 to C009	Listing 10 - dangerous residues for containing volatile components, in which do not apply solubilização and/or leaching tests, presenting superior concentrations to the indicated ones in listing 10 of Norm NBR 10004	**HW14**
D001	Dangerous residues for presenting inflammability	**HW10 HW08 HW09 HW14**
D002	Dangerous residues for presenting corrosivity	**HW01 HW02 HW3**
D003	Dangerous residues for presenting reactivity	**HW01 HW02 HW03 HW07**
D004	Dangerous residues for presenting pathogenicity	**HW10 HW14**
D005 to D029	Listing 7 of Norm NBR 10004: dangerous residues characterized by the leaching test	**HW05 HW06 HW10 HW11**
K193	Shavings of leather tanned to chromium	**HW04**
K194	Leather Serragem and dust I contend chromium	**HW04**
K195	Silt of stations of treatment of effluent of tanning to chromium	**HW04**
F102	Residue of catalysers not specified in Norm NBR 10.004	**HW14**
F103	Deriving residue of industrial laboratories (chemical products) not specified in Norm NBR 10.004	**HW04 HW10**
F104	Not specified contaminated empty packings in Norm NBR 10.004	**HW14**
F105	Solvent contaminated (to specify solvent and the main contaminante)	**HW07**
D099	Other dangerous residues - to specify	**HW14**
F001 F0301	Listing 1 of Norm NBR 10004- admittedly dangerous residues - Classroom 1, of not-specific sources	**HW04 HW07**
F100	Bifenilas Policloradas - PCB`s. Packings contaminated with PCBs also transforming and capacitors	**HW07**
P001 to P123	Listing 5 of Norm NBR 10004 - dangerous residues for containing toxic substances acutely (remaining portions of packings contaminated with substances of listing 5; contaminated residues of spilling or ground, and products are of specification or products of commercialization	**HW07**

	forbidden of any constant substance in listing 5 of Norm NBR 10.004	
K001 to K209	Listing 2 of Norm NBR 10004- admittedly dangerous residues of specific sources	**HW04 HW07**
K053	Remaining portions and you splodge of inks and pigments	**HW07**
K078	Residue of cleanness with solvent in the manufacture of inks	**HW07**
K081	Silt of ETE of the production of inks	**HW07 HW11**
K203	Residues of laboratories of research of illnesses	**HW10**
K207	It splodges of the used oil re-refining (it splodges acid)	**HW01 HW09**
U001 to U246	Listing 6 of Norm NBR 10004- dangerous residues for containing toxic substances (contaminated residues of spilling or ground; products are of specification or products of commercialization forbidden of any constant substance in listing 6 of Norm NBR 10.004	**HW14**

Code of Storage, Treatment, Reuse, Recycling and Final Disposal Methods in RESOLUCOES DO CONAMA

	Code[*1]		Description
Storage method	Z01	S01	Storage in drums on impermeable floor with roof
	Z11	S11	Storage in drums on impermeable floor without roof
	Z21	S21	Storage in drums on the ground with roof
	Z31	S31	Storage in drums on the ground without roof
	Z02	S02	Storage in bulk on impermeable floor with roof
	Z12	S12	Storage in bulk on impermeable floor without roof
	Z22	S22	Storage in bulk on the ground with roof
	Z32	S32	Storage in bulk on the ground without roof
	Z03	S03	Storage in containers with roof
	Z13	S13	Storage in containers without roof
	Z04	S04	Storage in tanks with settling tank
	Z14	S14	Storage in tanks without settling tank
	Z05	S05	Storage in plastic drum containers on impermeable floor with roof
	Z15	S15	Storage in plastic drum containers on impermeable floor without roof
	Z25	S25	Storage in plastic drum containers on the ground with roof
	Z35	S35	Storage in plastic drum containers on the ground without roof
	Z09	S09	Storage in lagoon with impermeable layer
	Z19	S19	Storage in lagoon without impermeable layer
	Z08	S08	Others
Treatment method	T01		Incineration
	T02		Incineration with chamber
	T05		Open burning
	T06		Explosion
	T07		Oxidation of cyanides
	T08		Encapsulation/Solidification
	T09		Chemical oxidation
	T10		Precipitation
	T11		Detoxification
	T12		Neutralization
	T13		Adsorption
	T15		Biological treatment
	T16		Composting
	T17		Drying
	T18		Land farming
	T19		Decomposition by plasma
	T34		Others (including other thermal treatment) such as autoclave)
Reutilization/ Recycling/ Recover	R01		Utilization in industrial furnace (except cement kiln)
	R02		Utilization in boiler
	R03		Incorporation in cement kiln
	R04		Blending of wastes for further treatment
	R05		Utilization as micronutrient for agricultural application
	R06		Incorporation to agricultural soil
	R07		Fertilizer
	R08		Animal feed
	R09		Re-treatment of solvent (Distillation etc)

	R10	Refining of waste oils
	R11	Re-refining of oils
	R12	Intermediate scraps
	R13	On-site Reuse/ Recycle/ Recovery
	R99	Other Reuse/ Recycle/ Recovery method (specify)
Final Disposal	B01	Infiltration to the ground for liquid waste
	B02	Landfill in municipal waste landfill
	B03	Landfill in own landfill (Internal landfill site)
	B04	Landfill in industrial landfill of outside (not own landfill)
	B05	Open dumping at municipal waste disposal site
	B06	Open dumping at private waste disposal site
	B20	Sewage for liquid waste or wastewater
	B30	Others

1* : The code to be used for the type of storage meets in Annex III (System - Storage), using "S" for residues currently generated and "Z" for the not generated residues more.

2.2 Study of Waste Management in Factories

2.2.1 Outline of the Study

a. Study Objective

The study aims to clarify the current conditions of industrial waste management at the source of generation by visiting the PIM factories where waste is generated and conducting an interview survey to assess operation conditions, the types and amounts of wastes generated and the conditions of industrial waste management.

b. Study Method

A local consultant (SEA LTD.) was consigned to conduct the study. The local consultant visited and conducted interviews with target factories using a questionnaire made by the study team.

The study team produced a draft of the questionnaire to use as the basis for discussion with the C/P. Revisions were made based on that discussion, and then members of the study team accompanied the local consultant initially on a trial basis to further modify the questionnaire that was used in the full-scale survey. The following items were included in the questionnaire:

- General factory information, factory name, type of industry, number of employees, scale of production, value of annual shipment
- Kinds of industrial wastes, amount generated and amount discharged
- Storage, treatment and reuse/recycle methods for industrial wastes, and related costs (on- and off-site information)
- Needs for government administrative support
- Problems faced with management of industrial wastes
- Needs for a waste exchange database
- Future production plans, process improvements, environmental measures, etc. to be taken
- Existence of a clinic on premises
- Discharge of radioactive and construction waste
- Other

c. Study Schedule

A local consultant (SEA LTD.) was consigned to conduct the study on 27 March 2009. Immediately after the contract was signed, the trial survey was implemented, and upon appropriate revisions and additions to the draft questionnaire sheet, a full-scale survey was begun in late April, and the direct interviews were to be completed by late July. The results were to be compiled into a report in August, but delays in the interview process led to an extension into September. Therefore, the first analysis report were made based on the data from 134 factories obtained by August 17th. When the direct interviews were completed at the end of September, the additional data from the 53 factories were included and the first analysis report was modified to reflect those additions.

The primary causes for the delay in the factory survey were as follows:

- Although a draft of the questionnaire sheet was sent in mid-May to 339 factories, by the end of July, only 106 factories, at most, had returned the completed questionnaires.
- Furthermore, direct interviews were to be conducted based on the returned questionnaires, but the time required to obtain permission to visit the factories were greater than expected.

2.2.2 Target Wastes

a. Categories of Industrial Waste in CONAMA Resolution 313

The National Environment Council (CONAMA) issued their Resolution 313 on 29 October 2002. CONAMA Resolution 313 requires specified industries to report (using a waste inventory) on management conditions for industrial waste generated through industrial activity. CONAMA Resolution 313 designates that the inventory is produced in accordance with the Brazilian Association of Technical Standards (ABNT) NBR 10004, which stipulates the categorization of wastes.

b. Target Wastes

The target wastes are those generated by PIM which are designated in CONAMA Resolution 313 for inventory formulation.

c. Categories of Target Wastes

CONAMA Resolution 313 was issued and went into effect on 29 October 2002. Despite the fact that SUFRAMA also began to receive a number of waste inventories from PIM factories in 2001[1], neither the types and amounts of PIM generated wastes nor the actual management practices were understood at the start of this study. This indicates an inadequate system to manage this at SUFRAMA; however, the failure to grasp actual conditions of waste management in most cases is the immense and complicated categorization of waste that makes it exceedingly difficult to identify.

CONAMA Resolution 313 condensed waste categorization in ABNT NBR 10004 in order for factories to make their waste inventories; however, it remained difficult to identify to which category the generated wastes would be attributed. Thus, the study team held repeated discussions with the C/P to categorize wastes as follows in order to conduct the present study:

1. Industrial Waste will be broadly divided into the following categories.
   - Non-HIW (Non Hazardous Industrial Waste) generated from Non-production process
   - HIW (Hazardous Industrial Waste) generated from Non-production process
   - Non-HIW generated from Production process
   - HIW generated from Production process
2. Given the above, it was reasoned that making it easier for the creators of the waste inventory--i.e. the factories--to identify the wastes generated, that it would in turn become easier for those receiving the waste inventory to compile and manage that information. To do so, wastes were grouped to the greatest extent possible into 13

[1] In 2001, the Public Ministry of the State of Amazonas, through Recommendation No. 003/2001, advised SUFRAMA to obtain an operation license for PIM and for each PIM factory to submit a waste inventory. In response, SUFRAMA appealed to the PIM factories to submit their waste inventories, which a number of factories, in turn, submitted.

non-hazardous and 16 hazardous categories, each with their own respective code, as shown in the table below.

Table 2-4: Non-Hazardous Industrial Waste Categories used in the Study

Type of Non-HIW	Non-HIW Code
Kitchen waste (include waste from animal such as bone, skin, hair)	NH01
Wood	NH02
Paper	NH03
Plastic or polymers and resins	NH04
Textile and fiber	NH05
Animal oil, Vegetable oil	NH06
Rubbers and Leather	NH07
Ash/dust from coal-fired power plants, etc.	NH08
Metals and metal alloys such as aluminum, copper, bronze	NH09
Ceramic & Glasses	NH10
Stone, sand or material that have composition of soil such as tile, brick, gypsum, cement	NH11
Mixed waste (This code shall be applied in case wastes are discharged without separation.)	NH12
Others	NH13

Source: JICA Study Team

Table 2-5: Comparison of Study Code and CONAMA code (Non-HIW)

Study Code	CONAMA Code	Description
NH01	A001	Residues of restaurant (food remaining portions)
	A024	Bagasse of sugar cane
	A499	Carnaça
	A599	Residues organic of process (tallow, serum, bones, blood, others of the nourishing industry, etc)
	A699	Rind of rice
	A999	Residues of fruits (bagasse, must, rind, etc.)
NH02	A009	Residues wooden I contend not toxic substances
NH03	A006	Residues of paper and cardboard
NH04	A007	Polymerized plastic residues of process
	A107	Bombonas of plastic not contaminated
	A108	Etil acetate residues vinila (EVA)
	A207	Plastic films and small packings
	A208	Polyurethane residues (PU)
NH05	A010	Residues of têxteis materials
NH06	'---	'---
NH07	A008	Rubber residues
	A299	Caleadas shavings of skins
NH08	A111	Leached ashes of boiler
NH09	A004	Ferrous metal scrap iron
	A005	Not ferrous metal scrap iron (brass, etc.)
	A011	Not metallic mineral residues
	A012	Slag of aluminum casting
	A013	Slag of iron production and steel
	A014	Slag of brass casting
	A015	Slag of zinc casting
	A016	Sand of casting
	A104	Metallic packings (empty cans)
	A105	Not ferrous metal packings (empty cans)

	A204	Tambores metallic
	A399	Atanado leather shavings, remnants
NH10	A017	Refractory ceramic residues and material
	A025	Fibre glass
	A117	Glass residues
	A799	Atanado leather Serragem, bran and dust
NH11	'---	'---
NH12	A002	Generated residues outside of the industrial process (office, packings, etc.)
NH13	A003	Residues of varrição of plant
	A018	Solid residues not toxic metal composites
	A019	Solid residues of stations of treatment of effluent I contend material biological not toxic
	A021	Solid residues of stations of treatment of effluent I contend not toxic substances
	A022	Pastosos residues of stations of treatment of effluent I contend not toxic substances
	A023	Pastosos residues I contend limy
	A026	Slag of jateamento I contend not toxic substances
	A027	Used catalysers I contend not toxic substances
	A028	Residues of system of control of not toxic gaseous emission I contend substance (sleeve precipitadores, filters, among others) Products are of the specification or are of the validity stated period contend not dangerous substances
	A029	Other not dangerous residues
	A099	Salty shavings
	A199	Foam
	A308	Silt of the caleiro
	A899	Generated residues outside of the industrial process (office, packings, etc.)

Table 2-6: Hazardous Industrial Waste Categories used in the Study

Type of HIW	HIW Code	Example of HIW
Inorganic acid	HW01	Sulfuric acid (H_2SO_4), Hydrochloric acid (HCl), Nitric acid (HNO_3), Phosphoric acid (H_3PO_4), Other inorganic acids
Organic acid	HW02	Acetic acid (CH_3COOH), Formic acid (HCOOH), Other organic acids
Alkalis	HW03	Caustic soda (NaOH), Ammonia (NH_3), Sodium carbonate (Na_2CO_3), Other alkaline materials
Toxic Compounds	HW04	including Hg, As, Cd, Pb, Cr, CN
Inorganic Compounds	HW05	Plating wastes, Picking waste, Sulphides, etc.
Other Inorganic	HW06	Asbestos, Slug, etc.
Organic Compounds	HW07	Reactive chemical wastes (Oxidizing agents, Reducing agents, etc), Solvents etc.
Polymeric Materials	HW08	Epoxy resin, Chelate resin, Polyurethan resin, Latex rubber etc.
Fuel, Oil and Grease	HW09	Fats, Waxes, Kerosene, Lubricating oil, Engine oil, Grease etc
Fine Chemicals and Biocides	HW10	Pesticides, Medicine, Cosmetic, Drugs, etc.
Treatment Sludge	HW11	Inorganic sludge, Organic sludge, Septic tank sludge, etc.
Ash from incinerator	HW12	---
Dust and Air pollution control (APC) products	HW13	Soot and dust waste from incineration facilities, treating exhaust gas

Other Hazardous substance (besides HW01-HW13)	HW14	HIWs other than the above
Mixed Waste	HW15	---
Hazardous materials from Non-production process	HW16	Fluorescent tubes, Thermometer (use mercury), Batteries, Pesticides (Household use), etc.

Source: JICA Study Team

Table 2-7: Comparison of Study Code and CONAMA code (HIW)

CONAMA code	Description	Study code
C001 to C009	Listing 10 - dangerous residues for containing volatile components, in which do not apply solubilização and/or leaching tests, presenting superior concentrations to the indicated ones in listing 10 of Norm NBR 10004	**HW14**
D001	Dangerous residues for presenting inflammability	**HW10 HW08 HW09 HW14**
D002	Dangerous residues for presenting corrosively	**HW01 HW02 HW03**
D003	Dangerous residues for presenting reactivity	**HW01 HW02 HW03 HW07**
D004	Dangerous residues for presenting pathogenicity	**HW10 HW14**
D005 to D029	Listing 7 of Norm NBR 10004: dangerous residues characterized by the leaching test	**HW05 HW06 HW10 HW11**
K193	Shavings of leather tanned to chromium	**HW04**
K194	Leather Serragem and dust I contend chromium	**HW04**
K195	Silt of stations of treatment of effluent of tanning to chromium	**HW04**
F102	Residue of catalysers not specified in Norm NBR 10.004	**HW14**
F103	Deriving residue of industrial laboratories (chemical products) not specified in Norm NBR 10.004	**HW04 HW10**
F104	Not specified contaminated empty packings in Norm NBR 10.004	**HW14**
F105	Solvent contaminated (to specify solvent and the main contaminante)	**HW07**
D099	Other dangerous residues - to specify	**HW14**
F001 F0301	Listing 1 of Norm NBR 10004- admittedly dangerous residues - Classroom 1, of not-specific sources	**HW04 HW07**
F100	Bifenilas Policloradas - PCB`s. Packings contaminated with PCBs also transforming and capacitors	**HW07**
P001 to P123	Listing 5 of Norm NBR 10004 - dangerous residues for containing toxic substances acutely (remaining portions of packings contaminated with substances of listing 5; contaminated residues of spilling or ground, and products are of specification or products of commercialization forbidden of any constant substance in listing 5 of Norm NBR 10.004	**HW07**
K001 to K209	Listing 2 of Norm NBR 10004- admittedly dangerous residues of specific sources	**HW04 HW07**
K053	Remaining portions and you splodge of inks and pigments	**HW07**
K078	Residue of cleanness with solvent in the manufacture of inks	**HW07**
K081	Silt of ETE of the production of inks	**HW07 HW11**
K203	Residues of laboratories of research of illnesses	**HW10**
K207	It splodges of the used oil re-refining (it splodges acid)	**HW01 HW09**
U001 to U246	Listing 6 of Norm NBR 10004- dangerous residues for containing toxic substances (contaminated residues of spilling or ground; products are of specification or products of commercialization forbidden of any constant substance in listing 6 of Norm NBR 10.004	**HW14**

2.2.3 Selection of Target Factories

a. Basic Considerations

At the beginning of the study, the Study Team planned to select 200 factories[1] located in PIM and it was planned to select 180 PIM factories and 20 PIM subcontractors and non-PIM factories. However, upon discussion with the C/P, it was decided to abandon non-PIM factories for the following reasons:

- The majority of PIM subcontracted factories are licensed by SUFRAMA and PIM factories are the ones receiving tax benefits.
- The non-PIM factories are non-registered cottage industries, and the C/P was not in possession of the locations and other such basic data that would be required for the study, making it impossible for the C/P to conclude which factories would be targeted.

b. Factory Industrial Sectors for Conducting Survey of Generation Sources

The 19 industrial sectors, as reported in "Industries (companies) established and producing in western Amazon with full projects approved by SUFRAMA" (Source: CGPRI & CGMER/COCAD SUFRAMA, up to 8/2008), were used when conducting the survey of generation sources.

c. Factory List

SUFRAMA formulates a list of PIM factories[2], hereafter referred to simply as the SUFRAMA factory list. In this list, the PIM factories are divided into four categories, or parts.

1. Part 1: Complete Projects Approved and Installed in PIM
2. Part 2: Simplified Projects Approved and Installed in PIM
3. Part 3: Complete Projects Approved and Under Installation in PIM
4. Part 4: Simplified Projects Approved and Under Installation in PIM

Here, the division between complete and simplified depends on criterion such as production output—complete projects are 2 million USD and above.

d. Selection of Target Factories

The target factories for the study were chosen by selecting 200 from the total 457 listed in Part 1 and 2 of the SUFRAMA Factory List. The following criteria were used to make the selection:

1. The PIM is divided largely into two Industrial Districts (DIs), as well as those outside the DIs, and target factories were to be selected from each.
2. A minimum number of factories to be surveyed in each industrial sector was established in order to grasp the waste management conditions in as many of the 19 sectors as possible.

Based on the above criteria, the C/P and Study Team established the minimum number of factories to be surveyed in each sector. A local consultant (SEA LTD.) was consigned to carry

[1] It is preferable to survey as many factories as possible. However, considering limited time of the survey and experience of the previous similar study, it was decided as 200.
[2] Profile of the Companies with Projects Approved by SUFRAMA, December 2008 (Perfil Das Empresas Com Projetos Aprovados Pela SUFRAMA Dez/2008)

out the survey.

Although the Study Team intended to 200 factories, due to the following difficulties, the local consultant has completed 187 factories. This report, therefore, was based on the analysis of data completed for 187 factories.

- Time limitation;
- Insufficient cooperation of factories selected; and
- Some information of the factories provided to the study team was not updated.

Table 2-8: Number of PIM Factories and Number of Samples for Factory Survey

Factory Code	Sector	Inside Industrial District			Outside Industrial District			Total No. of Factories (A)	Target Factories	
		Part 1 No. of Factory	Part 2 No. of Factory	Sub-total	Part 1 No. of Factory	Part 2 No. of Factory	Sub-total		No. Surveyed (B)	Ratio (%) (B/A)
F01	Beverages	3		3	12		12	15	5	33.3
F02	Leathers									
F03	Printing	6		6	3	7	10	16	6	37.5
F04	Electric/-tronic	64	1	65	51	5	56	121	65	53.7
F05	Wood	2		2				2	0	0.0
F06	Mechanical	19		19	9		9	28	17	60.7
F07	Metallurgy	23	2	25	19	3	22	47	19	40.4
F08	Non-metallic Minerals		1	1	2	3	5	6	1	16.7
F09	Furniture	1		1	3	1	4	5	2	40.0
F10	Paper	7		7	6		6	13	7	53.8
F11	Rubber	2		2	1		1	3	0	0.0
F12	Food Products				4	9	13	13	3	23.1
F13	Chemical	13	2	15	15	4	19	34	12	35.3
F14	Plastic	31	2	33	35	7	42	75	24	32.0
F15	Textile				1		1	1	0	0.0
F16	Fabric				2		2	2	0	0.0
F17	Transport mat.	15		15	16	2	18	33	19	57.6
F18	Construction		1	1	2	3	5	6	0	0.0
F19	Others	7		7	5	8	13	20	7	35.0
	Total	193	9	202	186	52	238	440	187	42.5

Source: Profile of the Companies with Projects Approved by SUFRAMA, December 2008 (Perfil Das Empresas Com Projetos Aprovados Pela SUFRAMA Dez/2008), and JICA Study Team

2.2.4 Execution of the Survey

a. Survey Procedures

The procedures which were carried out for the survey are shown in the following figure.

First, a trial survey was conducted in order to complete the draft questionnaire. Next, the modified questionnaire was to be sent to all 457 target factories accompanied by a letter from

SUFRAMA requesting their cooperation for the study. Then, when the questionnaires were returned, upon looking over the responses, direct interviews were conducted at the factories to complete the questionnaires. The completed questionnaires were entered into a prescribed format and the results were analyzed.

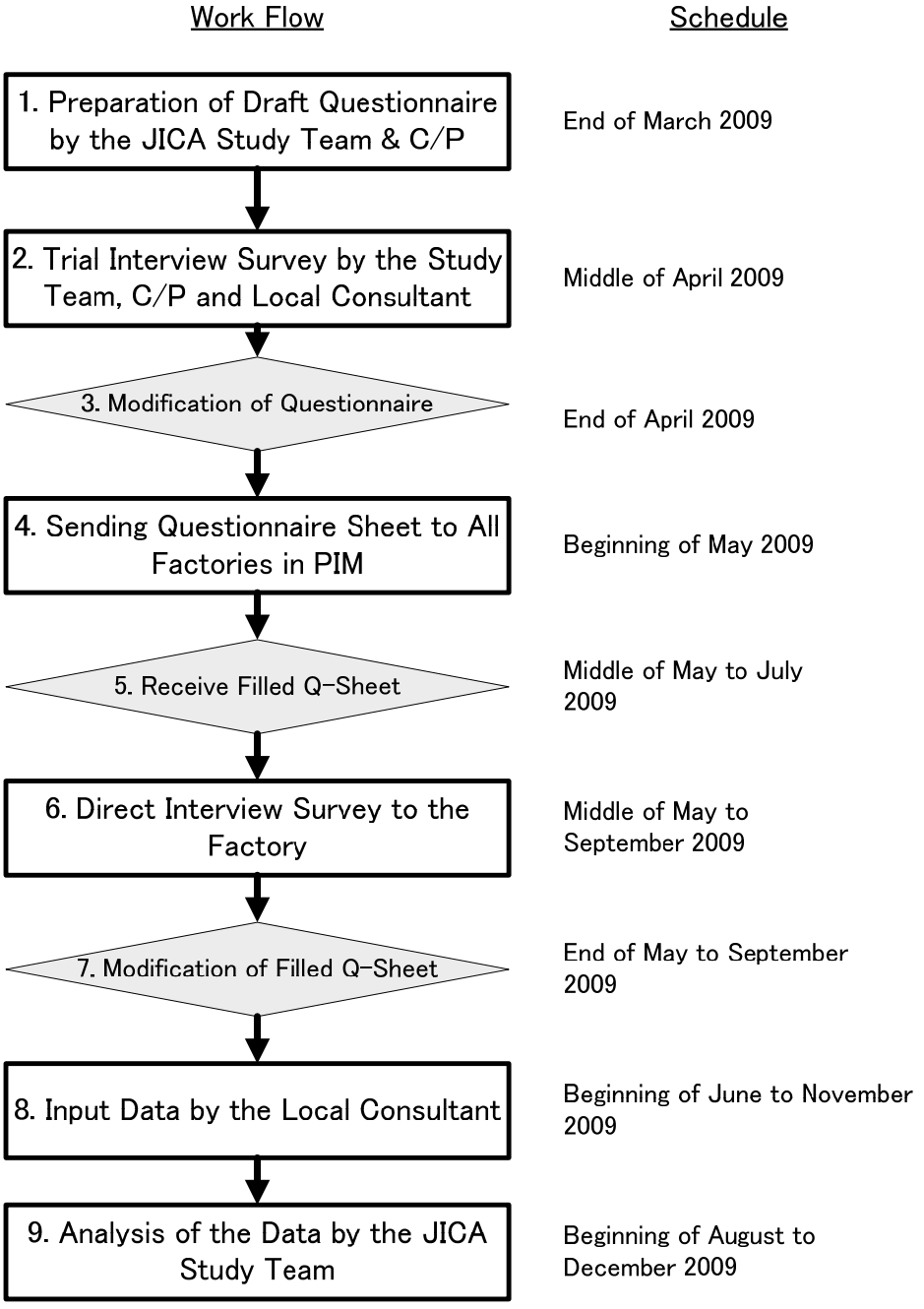


Figure 2-2: Work Flow of the Factory Survey

b. Survey Implementation Issues

Initially it was planned to send the questionnaire along with a letter of request from SUFRAMA to all 457 factories in Part 1 and 2 of the SUFRAMA factory list. However, because some of these factories were no longer located as indicated on the factory list, and others were no longer operating, the actual number of factories to which the questionnaire was distributed was 339. Furthermore, by the end of July, the number of factories that had

returned the questionnaire with their answers was at most 106. As a result, the procedures for the factory survey were greatly delayed.

Given the above results, it is necessary to resolve the following issues so that when SUFRAMA conducts factory surveys at regular intervals in the future it will be possible to grasp any change in the condition of waste and environmental management in the PIM.

- Increase the reliability and accuracy of the SUFRAMA factory list
- Explore and execute measures to promote PIM factories to comply with the factory survey.

2.2.5 Results of the Survey

The results of the questionnaire survey are given below.

a. General Information

a.1 Target Factory

Base: Population = 187

Factory code	Distrito Industrial			Outside			Total number of factory (A)	Surveyed number of factory	
	Number of Factory			Number of Factory					
	Part 1	Part 2	Sub-total	Part 1	Part 2	Sub-total		Number (B)	% (B/A)
F01	3		3	12		12	15	5	33.3
F02									
F03	6		6	3	7	10	16	6	37.5
F04	64	1	65	51	5	56	121	65	53.7
F05	2		2				2	0	0.0
F06	19		19	9		9	28	17	60.7
F07	23	2	25	19	3	22	47	19	40.4
F08		1	1	2	3	5	6	1	16.7
F09	1		1	3	1	4	5	2	40.0
F10	7		7	6		6	13	7	53.8
F11	2		2	1		1	3	0	0.0
F12				4	9	13	13	3	23.1
F13	13	2	15	15	4	19	34	12	35.3
F14	31	2	33	35	7	42	75	24	32.0
F15				1		1	1	0	0.0
F16				2		2	2	0	0.0
F17	15		15	16	2	18	33	19	57.6
F18		1	1	2	3	5	6	0	0.0
F19	7		7	5	8	13	20	7	35.0
Total	193	9	202	186	52	238	440	187	42.5

a.2 Foundation

Base: Population = 187

Foundation year	Number of Factories
1968 - 1970	3
1971 - 1980	18

1981 - 1990	28
1991 - 2000	62
2001 - 2008	54
Total	187

a.3 Reason of setting up the factory in MFZ

Base: Population = 187	
Foundation year	Number of Factories
A - Tax Benefits	104
B - Logistic	30
C - Contribute with Amazons State	5
A & B	5
A & C	5
No answer	38
Total	187

a.4 Factory area

Base: Population = 187				
Area	Valid Answer	Average (m^2)	Maximum (m^2)	Minimum (m^2)
Ground area	159	55,826	993,000	85
Construction area	154	15,300	246,000	85

a.5 Share Capital (Optional)

Regarding the share capital at the time of foundation and in December 2008.

Base: Population = 187				
Foundation year	Valid Answer	Average (R$)	Maximum (R$)	Minimum (R$)
Foundation	46	63,417,000	1,500,000,000	2,000
Dec 2008	42	43,377,000	276,320,000	21,000

a.6 Number of Employee

Base: Population = 187				
Foundation year	Total Number of Employee (187 factories) (person)	Average (person)	Maximum (person)	Minimum (person)
Employees	44,481	271	6,255	3
Hereof in Administration	13,989	84	2,850	2
Total	58,470	350	---	---

a.7 Factory layout and Production drawing

Base: Population = 187			
	Valid answer	1. Yes	2. No
Factory layout	165	48	117
Production drawing	158	38	120

a.8 Annual sales, Main products, Raw materials

The number of factories that answered each question.

Base: Population = 187	
	Valid answer
Annual sales amount (R$)	115
Name of main products	173
Name of raw materials	145

a.9 Pollution control facilities

Base: Population = 187			
Pollution control facilities	Valid answer (A)	1. Yes (B)	% (B/Ax100)
a. Boiler	172	22	12.8
b. Incinerator	171	3	1.8
c. Industrial wastewater treatment facilities	171	47	27.5
d. Domestic wastewater treatment facilities	175	95	54.3
e. Dust collector	172	20	11.6
f. Air control facilities	169	21	12.4
g. Plating process	168	5	3.0
h. Powder Painting process	170	15	8.8
i. Water Painting process	170	22	12.9
j. Metal coating process	173	13	7.5
k. Storage space of Dangerous substance (Underground : Oils, Volatile substance, etc.)	145	29	20.0
l. Storage space of Dangerous substance (Above surface : Oils , Volatile substance, etc.)	167	96	57.5
m. Others	116	17	14.7

a.10 Water/Energy demands

The number of factories that responded are given below (right column is preparatory)

Base: Population = 187					
Pollution control facilities		Valid answer (A)	Average	Maximum	Minimum
a. Working days	day/month	176	23	30	13
b. Working hours	hour/day	174	12	24	2
c. Electricity	MWh/year	157	1,604,000	74,479,00	1
d. Gas	m3/year	98	52,000	1,772,000	0
e. Tap water/Ground water	m3/year	126	42,000	1,158,000	1
f. Fuel	KL/year	91	88	6,055	0

b. Results of questionnaire concerning factory waste

b.1 Industrial Waste (IW) Management

- General information

Q. 1 Does your factory has obligation to submit the waste inventory?

Base: Population = 187		
Q1	Answer	%
1. Yes, we have obligation and submit.	114	64.1
2. Yes we have , but we did not submit.	15	8.4
3. No, we do not have obligation.	49	27.5
Total	178	100.0

Q. 2 Are Non-Production Process Industrial Waste and Production process Industrial Waste discharged separately from your factory?

Base: Population = 187		
Q2	Answer	%
1. Yes	154	86.0
2. No	25	14.0
Total	179	100.0

Q. 3 Are Non-Hazardous Industrial Waste (Non-HIW) and Hazardous Industrial Waste (HIW) discharged separately from your factory?

Base: Population = 187			
Q3		Answer	%
1. Yes, 100%	(Go to Q. 5)	123	69.9
2. Yes, partly	(Go to Q. 5)	20	11.3
3. No	(Go to Q. 4)	33	18.8
Total		176	100.0

Q. 4 What is the reason why these waste are not separated? You can select all that correspond to your factory.
(You may choose more than one answer given below)

Base: Population = 31		
Q4	Answer	%
1. We don't know the difference between Non-HIW and HIW.	0	0.0
2. The volume of waste is too small to separate.	13	41.9
3. The production process makes it difficult to separate Non-HIW and HIW.	4	12.9
4. The collection service does not require to separate Non-HIW and HIW.	3	9.7
5. It is troublesome and waste of time to separate Non-HIW and HIW.	1	3.2
6. It seems unnecessary to separate Non-HIW and HIW.	0	0.0
7. It is difficult to separate Non-HIW and HIW.	0	0.0
8. Even though Non-HIW and HIW are separated, there are no ways to utilize them.	3	9.7
9. Others	7	22.6
Total	31	---

xxx

Q. 5 Interviewee shall fill the following 4 answer sheets according to the type and source of waste generated.

The factory survey results of the amount of four types of wastes discharged are summarized at the end of this section.

		Waste generation source	
		Non-production process	Production process
Waste category	Non-HIW	**Answer sheet No.1**	**Answer sheet No.3**
	HIW	**Answer sheet No.2**	**Answer sheet No.4**

Each question is divided for each of the above four categories. Below are the results for each category.

<Q.5 1 Summary of survey results for discharged waste amount

The following table summarizes the results of the survey for discharged waste amount.

The following table is a summary of factory responses, with the exception of the following waste data. The data is for the 170 factories that supplied information on their discharged waste amount, out of the 187 surveyed.

<Excluded Waste Data>

1. Health-care waste
2. Construction waste
3. Wastewater (effluent)
4. Instances where the discharged amount was given as “cases”, etc (i.e. a unit where the weight could not be calculated)

Note: weight was calculated for cubic meters (m^3) to the power of 1.0.

Table 2-9: Summary of results for discharged waste amount (170 factories, by sector)

Unit: ton/year

Factory Code	Non production process		Production process		Total
	Non-HIW	HIW	Non-HIW	HIW	
F01	2,870.6	40.6	237.9	45.0	3,194.1
F02	-	-	-	-	-
F03	28.9	2.2	576.8	307.5	915.4
F04	10,921.5	1,929.9	20,285.2	4,351.5	37,488.1
F05	-	-	-	-	-
F06	2,368.3	970.5	7,222.8	1,032.4	11,594.0
F07	2,720.5	515.8	10,878.8	756.9	14,872.0
F08	95.6	0.9	436.7	1.6	534.8
F09	0.0	0.0	15.0	51.0	66.0
F10	7,026.5	42.9	3,064.2	274.3	10,407.9
F11	-	-	-	-	-
F12	0.1	0.0	3,573.6	61.0	3,634.7

F13	44.7	0.3	365.0	33.6	443.6
F14	1,617.2	4,340.2	2,583.7	397.2	8,938.3
F15	-	-	-	-	-
F16	-	-	-	-	-
F17	4,448.0	445.2	15,273.4	11,778.9	31,945.5
F18	-	-	-	-	-
F19	365.5	1.3	1,009.5	318.8	1,695.1
Total	32,507.4	8,289.8	65,522.6	19,409.7	125,729.5

(1) Non-production process – Non HIW

(1)-1 On-site treatment

Base: Population = 588 waste items

Question	Valid Answer	yes		No	
		Answer	%	Answer	%
(1) Reuse	588	6	1.0	582	99.0
(2) Storage	588	16	2.7	572	97.3
(3) Intermediate treatment	588	3	0.5	585	99.5
(4) Recycling	588	1	0.2	587	99.8
(5) Reduction	588	0	0.0	588	100.0
(6) On-site disposal	588	14	2.4	574	97.6

- This question concerns storage

<How do you store IW?>

Base: Population = 16 waste items (Valid answer = 11)

Question	Answer	%
1. We mix them all together.	2	18.2
2. We store them separately.	9	81.8
3. We store only waste that can be reused/recycled.	0	0.0
4. Others	0	0.0
Total	11	100.0

< What is the purpose of on-site storage of IW?>

Base: Population = 16 waste items (Valid answer = 9)

Question	Answer	%
1. Temporary storage before its collection by haulers.	9	100.0
2. Temporary storage for on-site reuse and recycling.	0	0.0
3. Temporary storage for on-site treatment and disposal.	0	0.0
4. Temporary storage due to no existence of proper treating companies	0	0.0
5. Others	0	0.0
Total	9	100.0

(1)-2 Off-site treatment

- This question concerns collection

Who collects wastes generated in your factory?

Base: Population = 548 waste items		
Question	Answer	%
1. Manaus city	139	25.4
2. PIM	0	0.0
3. Others Private company contracted by us	384	70.1
4. No collection service (Self disposal)	25	4.5
Total	548	100.0

- This question concerns transport

Where your factory waste is transported to?

Base: Population = 548 waste items (Valid answer = 455)		
Question	Answer	%
1. Public landfill site	176	38.7
2. Private landfill site	26	5.7
3. Other landfill site	36	7.9
4. Incineration plants	36	7.9
5. Co-processing	124	27.3
6. I don't know.	57	12.5
Total	455	100.0

(2) Non-production process –HIW

(2)-1 On-site treatment

Base: Population = 237 waste items					
Question	Valid Answer	yes		No	
		Answer	%	Answer	%
(1) Reuse	237	0	0.0	237	100.0
(2) Storage	237	8	3.4	229	96.6
(3) Intermediate treatment	237	0	0.0	237	100.0
(4) Recycling	237	0	0.0	237	100.0
(5) Reduction	237	0	0.0	237	100.0
(6) On-site disposal	237	10	4.2	227	95.8

- This question concerns storage

<How do you store IW?>

Base: Population = 8 waste items (Valid answer = 6)		
Question	Answer	%
1. We mix them all together.	0	0.0
2. We store them separately.	6	100.0
3. We store only waste that can be reused/recycled.	0	0.0
4. Others	0	0.0
Total	6	100.0

< What is the purpose of on-site storage of IW?>

Base: Population = 8 waste items (Valid answer = 6)		
Question	Answer	%
1. Temporary storage before its collection by haulers.	5	83.3
2. Temporary storage for on-site reuse and recycling.	0	0.0
3. Temporary storage for on-site treatment and disposal.	0	0.0
4. Temporary storage due to no existence of proper treating companies	1	16.7
5. Others	0	0.0
Total	6	100.0

(2)-2 Off-site treatment

- This question concerns collection

  Who collects wastes generated in your factory?

Base: Population = 219 waste items		
Question	Answer	%
1. Manaus city	17	7.8
2. PIM	0	0.0
3. Others Private company contracted by us	193	88.1
4. No collection service (Self disposal)	9	4.1
Total	219	100.0

- This question concerns transport

  Where your factory waste is transported to?

Base: Population = 219 Valid answer = 182)		
Question	Answer	%
1. Public landfill site	23	12.6
2. Private landfill site	7	3.8
3. Other landfill site	10	5.5
4. Incineration plants	70	38.5
5. Co-processing	46	25.3
6. I don't know.	26	14.3
Total	182	100.0

(3) Production process – Non-HIW

(3)-1 On-site treatment

Base: Population = 575 waste items					
Question	Valid Answer	yes		No	
		Answer	%	Answer	%
(1) Reuse	575	1	0.2	574	99.8
(2) Storage	575	18	3.1	557	96.9
(3) Intermediate treatment	575	9	1.6	566	98.4
(4) Recycling	575	4	0.7	571	99.3
(5) Reduction	575	0	0.0	575	100.0
(6) On-site disposal	575	3	0.5	572	99.5

- This question concerns storage

<How do you store IW?>

Base: Population = 18 waste items (Valid answer = 9)		
Question	Answer	%
1. We mix them all together.	8	88.9
2. We store them separately.	0	0.0
3. We store only waste that can be reused/recycled.	0	0.0
4. Others	1	11.1
Total	9	100.0

< What is the purpose of on-site storage of IW?>

Base: Population = 18 waste items (Valid answer = 0)		
Question	Answer	%
1. Temporary storage before its collection by haulers.	-	-
2. Temporary storage for on-site reuse and recycling.	-	-
3. Temporary storage for on-site treatment and disposal.	-	-
4. Temporary storage due to no existence of proper treating companies	-	-
5. Others	-	-
Total	-	-

(3)-2 Off-site treatment

- This question concerns collection

Who collects wastes generated in your factory?

Base: Population = 540 waste items (Valid answer = 538)		
Question	Answer	%
1. Manaus city	35	6.5
2. PIM	0	0.0

3. Others Private company contracted by us	479	89.0
4. No collection service (Self disposal)	24	4.5
Total	538	100.0

- This question concerns transport

Where your factory waste is transported to?

Base: Population = 540 waste items (Valid answer = 439)		
Question	Answer	%
1. Public landfill site	57	13.0
2. Private landfill site	8	1.8
3. Other landfill site	62	14.1
4. Incineration plants	25	5.7
5. Co-processing	224	51.0
6. I don't know.	63	14.4
Total	439	100.0

(4) Production process – HIW

(4)-1 On-site treatment

Base: Population = 18 waste items					
Questionnaire	Valid Answer	yes		No	
		Answer	%	Answer	%
(1) Reuse	18	3	16.7	15	83.3
(2) Storage	18	7	38.9	11	61.1
(3) Intermediate treatment	18	0	0.0	18	100.0
(4) Recycling	18	3	16.7	15	83.3
(5) Reduction	18	0	0.0	18	100.0
(6) On-site disposal	18	5	27.8	13	72.2

- This question concerns storage

<How do you store IW?>

Base: Population = 18 (Valid answer = 7)		
Question	Answer	%
1. We mix them all together.	7	100.0
2. We store them separately.	0	0.0
3. We store only waste that can be reused/recycled.	0	0.0
4. Others	0	0.0
Total	7	100.0

< What is the purpose of on-site storage of IW?>

Base: Population = 18 (valid answer = 0)		
Question	Answer	%
1. Temporary storage before its collection by haulers.	-	-
2. Temporary storage for on-site reuse and recycling.	-	-
3. Temporary storage for on-site treatment and disposal.	-	-
4. Temporary storage due to no existence of proper treating companies	-	-
5. Others	-	-
Total	-	-

(4)-2 Off-site treatment

- This question concerns collection

Who collects wastes generated in your factory?

Base: Population = 383		
Question	Answer	%
1. Manaus city	26	6.8
2. PIM	0	0.0
3. Others Private company contracted by us	316	82.5
4. No collection service (Self disposal)	41	10.7
Total	383	100.0

- This question concerns transport

Where your factory waste is transported to?

Base: Population = 383 (Valid answer = 326)		
Question	Answer	%
1. Public landfill site	24	7.4
2. Private landfill site	5	1.5
3. Other landfill site	29	8.9
4. Incineration plants	150	46.0
5. Co-processing	87	26.7
6. I don't know.	31	9.5
Total	326	100.0

b.2 Other waste

Q. 6 Does your factory have any health service inside ?

Base: Population = 187			
Q6		Answer	%
1. Yes	(Go to Q. 7)	78	44.3
3. No	(Go to Q. 8)	98	55.7
Total		176	100.0

Q. 7 Can you provide us the necessary information for the health-care waste survey ?

Base: Population = 78 (Valid answer = 78)		
Q7	Answer	%
1. Yes	64	82.1
2. No	14	17.9
Total	78	100.0

Q. 8 Does your factory generate the radioactive wastes ?

Base: Population = 187			
Q8		Answer	%
1. Yes	(Go to Q. 9)	0	0.0
2. No	(Go to Q. 10)	173	100.0
Total		173	100.0

Q. 9 Please inform on the treatment and disposal methods for the radioactive wastes.

No answer

Q. 10 Please inform on the treatment and disposal methods for the construction wastes generated in your factory.

No answer

c. Future Management of IW

Q. 11 How will the generation of IW increase in your factory?

Base: Population = 187		
Q11	Answer	%
1. The volume of IW will not increase so much.	54	31.8
2. The volume will increase due to the expansion of production, change of raw materials, etc.	64	37.6
3. The volume will decrease due to change or improvement of manufacturing process, change of raw materials, etc..	36	21.2
4. Others	16	9.4
Total	170	100.0

Q. 12 Are there any future plans to reduce and recycle IW in your factory?

Base: Population = 187		
Q12	Answer	%
1. No, basically we will apply the present management.	120	70.2
2. Yes, we have a specific plan to improve waste reduction and recycling system in our factory.	51	29.8
Total	171	100.0

Q. 13 What types of IW do you plan to introduce or reuse/recycle in your factory?

No available answer

Q. 14 Are there any future plans to improve treatment and final disposal system of IW in your factory?

Base: Population = 187		
Q14	Answer	%
1. No, basically we will apply the present management.	134	78.8
2. Yes, we have a specific plan to improve treatment and disposal system in our factory.	36	21.2
Total	170	100.0

d. Waste Exchange

Q. 15 Do you know the meaning of waste exchange concretely?

Base: Population = 187		
Q15	Answer	%
1. Yes	127	73.4
2. No	46	26.6
Total	173	100.0

Q. 16 Is your factory interested in waste exchange program?

Base: Population = 187		
Q16	Answer	%
1. Yes, very much.	74	43.3
2. Yes, eventually.	42	24.6
3. No	55	32.1
Total	171	100.0

Q. 17 Is your factory now involved in any kinds of waste exchange program of either Non-HIW or HIW?

Base: Population = 187		
Q17	Answer	%
1. Yes	63	36.2
2. No	95	54.7
3. I don't know	16	9.1
Total	174	100.0

e. Financial Matter

Q. 18 How much do you spend per year for off-site destination (collection, treatment and final disposal)?

Base: Population = 187		
Q18-1	Answer	%
1. I know	66	44.9
2. I don't know.	81	55.1
Total	147	100.0

<Payment to transport company>

Base: Population = 60				
Q18-2		Average	Maximum	Minimum
Spend	(R$/year)	563,000	14,137,000	600

Q. 19 How much does your factory spend annually for the on-site destination (treatment and final disposal) of IW?

Base: Population = 187		
Q19	Answer	%
1. I know	27	18.4
2. I don't know.	120	81.6
Total	147	100.0

Of the factories that responded "I know", 20 supplied the amount they are able to pay

Base: Population = 20				
Q19-2		Average	Maximum	Minimum
Spend	(R$/year)	769,000	13,301,000	1,000

f. Evaluation of the Present IW System

Q. 20 Which of the following phrases best describes the present status of IWM in your factory?

Base: Population = 187			
Q20		Answer	%
1.There is no problem with the present IWM.	(Go to the end)	59	34.1
2. There are some problems with present IWM.	(Go to Q. 21)	114	65.9
Total		173	100.0

Q. 21 Do you evaluate what are the problems of present IWM in your factory? (You may choose more than one answer given below)

Base: Population = 114		
Q21	Answer	%
1. We do not know the difference between hazardous and non-hazardous industrial waste.	0	0.0
2. We do not segregate hazardous from non-hazardous industrial waste.	8	7.3
3. There are no or only limited services available for industrial waste treatment.	41	37.6
4. High cost of industrial waste treatment.	63	57.8
5. Reuse and recycling of industrial waste is non-existent or limited.	53	48.6
6. There are no reliable and licensed companies offering treatment and/or disposed service, in Manaus.	38	34.9
7. Others	20	18.3
Total	221	---

Q. 22 Do you think what measures and actions need to be taken to solve the above problems? (You may choose more than one answer given below)

Base: Population = 114

Q21	Answer	%
1. Formulation and enforcement of relevant laws and regulations.	14	13.0
2. Guidance on proper IWM inside the factories (generators).	18	16.7
3. Introduction of financial and economic incentives to promote proper IWM.	60	55.6
4. Preparation of guidelines for proper IWM.	22	20.4
5. Development of the waste reuse and recycle market.	69	63.9
6. Development of the intermediate treatment facilities for industrial waste.	44	40.7
7. Development of the final disposal facilities for industrial waste. facilities for industrial waste.	51	47.2
8. Others	5	4.6
Total	223	---

g. Results of Waste Amount, Generation Rate and Waste Streams

g.1 Waste amount by 170 factories survey

The waste amount from the survey of 170 factories is summarized into 19 factory codes and individual waste codes according to the following four main categories of waste.

1.	Non-Production Process, Non-Hazardous Industrial Waste:	Non-PP/Non-HIW	Table 2-10
2.	Non-Production Process, Hazardous Industrial Waste:	Non-PP /HIW	Table 2-11
3.	Production Process, Non-Hazardous Industrial Waste:	PP /Non-HIW	Table 2-12
4.	Production Process, Hazardous Industrial Waste:	PP/HIW	Table 2-13

g.2 Generation rate

The generation rate for each factory code and waste code was calculated from the generation amount of each of the four types of waste and the total number of employees at 170 factories.

1.	Non-Production Process, Non-Hazardous Industrial Waste:	Non-PP /Non-HIW	Table 2-14
2.	Non-Production Process, Hazardous Industrial Waste:	Non-PP /HIW	Table 2-15
3.	Production Process, Non-Hazardous Industrial Waste:	PP /Non-HIW	Table 2-16
4.	Production Process, Hazardous Industrial Waste:	PP/HIW	Table 2-17

g.3 Waste stream

The waste stream was made based on the results of the survey of 170 factories.

1.	Non-Production Process, Non-Hazardous Industrial Waste:	Non-PP /Non-HIW	Figure 2-3
2.	Non-Production Process, Hazardous Industrial Waste:	Non-PP /HIW	Figure 2-4
3.	Production Process, Non-Hazardous Industrial Waste:	PP /Non-HIW	Figure 2-5
4.	Production Process, Hazardous Industrial Waste:	PP/HIW	Figure 2-6

Table 2-10: Waste amount by 170 factories (Non production process – Non HIW)

Waste amount (Unit : ton/year)														
Factory code	NH01	NH02	NH03	NH04	NH05	NH06	NH07	NH08	NH09	NH10	NH11	NH12	NH13	Total
F01	82.6	1,039.0	226.0	81.0	7.0				-	921.0	59.0	233.0	222.0	2,870.6
F02														
F03	3.7		4.3	0.9	0.1	0.1			2.2				17.5	28.8
F04	1,570.7	1,192.3	3,648.6	581.2	3.6	17.5			337.1	83.4	28.7	67.7	3,390.9	10,921.7
F05														
F06	187.1	556.5	832.6	131.8	166.0				23.0	0.8	12.0		458.4	2,368.2
F07	224.1	44.0	769.0	201.2		0.7			243.6	820.6			417.3	2,720.5
F08		57.9	2.6	9.9	4.5					0.4			20.2	95.5
F09														
F10	1,128.1	227.7	60.1	44.2		0.3			5,412.3				153.9	7,026.6
F11														
F12			0.1										-	0.1
F13	18.0		5.7	5.3					0.1	-		0.6	14.9	44.6
F14	101.4	254.4	593.8	24.4		3.3			96.7	3.0		39.0	501.1	1,617.1
F15														
F16														
F17	1,605.4	23.5	428.8	406.1	2.0	0.3	0.1			0.1	29.4		1,952.3	4,448.0
F18														
F19	27.0		55.9	140.2	38.0	2.0							102.4	365.5
All Code	4,948.1	3,395.3	6,627.5	1,626.2	221.2	24.2	0.1	-	6,115.0	1,829.3	129.1	340.3	7,250.9	32,507.2

Table 2-11: Waste amount by 170 factories (Non production process – HIW)

Waste amount (Unit : ton/year)																	
Factory code	HW01	HW02	HW03	HW04	HW05	HW06	HW07	HW08	HW09	HW10	HW11	HW12	HW13	HW14	HW15	HW16	Total
F01			0.1						1.0		13.0				25.2	1.3	40.6
F02																	
F03							-		-					2.0		0.2	2.2
F04	-			0.8			37.3		57.2		832.0			58.0	931.9	12.7	1,929.9
F05																	
F06							0.2		0.2		953.6			2.0	12.1	2.5	970.6
F07							0.3		111.3		64.0		199.0	68.0	65.4	7.9	515.9
F08																0.9	0.9
F09																	
F10									13.8		16.0				12.1	0.9	42.8
F11																	
F12																	
F13					-		0.1		0.1						0.1	-	0.3
F14							12.0		1,866.6	-	1,928.1			4.0	20.7	508.7	4,340.1
F15																	
F16																	
F17									405.3		32.0			2.0	5.1	0.7	445.1
F18																	
F19									-						1.0	0.2	1.2
All Code	-	-	0.1	0.8	-	-	49.9	-	2,455.5	-	3,838.7	-	199.0	136.0	1,073.6	536.0	8,289.6

Table 2-12: Waste amount by 170 factories (Production process – Non HIW)

Waste amount (Unit : ton/year)														
Factory code	NH01	NH02	NH03	NH04	NH05	NH06	NH07	NH08	NH09	NH10	NH11	NH12	NH13	Total
F01	-			87.9				117.0	33.0				-	237.9
F02														
F03			478.7	-		-			98.0					576.7
F04		720.0	10,201.3	5,240.6	0.4	0.6			2,024.3	1,210.0		9.5	878.6	20,285.3
F05														
F06		91.0	522.7	219.7					4,826.2	7.0			1,556.2	7,222.8
F07	102.8	440.3	385.8	240.7					8,759.7	0.3	-		949.1	10,878.7
F08													436.7	436.7
F09				15.0										15.0
F10		7.2	2,493.8	16.8					2.9				543.4	3,064.1
F11														
F12	2.0	12.2	57.6	67.3					3,328.0				106.6	3,573.7
F13		30.9	31.6	99.8	0.1			27.0	66.3	-			109.2	364.9
F14		81.7	137.4	2,071.1	2.1				18.6	0.2		0.3	272.2	2,583.6
F15														
F16														
F17	6.0	1,552.7	3,437.2	1,698.3	18.0		0.5		7,352.5	1.0	361.0	0.5	845.8	15,273.5
F18														
F19		238.1	104.1	354.5	6.0		39.0		132.5				135.3	1,009.5
All Code	110.8	3,174.1	17,850.2	10,111.7	26.6	0.6	39.5	144.0	26,642.0	1,218.5	361.0	10.3	5,833.1	65,522.4

Table 2-13: Waste amount by 170 factories (Production process – HIW)

Waste amount (Unit : ton/year)																	
Factory code	HW01	HW02	HW03	HW04	HW05	HW06	HW07	HW08	HW09	HW10	HW11	HW12	HW13	HW14	HW15	HW16	Total
F01							2.0		43.0								45.0
F02																	
F03	-		-	3.2			102.3		2.1					1.6	198.3		307.5
F04	2.0		3.7	280.1			2,160.7	40.1	116.7	0.1				1,117.1	404.2	226.8	4,351.5
F05																	
F06							70.6	3.6	548.4		31.0			123.1	89.5	166.3	1,032.5
F07							9.1		13.7		15.2		-	277.3	371.6	70.0	756.9
F08									1.6								1.6
F09								51.0									51.0
F10							67.0				131.3			65.0	11.0		274.3
F11																	
F12			1.8											59.2			61.0
F13							11.0		1.2	2.3					19.0		33.5
F14					26.2		171.1	49.9	24.8		3.0	0.5		44.1	75.8	2.0	397.4
F15																	
F16																	
F17	56.0			392.0	20.0		1,551.2	78.0	1,472.1		388.0	56.0	33.0	6,817.1	574.1	341.2	11,778.7
F18																	
F19							28.1		9.1	0.5	50.0			12.9	218.2		318.8
All Code	58.0	-	5.5	675.3	46.2	-	4,173.1	222.6	2,232.7	2.9	618.5	56.5	33.0	8,517.4	1,961.7	806.3	19,409.7

Table 2-14: Generation rate (Non production process – Non HIW)

Generation rate (Unit : kg/year/person)														
Factory code	NH01	NH02	NH03	NH04	NH05	NH06	NH07	NH08	NH09	NH10	NH11	NH12	NH13	Total
F01	38.8	488.5	106.3	38.1	3.3				0.0	433.0	27.7	109.5	104.4	1,349.6
F02														
F03	10.8		12.6	2.6	0.3	0.3			6.4				51.2	84.2
F04	70.5	53.5	163.8	26.1	0.2	0.8			15.1	3.7	1.3	3.0	152.3	490.3
F05														
F06	44.0	130.9	195.9	31.0	39.1				5.4	0.2	2.8		107.9	557.2
F07	61.4	12.1	210.6	55.1					66.7	224.8			114.3	745.0
F08	0.0	111.6	5.0	19.1	8.7					0.8			38.9	184.1
F09														
F10	1,843.3	372.1	98.2	72.2		0.5			8,843.6				251.5	11,481.4
F11														
F12			0.4										0.0	0.4
F13	53.7		17.0	15.8					0.3	0.0		1.8	44.5	133.1
F14	18.3	45.8	106.9	4.4		0.6			17.4	0.5		7.0	90.2	291.1
F15														
F16														
F17	49.6	0.7	13.2	12.5	0.1	0.0	0.0			0.0	0.9		60.3	137.3
F18														
F19	18.5		38.3	96.2	26.1	1.4							70.2	250.7
All Code	66.9	45.9	89.6	22.0	3.0	0.3	0.0		82.7	24.7	1.7	4.6	98.0	439.4

Table 2-15: Generation rate (Non production process – HIW)

Generation rate (Unit : kg/year/person)																	
Factory code	HW01	HW02	HW03	HW04	HW05	HW06	HW07	HW08	HW09	HW10	HW11	HW12	HW13	HW14	HW15	HW16	Total
F01			-						0.5		6.1				11.8	0.6	19.0
F02																	
F03							-		-					5.8		0.6	6.4
F04	-			-			1.7		2.6		37.4			2.6	41.8	0.6	86.7
F05																	
F06							-		-		224.4			0.5	2.8	0.6	228.3
F07							0.1		30.5		17.5		54.5	18.6	17.9	2.2	141.3
F08																1.7	1.7
F09																	
F10									22.5		26.1				19.8	1.5	69.9
F11																	
F12																	
F13					-		0.3		0.3						0.3	-	0.9
F14							2.2		336.0	-	347.1			0.7	3.7	91.6	781.3
F15																	
F16																	
F17									12.5		1.0			0.1	0.2		13.8
F18																	
F19									-						0.7	0.1	0.8
All Code	-	-	-	-	-	-	0.7	-	33.2	-	51.9	-	2.7	1.8	14.5	7.2	112.0

Table 2-16: Generation rate (Production process – Non HIW)

Generation rate (Unit : kg/year/person)														
Factory code	NH01	NH02	NH03	NH04	NH05	NH06	NH07	NH08	NH09	NH10	NH11	NH12	NH13	Total
F01	-			41.3				55.0	15.5				-	111.8
F02														
F03			1,399.7	-		-			286.5					1,686.2
F04		32.3	458.1	235.3	-	-			90.9	54.3		0.4	39.5	910.8
F05														
F06		21.4	123.0	51.7					1,135.6	1.6			366.2	1,699.5
F07	28.2	120.6	105.7	65.9					2,399.3	0.1	-		260.0	2,979.8
F08	-	-	-	-					-				841.4	841.4
F09				72.1										72.1
F10		11.8	4,074.8	27.5					4.7				887.9	5,006.7
F11														
F12	7.9	48.2	227.7	266.0					13,154.2				421.3	14,125.3
F13		92.2	94.3	297.9	0.3			80.6	197.9	-			326.0	1,089.2
F14		14.7	24.7	372.8	0.4				3.3	-		0.1	49.0	465.0
F15														
F16														
F17	0.2	47.9	106.1	52.4	0.6		-		227.0	-	11.1	-	26.1	471.4
F18														
F19		163.3	71.4	243.1	4.1		26.7		90.9				92.8	692.3
All Code	1.5	42.9	241.3	136.7	0.4	-	0.5	1.9	360.2	16.5	4.9	0.1	78.9	885.8

Table 2-17: Generation rate (Production process – HIW)

Generation rate (Unit : kg/year/person)																	
Factory code	HW01	HW02	HW03	HW04	HW05	HW06	HW07	HW08	HW09	HW10	HW11	HW12	HW13	HW14	HW15	HW16	Total
F01							0.9		20.2								21.1
F02																	
F03	-		-	9.4			299.1		6.1					4.7	579.8		899.1
F04	0.1		0.2	12.6			97.0	1.8	5.2	-				50.2	18.2	10.2	195.5
F05																	
F06							16.6	0.8	129.0		7.3			29.0	21.1	39.1	242.9
F07							2.5		3.8		4.2		-	76.0	101.8	19.2	207.5
F08									3.1								3.1
F09								245.2									245.2
F10							109.5				214.5			106.2	18.0		448.2
F11																	
F12			7.1											234.0			241.1
F13							32.8		3.6	6.9					56.7	-	100.0
F14					4.7		30.8	9.0	4.5	-	0.5	0.1	-	7.9	13.6	0.4	71.5
F15																	
F16																	
F17	1.7			12.1	0.6		47.9	2.4	45.5		12.0	1.7	1.0	210.5	17.7	10.5	363.6
F18																	
F19							19.3		6.2	0.3	34.3			8.8	149.7		218.6
All Code	0.8		0.1	9.1	0.6		56.4	3.0	30.2	-	8.4	0.8	0.4	115.2	26.5	10.9	262.4

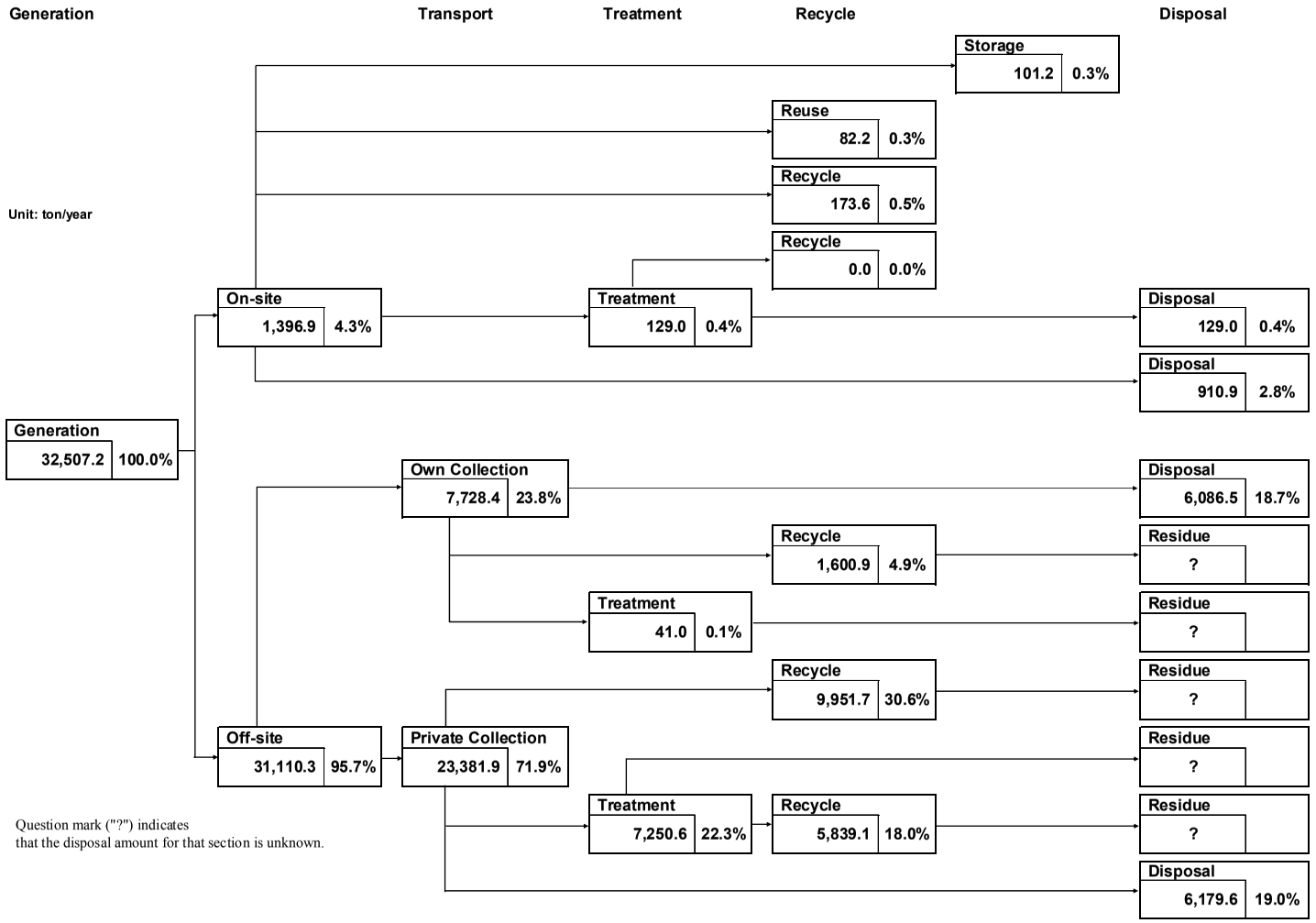


Figure 2-3: Waste stream (170 factories: Non production process – Non HIW)

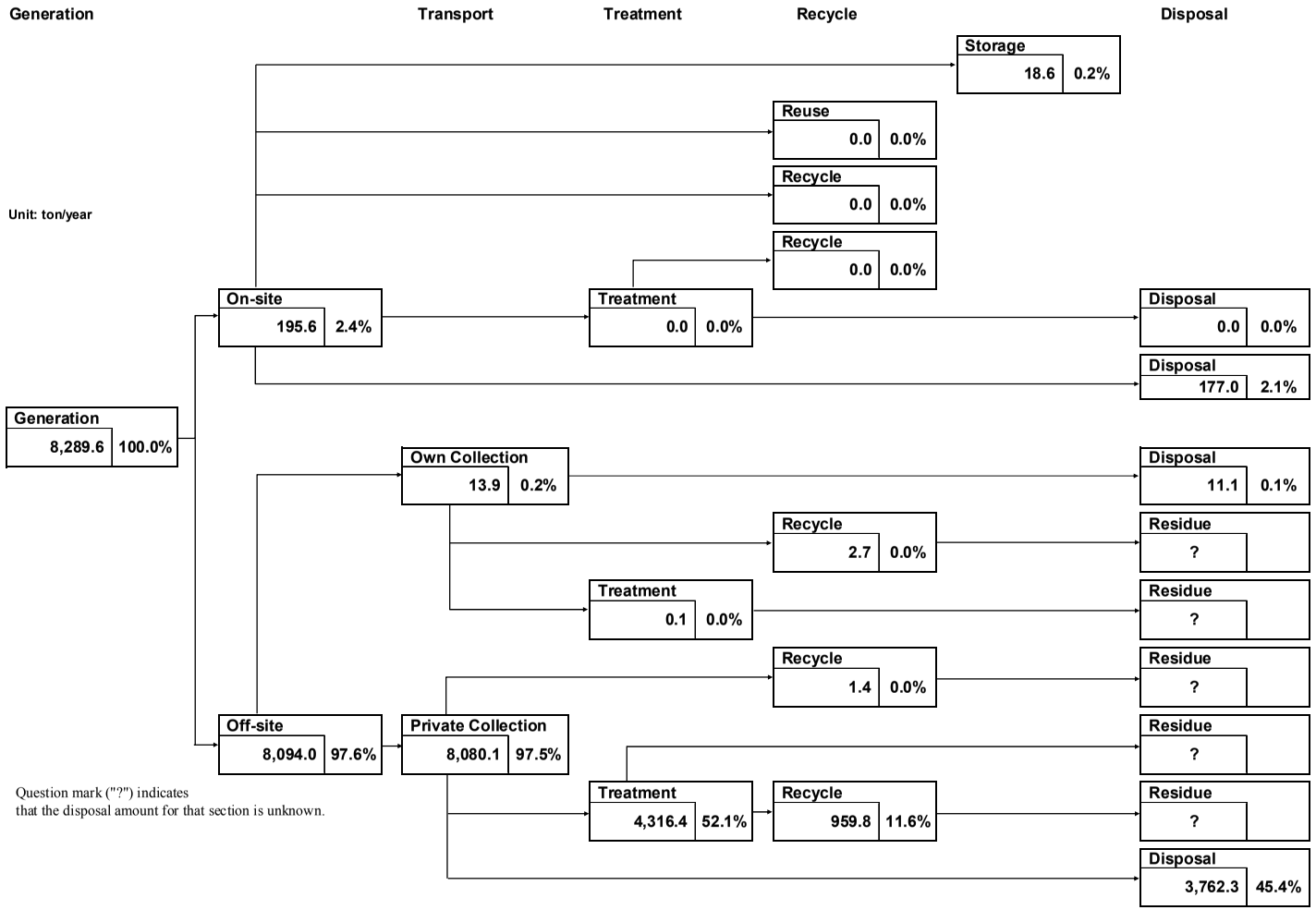


Figure 2-4: Waste stream (170 factories: Non production process – HIW)

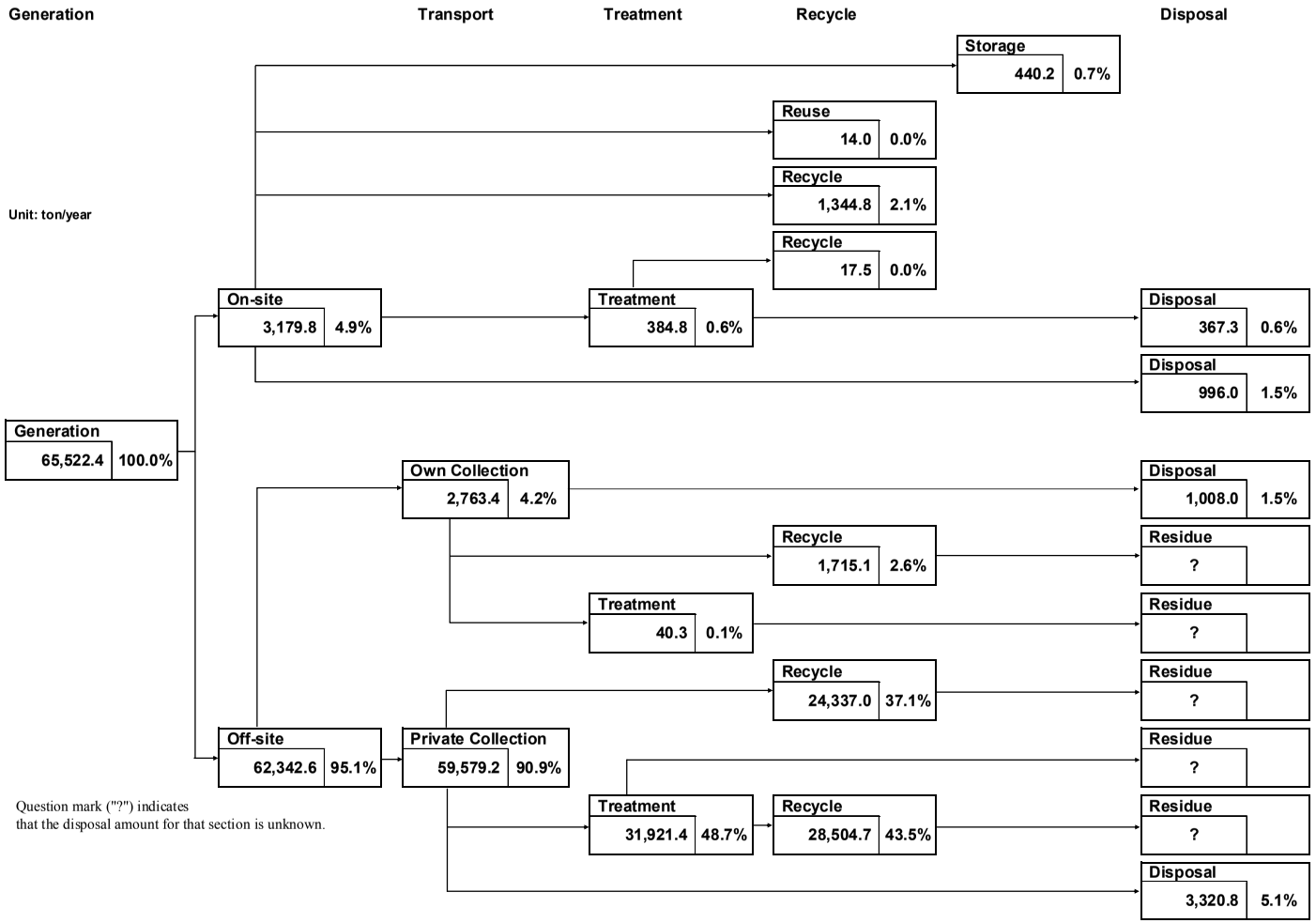


Figure 2-5: Waste stream (170 factories: Production process – Non HIW)

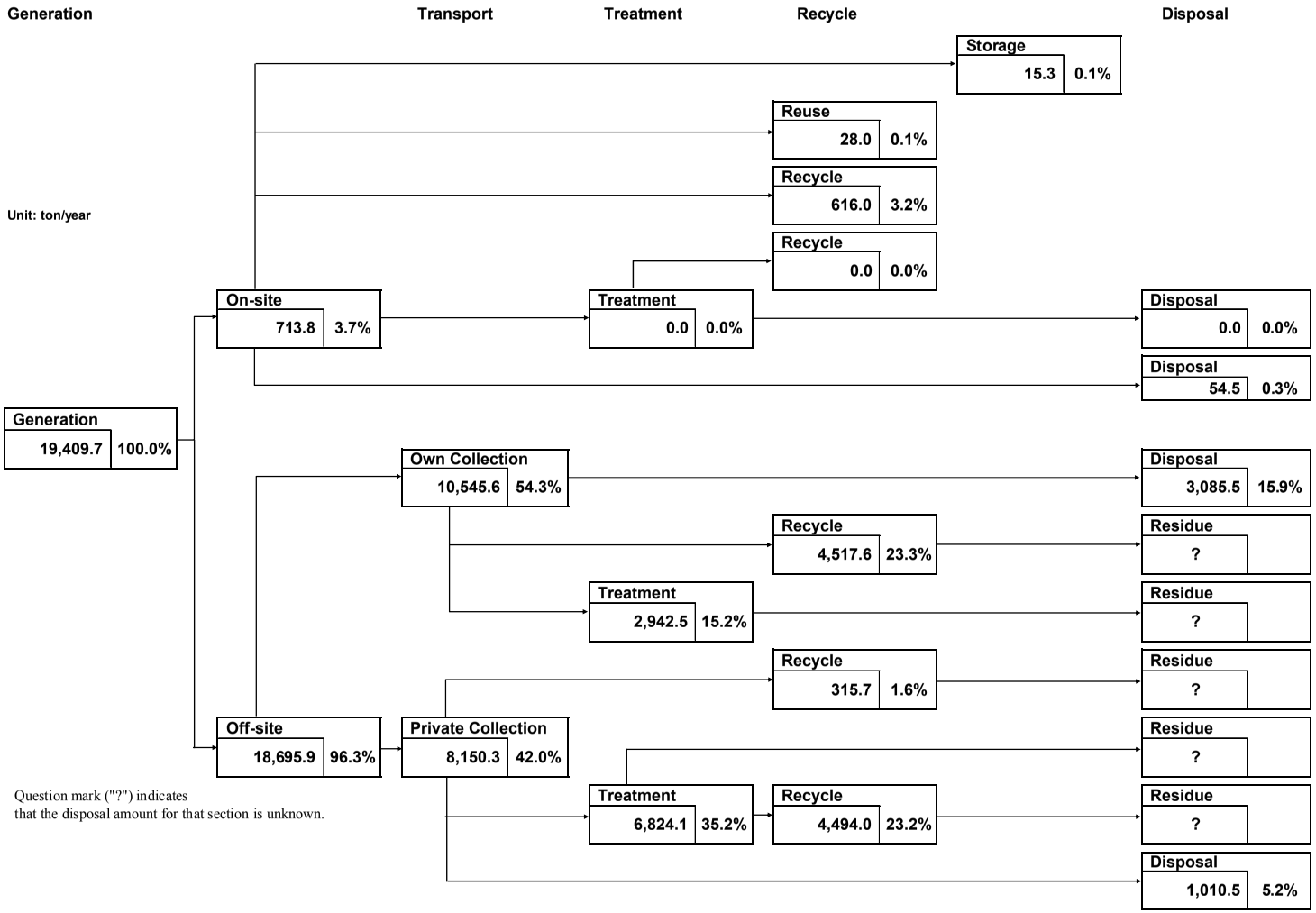


Figure 2-6: Waste stream (170 factories: Production process – HIW)

2.2.6 Questionnaire of Factory Survey

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Introduction of the Survey

"The Study for the Development of an Integrated Solution related to Industrial Waste Management in the Industrial Pole of Manaus" being carried out by JICA Study Team with the cooperation of SUFRAMA.
The questionnaire survey to the factories is being carried out by SUFRAMA and the JICA Study Team. The purpose of this survey is to understand the generation amount of industrial (factory) waste, the waste management practices of the factories in PIM in terms of storage, reuse/recycle, discharge, collection, intermediate treatment and final disposal.
In this questionnaire the waste generated in a factory is called as industrial waste. The industrial waste is classified into the Non-Hazardous Industrial Waste (Non-HIW) and Hazardous Industrial Waste (HIW) generated from each of production process and Non-process source : The results of this survey, together with other engineering investigations, will be used for the formulation of Waste stream (Waste Stream) for PIM.
The questionnaire should be answered by a responsible person on IWM in your factory. It should take about 30-40 min to complete. All answers are confidential and your help is greatly appreciated.

Definition of Waste generation source, Waste, Reuse, and Recycle

A. Waste generation source

The waste generation sources in a factory are classified into following two categories.

1. **Non-production process source:** The waste generation source, excluding the production process and storage area, such as canteens, administration area, clinic, construction and so on.
2. **Production process source:** The waste generation source related to the production of final products of a factory, including treatment plants, maintenance and sweeping of the industrial areas.

B. Waste

In this questionnaire the waste generated in a factory is called as industrial waste. The industrial waste is classified into the following two categories:

1. **Non-Hazardous Industrial Waste (Non-HIW):** Non- HIW generated from both non-production and production processes as listed in Table 1.
2. **Hazardous Industrial Waste (HIW):** HIW generated from both non-production and production processes as listed in Table 2.

Accordingly, Industrial waste can be classified into four categories as follows.

- Non-HIW generated from Non-production process
- HIW generated from Non-production process
- Non-HIW generated from Production process
- HIW generated from Production process

C. Reuse

To use waste again, or repeatedly, without transforming and/or modifying, or only with simple treatment (e.g. use a used bottle after rinsing).

D. Recycle

To use waste again as raw material (including as energy source) with chemical, physical

and/or biological processing (e.g. producing compost from food waste, manufacturing cement using wastewater sludge).

Survey Sheet for Factory Survey

1_ General information

1. Name of Company				
2. Type of Industry (See Table 3)				
3. Registration number	INSC.CNPJ:			
	INSC.SUF:			
	Environmental License number			
4. Address			Tel ……..	
5. Date of foundation				
6. Reason of setting up the factory in MFZ				
7. Factory area	Ground-floor area： ha , Building area： ha			
8. Share Capital (optional)	R$			
9. Number of employees	Employees in the factory		persons	
	Hereof in Administration		persons	
	Total Employees		persons	
10. Factory layout drawing	1. No. 2. Yes. (Attach drawing copies)			
11. Production Flowchart	1. No. 2. Yes. (the Answer sheet of Production process and Material flow or Attach catalog copies)			
12. Main Products	No.	Name of Main Products	Output	
			Amount	Unit
	1.			
	2.			
	3.			
	4.			
	5.			
13. Annual Sales Amount （Optional）	R$			
14. Raw materials	No.	Name of Raw material[*1]	Input	
			Amount	Unit
	1.			
	2.			
	3.			
	4.			
	5.			

[*1] Raw material : Raw materials shall be described according to the following categories.

(1) Primary raw materials which are used for producing the final products such as;

a. Heavy metals etc.(Hg, Pb, Cr, Cd, As, CN etc.), b. Solvents, c. Acids, d. Alkalis, e. Pigments, f. Oils, g. Asbestos, h. Others organic/Inorganic chemicals

(2) Components which are used for assembling final products.

15. Pollution control facility			Please specify type and capacity
	a. Boiler	No.	Yes.
	b. Incinerator	No.	Yes.
	c. Industrial wastewater treatment facilities	No.	Yes.
	d. Domestic wastewater treatment facilities	No.	Yes.
	e. Dust collector	No.	Yes.
	f. Air control facilities	No.	Yes.
	g. Plating process	No.	Yes.
	h. Painting process	No.	Yes.
	i. Metal coating process	No.	Yes.
	j. Storage space of Dangerous substance (Underground : Oils, Volatile substance, etc.)	No.	Yes.
	k. Storage space of Dangerous substance (Above surface : Oils , Volatile substance, etc.)	No.	Yes.
	h. Others	No.	Yes.
16. Water/Energy Demands	a. Working Days		days/week
	b. Working hours		hours/day
	c. Electricity		unit: MWH/year
	d. Gas		unit: 1000 m^3/year
	e. Tap water / Ground water		unit: 1000 m^3/year
	f. Fuel		unit: kl/year, 1000 m^3/year, etc.

2_ Interviewee

1. Interviewee	1. Name	:
	2. Position	:
2. Interviewer	1. Name	:
	2. Position	:
	Signature	:
3. Date of Interview		:

3_ Industrial Waste (IW) Management

3_1 General information

Q.1. Does your factory has obligation to submit the waste inventory

[ ] 1. Yes, we have obligation and submit.
[ ] 2. Yes we have , but we did not submit.
(specify reasons:)
[ ] 3. No, we do not have obligation.

Q.2. Are Non-Production Process Industrial Waste and Production process Industrial Waste discharged separately from your factory?

[ ] 1. Yes
[ ] 2. No

Q.3. Are Non-Hazardous Industrial Waste (Non-HIW) and Hazardous Industrial Waste (HIW) discharged separately from your factory?

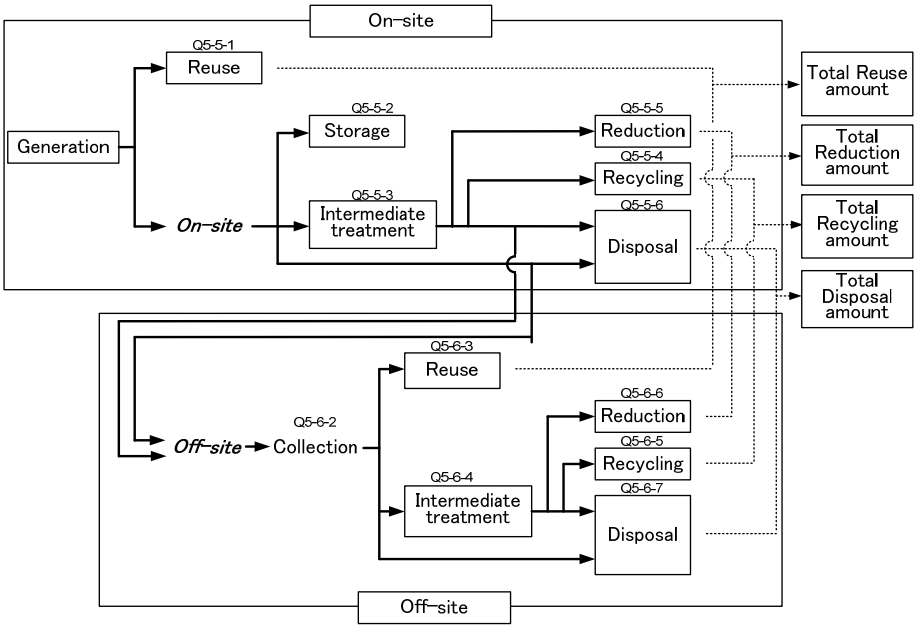
[ ] 1. Yes, 100 %. (Go to Q. 5)
[ ] 2. Yes, partly (Go to Q. 5)
(specify :)
[ ] 3. No (Go to Q. 4)

Q.4. What is the reason why these waste are not separated? You can select all that correspond to your factory.

(You may choose more than one answer given below)

[ ] 1. We don't know the difference between Non-HIW and HIW.
[ ] 2. The volume of waste is too small to separate.
[ ] 3. The production process makes it difficult to separate Non-HIW and HIW.
[ ] 4. The collection service does not require to separate Non-HIW and HIW.
[ ] 5. It is troublesome and waste of time to separate Non-HIW and HIW.
[ ] 6. It seems unnecessary to separate Non-HIW and HIW.
[ ] 7. It is difficult to separate Non-HIW and HIW.
[ ] 8. Even though Non-HIW and HIW are separated, there are no ways to utilize them.
[ ] 9. We don't generate HIW in our factory.
[ ] 10. Others (specify:)

3_2 Industrial Waste Disposal



Flowchart of Industrial Waste Disposal

Q.5. Interviewee shall fill the following 4 answer sheets according to the type and source of waste generated.

		Waste generation source	
		Non-production process	Production process
Waste category	Non-HIW	**Answer sheet No.1**	**Answer sheet No.3**
	HIW	**Answer sheet No.2**	**Answer sheet No.4**

＜How to fill in answer sheets＞

Q5-1	**Name of Waste**	Describe all the waste generated within the factory.
Q5-2	**Waste Code**	Q5-2-1 Describe the waste study code according to the waste categories shown in table 1 and 2.
		Q5-2-2 Describe the waste code according to the waste inventory in CONAMA313, if it is known.
Q5-3	**Generation source**	Describe the concrete production process for those wastes which generated from production process according to the code of production waste shown in table 4.
Q5-4	**Waste of Amount**	・How many tons (or kg) of this IW is generated in your factory per year? Please enter the amount of generated wastes in **the Answer Sheet**.
Q5-5	**On-site treatment**	
	Q5-5-1 Reuse	(1) How many tons (or kg) of this IW is reused in your factory per year? Please enter the amount of generated wastes in **the Answer Sheet**.
		(2) If you said **Yes** please put information of the reuse method.
	Q5-5-2 Storage	(1) Is your IW stored inside your factory? Please enter the amount of generated wastes in **the Answer Sheet**.
		(2) If you said **Yes** please put information of the storage method. Please use the code number which is specified in **Annex III of "CONAMA Resolution 313 (Please see attached Table 5)** "
		(3) How do you store IW? 1. We mix them all together. 2. We store them separately. 3. We store only waste that can be reused/recycled. 4. Others
		(4) What is the purpose of on-site storage of IW? 1. Temporary storage before its collection by haulers. 2. Temporary storage for on-site reuse and recycling. 3. Temporary storage for on-site treatment and disposal. 4. Temporary storage due to no existence of proper treating companies 5. Others
	Q5-5-3 Intermediate Treatment	(1) Is IW treated on-site in your factory? Please enter the amount of treated wastes in **the Answer Sheet**.
		(2) If you said **Yes**, please put information of the treatment method. Please use the code number which is specified in **Annex III of "CONAMA Resolution 313 (Please see attached Table 5)** "
	Q5-5-4 Recycling	(1) Is IW reused or recycled inside your factory? Please enter the amount of reused/recycled wastes in **the Answer Sheet**.
		(2) If you said **Yes** please put information of the reuse/recycle method. Please use the code number which is specified in **Annex III of "CONAMA Resolution 313 (Please see attached Table 5)** "
	Q5-5-5 Reduction	・Is IW reduced inside your factory? Please enter the amount of deducted wastes in **the Answer Sheet**.
	Q5-5-6 On-site disposal	(1) Is IW disposed inside your factory? Please enter the amount of disposed wastes in **the Answer Sheet**.
		(2) If you are **Yes** please put information of the disposal method.
Q5-6	**Off-site treatment**	

	Q5-6-1 General	・Do you know how IW discharged from your factory are treated/disposed of outside the factory? Please enter the amount of treated/disposed wastes in **the Answer Sheet**.
		If you know the method (treatment, reuse/recycling, disposal etc.), please reply following questions.
	Q5-6-2 Collection	(1) Who collects wastes generated in your factory? 1. Manaus city 2. PIM 3. Others Private company contracted by us (please put company name) 4. No collection service (Self disposal) => Collection frequency ……
		(2) Where your factory waste is transported to? 1. Public landfill site (please put landfill name) 2. Private landfill site (please put landfill name) 3. Other landfill site (please put landfill name) 4. Incineration plants (please put plants name) 5. Co-processing (please put company name) 6. I don't know
	Q5-6-3 Reuse	(1) How many tons (or kg) of your IW is reused per year? Please enter the amount of reused wastes in **the Answer Sheet**.
		(2) If you said **Yes** please put information of the reuse method.
	Q5-6-4 Intermediate Treatment	(1) Is your IW processing off-site from your factory?
		(2) If you said **Yes**, please put information for the processing method. Please use the code number which is specified in **Annex III of "CONAMA Resolution 313 (Please see attached Table 5)** "
	Q5-6-5 Recycling	(1) Is IW reused or recycled off-site your factory? Please enter the amount of reused/recycled wastes in **the Answer Sheet**.
		(2) If you said **Yes** please put information on the reuse/recycle method. Please use the code number which is specified in **Annex III of "CONAMA Resolution 313 (Please see attached Table 5)** "
	Q5-6-6 Reduction	・Is IW reduced off-side your factory? Please enter the amount of reduced wastes in **the Answer Sheet**.
	Q5-6-7 Off-site disposal	・Do you know Where are off-site disposal site? (Specify)……

3_3 Other waste

Q.6. Does your factory have any health service inside ?

[ ] 1. Yes (Go to Q. 7)
[ ] 2. No (Go to Q. 8)

Q.7. Can you provide us the necessary information for the health-care waste survey ?

[ ] 1. Yes
(Collection by:)
(Discharge at:)
(Process or disposal method:)
(Who is in charge of, in this factory:)
(Person in charge、Department, Tel No :)
[ ] 2. No

Q.8. Does your factory generate the radioactive wastes ?

[ ] 1. Yes (Go to Q. 9)
[ ] 2. No (Go to Q. 10)

Q.9. Please inform on the treatment and disposal methods for the radioactive wastes.

(Treatment/Disposal by :.....)
(Discharge at:)
(Treatment/Disposal method:)
(Who is in charge of, in this factory:)
(Person in charge、Department, Tel No)

Q.10. Please inform on the treatment and disposal methods for the construction wastes generated in your factory.

(Treatment/Disposal by :.....)
(Discharge at:)
(Treatment/Disposal method:)
(Who is in charge of, in this factory:)
(Person in charge、Department, Tel No)

3_4 Future Management of IW

Q.11. How will the generation of IW increase in your factory?

[ ] 1. The volume of IW will not increase so much.
[ ] 2. The volume will increase due to the expansion of production, change of raw materials, etc..
[ ] 3. The volume will decrease due to change or improvement of manufacturing process, change of raw materials, etc..
[ ] 4. Others (Please inform):……

Q.12. Are there any future plans to reduce and recycle IW in your factory?

[ ] 1. No, basically we will apply the present management.
[ ] 2. Yes, we have a specific plan to improve waste reduction and recycling system in our factory.

(Pleases inform on the plan):…… ……..

Q.13. What types of IW do you plan to introduce or reuse/recycle in your factory?

(Please specify)…… ……

Q.14. Are there any future plans to improve treatment and final disposal system of IW in your factory?

[ ] 1. No, basically we will apply the present management.
[ ] 2.Yes, we have a specific plan to improve treatment and disposal system in our factory.

(Pleases inform on the plans):…….

3_5 Waste Exchange

Q.15. Do you know the meaning of waste exchange concretely?

[ ] 1. Yes
[ ] 2. No

Waste Exchange
Waste can be reused or recycled within one factory or more than two factories. The latter case, where waste from one factory is used (either reused or recycled) by another, is called Waste exchange.

Q.16. Is your factory interested in waste exchange program?

[ ] 1. Yes, very much.
[ ] 2. Yes, eventually.
[ ] 3. No

Q.17. Is your factory now involved in any kinds of waste exchange program of either on-HIW or HIW?

[ ] 1. Yes
[ ] 2. No
[ ] 3. I don't know.

4_Financial Matter

Q.18. How much do you spend per year for off-site destination (collection, treatment and final disposal)?

[ ] 1. ….R$ / year , ……. R$ / ton or m3 for transport company and
……R$ / year , ……. R$ / ton or m3 for the disposing company
[ ] 2. I don't know.

Q.19. How much does your factory spend annually for the on-site destination (treatment and final disposal) of IW?

[ ] 1. ……R$ /year
[ ] 2. I don't know.

5_Evaluation of the Present IW System

Q.20. Which of the following phrases best describes the present status of IWM in your factory?

[ ] 1. We do not know the difference between hazardous and non -hazardous industrial waste.
[ ] 2. There are some problems with present IWM.(Go to Q. 21)
(Please specify)……

Q.21. Do you evaluate what are the problems of present IWM in your factory? (You may choose more than one answer given below)

[ ] 1. There is no problem with the present IWM. (Go to the end)
[ ] 2. We do not segregate hazardous from non-hazardous industrial waste.
[ ] 3. There are no or only limited services available for industrial waste treatment.
[ ] 4. High cost of industrial waste treatment.
[ ] 5. Reuse and recycling of industrial waste is non-existent or limited.
[ ] 6. There are no reliable and licensed companies offering treatment and/or disposed service, in Manaus.
[ ] 7. Others (specify ……)

Q.22. Do you think what measures and actions need to be taken to solve the above problems? (You may choose more than one answer given below)

[ ] 1. Formulation and enforcement of relevant laws and regulations.
[ ] 2. Guidance on proper IWM inside the factories (generators).
[ ] 3. Introduction of financial and economic incentives to promote proper IWM.
[ ] 4. Preparation of guidelines for proper IWM.
[ ] 5. Development of the waste reuse and recycle market.
[ ] 6. Development of the intermediate treatment facilities for industrial waste.
[ ] 7. Development of the final disposal facilities for industrial waste.
[ ] 8. Others (specify ……)

Answer Sheet: Production Process and Materials flow

Indicate input of raw materials and waste generation specified in types.
Indicate amount of waste and intermediate treatment.

Please use the code number specified in the table-4 in order to explain the production process. Methods of storage, intermediate treatment, reuse, recycling and final disposal of generated wastes shall be described using the code number specified in Annex III of CONAMA Resolution 313.

Answer Sheet 1: Non-Production process / Non-HIW

On-site

No.				
Name of Waste	Q5-1			
Waste Code (Team code) (Waste inventory)	Q5-2-1			
	Q5-2-2			
Generation source	Q5-3			
Amount unit :ton/week	Q5-4			
Reuse	Q5-5-1 (1)			
	Q5-5-1 (2)			
Storage	Q5-5-2 (1)			
	Q5-5-2 (2)			
	Q5-5-2 (3)			
	Q5-5-2 (4)			
Intermediate treatment	Q5-5-3 (1)			
	Q5-5-3 (2)			
Recycling	Q5-5-4 (1)			
	Q5-5-4 (2)			
Reduction	Q5-5-5			
On-site Disposal	Q5-5-6 (1)			
	Q5-5-6 (2)			

Q5-6-1
Do you know how IW discharged from your factory are treated/disposed of outside the factory?

Off-site

[ ] 1. Yes. (If you know the method (treatment, reuse/recycling, disposal etc.), please reply following questions.)
[ ] 2. No. (Go to next answer sheet or Q6)

Collection	Q5-6-2 (1)			
	Q5-6-2 (2)			
Reuse	Q5-6-3 (1)			
	Q5-6-3 (2)			
Intermediate treatment	Q5-6-4 (1)			
	Q5-6-4 (2)			
Recycling	Q5-6-5 (1)			
	Q5-6-5 (2)			
Reduction	Q5-6-6			
Off-site Disposal	Q5-6-7 (1)			
	Q5-6-7 (2)			

Note In case the sheet is not enough, please copy and use it.

Answer Sheet 2: Non Production process / HIW

On-site

No.					
Name of Waste	Q5-1				
Waste Code (Team code) (Waste inventory)	Q5-2-1				
	Q5-2-2				
Generation source	Q5-3				
Amount unit :ton/week	Q5-4				
Reuse	Q5-5-1 (1)				
	Q5-5-1 (2)				
Storage	Q5-5-2 (1)				
	Q5-5-2 (2)				
	Q5-5-2 (3)				
	Q5-5-2 (4)				
Intermediate treatment	Q5-5-3 (1)				
	Q5-5-3 (2)				
Recycling	Q5-5-4 (1)				
	Q5-5-4 (2)				
Reduction	Q5-5-5				
On-site Disposal	Q5-5-6 (1)				
	Q5-5-6 (2)				

Q5-6-1
Do you know how IW discharged from your factory are treated/disposed of outside the factory?

Off-site

[ ] 1. Yes. (If you know the method (treatment, reuse/recycling, disposal etc.), please reply following questions.)
[ ] 2. No. (Go to next answer sheet or Q6)

Collection	Q5-6-2 (1)				
	Q5-6-2 (2)				
Reuse	Q5-6-3 (1)				
	Q5-6-3 (2)				
Intermediate treatment	Q5-6-4 (1)				
	Q5-6-4 (2)				
Recycling	Q5-6-5 (1)				
	Q5-6-5 (2)				
Reduction	Q5-6-6				
Off-site Disposal	Q5-6-7 (1)				
	Q5-6-7 (2)				

Note In case the sheet is not enough, please copy and use it.

Answer Sheet 3: Production process / Non-HIW

On-site

No.					
Name of Waste	Q5-1				
Waste Code (Team code) (Waste inventory)	Q5-2-1				
	Q5-2-2				
Generation source	Q5-3				
Amount unit :ton/week	Q5-4				
Reuse	Q5-5-1 (1)				
	Q5-5-1 (2)				
Storage	Q5-5-2 (1)				
	Q5-5-2 (2)				
	Q5-5-2 (3)				
	Q5-5-2 (4)				
Intermediate treatment	Q5-5-3 (1)				
	Q5-5-3 (2)				
Recycling	Q5-5-4 (1)				
	Q5-5-4 (2)				
Reduction	Q5-5-5				
On-site Disposal	Q5-5-6 (1)				
	Q5-5-6 (2)				

Off-site

Q5-6-1
Do you know how IW discharged from your factory are treated/disposed of outside the factory?
[ ] 1. Yes. (If you know the method (treatment, reuse/recycling, disposal etc.), please reply following questions.)
[ ] 2. No. (Go to next answer sheet or Q6)

Collection	Q5-6-2 (1)				
	Q5-6-2 (2)				
Reuse	Q5-6-3 (1)				
	Q5-6-3 (2)				
Intermediate treatment	Q5-6-4 (1)				
	Q5-6-4 (2)				
Recycling	Q5-6-5 (1)				
	Q5-6-5 (2)				
Reduction	Q5-6-6				
Off-site Disposal	Q5-6-7 (1)				
	Q5-6-7 (2)				

Note In case the sheet is not enough, please copy and use it.

Answer Sheet 4: Production process / HIW

On-site

No.					
Name of Waste	Q5-1				
Waste Code (Team code) (Waste inventory)	Q5-2-1				
	Q5-2-2				
Generation source	Q5-3				
Amount unit :ton/week	Q5-4				
Reuse	Q5-5-1 (1)				
	Q5-5-1 (2)				
Storage	Q5-5-2 (1)				
	Q5-5-2 (2)				
	Q5-5-2 (3)				
	Q5-5-2 (4)				
Intermediate treatment	Q5-5-3 (1)				
	Q5-5-3 (2)				
Recycling	Q5-5-4 (1)				
	Q5-5-4 (2)				
Reduction	Q5-5-5				
On-site Disposal	Q5-5-6 (1)				
	Q5-5-6 (2)				

Off-site

Q5-6-1
Do you know how IW discharged from your factory are treated/disposed of outside the factory?

[ ] 1. Yes. (If you know the method (treatment, reuse/recycling, disposal etc.), please reply following questions.)

[ ] 2. No. (Go to next answer sheet or Q6)

Collection	Q5-6-2 (1)			
	Q5-6-2 (2)			
Reuse	Q5-6-3 (1)			
	Q5-6-3 (2)			
Intermediate treatment	Q5-6-4 (1)			
	Q5-6-4 (2)			
Recycling	Q5-6-5 (1)			
	Q5-6-5 (2)			
Reduction	Q5-6-6			
Off-site Disposal	Q5-6-7 (1)			
	Q5-6-7 (2)			

Note In case the sheet is not enough, please copy and use it.

Annex Tables for Factory survey

Table 1 : Non-Hazardous Industrial Waste

(Class II A : Non-Inert waste, Class II B : Inert waste)

Type of Non-HIW	Non-HIW Code
Kitchen waste (include waste from animal such as bone, skin, hair)	NH01
Wood	NH02
Paper	NH03
Plastic or polymers and resins	NH04
Textile and fiber	NH05
Animal oil, Vegetable oil	NH06
Rubbers and Leather	NH07
Ash/dust from coal-fired power plants, etc.	NH08
Metals and metal alloys such as aluminum, copper, bronze	NH09
Ceramic & Glasses	NH10
Stone, sand or material that have composition of soil such as tile, brick, gypsum, cement	NH11
Mixed waste (This code shall be applied in case wastes are discharged without separation.)	NH12
Others	NH13

Study Code and CONAMA code (Non-HIW)

Study Code	CONAMA Code	Description
NH01	A001	Residues of restaurant (food remaining portions)
	A024	Bagasse of sugar cane
	A499	Carnaça
	A599	Residues organic of process (tallow, serum, bones, blood, others of the
	A699	Rind of rice
	A999	Residues of fruits (bagasse, must, rind, etc.)
NH02	A009	Residues wooden I contend not toxic substances
NH03	A006	Residues of paper and cardboard
NH04	A007	Polymerized plastic residues of process
	A107	Bombonas of plastic not contaminated
	A108	Etil acetate residues vinila (EVA)
	A207	Plastic films and small packings
	A208	Polyurethane residues (PU)
NH05	A010	Residues of têxteis materials
NH06	'---	'---
NH07	A008	Rubber residues
	A299	Caleadas shavings of skins
	A399	Atanado leather shavings, remnants
NH08	A111	Leached ashes of boiler
NH09	A004	Ferrous metal scrap iron
	A005	Not ferrous metal scrap iron (brass, etc.)
	A011	Not metallic mineral residues
	A012	Slag of aluminum casting
	A013	Slag of iron production and steel
	A014	Slag of brass casting
	A015	Slag of zinc casting

	A104	Metallic packings (empty cans)
	A105	Not ferrous metal packings (empty cans)
	A204	Tambores metallic
NH10	A017	Refractory ceramic residues and material
	A025	Fibre glass
	A117	Glass residues
	A799	Atanado leather Serragem, bran and dust
NH11	'---	'---
NH12	A002	Generated residues outside of the industrial process (office, packings, etc.)
NH13	A003	Residues of varrição of plant
	A018	Solid residues not toxic metal composites
	A019	Solid residues of stations of treatment of effluent I contend material biological
	A021	Solid residues of stations of treatment of effluent I contend not toxic substances
	A022	Pastosos residues of stations of treatment of effluent I contend not toxic
	A023	Pastosos residues I contend limy
	A026	Slag of jateamento I contend not toxic substances
	A027	Used catalysers I contend not toxic substances
	A028	Residues of system of control of not toxic gaseous emission I contend Products are of the specification or are of the validity stated period contend not
	A029	Other not dangerous residues
	A099	Salty shavings
	A199	Foam
	A308	Silt of the caleiro
	A899	Generated residues outside of the industrial process (office, packings, etc.)

Table 2 : Hazardous Industrial Waste

(Class I waste)

Type of HIW	HIW Code	Example of HIW
Inorganic acid	HW01	Sulfuric acid (H_2SO_4), Hydrochloric acid (HCl), Nitric acid (HNO_3), Phosphoric acid (H_3PO_4), Other inorganic acids
Organic acid	HW02	Acetic acid (CH_3COOH), Formic acid (HCOOH), Other organic acids
Alkalis	HW03	Caustic soda (NaOH), Ammonia (NH_3), Sodium carbonate (Na_2CO_3), Other alkaline materials
Toxic Compounds	HW04	including Hg, As, Cd, Pb, Cr, CN
Inorganic Compounds	HW05	Plating wastes, Picking waste, Sulphides, etc.
Other Inorganic	HW06	Asbestos, Slug, etc.
Organic Compounds	HW07	Reactive chemical wastes (Oxidizing agents, Reducing agents, etc), Solvents etc.
Polymeric Materials	HW08	Epoxy resin, Chelate resin, Polyurethan resin, Latex rubber etc.
Fuel, Oil and Grease	HW09	Fats, Waxes, Kerosene, Lubricating oil, Engine oil, Grease etc
Fine Chemicals and Biocides	HW10	Pesticides, Medicine, Cosmetic, Drugs, etc.
Treatment Sludge	HW11	Inorganic sludge, Organic sludge, Septic tank sludge, etc.
Ash from incinerator	HW12	---
Dust and Air pollution control (APC) products	HW13	Soot and dust waste from incineration facilities, treating exhaust gas

Other Hazardous substance (besides HW01-HW13)	HW14	HIWs other than the above
Mixed Waste	HW15	---
Hazardous materials from Non-production process	HW16	Fluorescent tubes, Thermometer (use mercury), Batteries, Pesticides (Household use), etc.

Study Code and CONAMA code (HIW)

CONAMA code	Description	Study code
C001 to C009	Listing 10 - dangerous residues for containing volatile components, in which do not apply solubilização and/or leaching tests, presenting superior concentrations to the indicated ones in listing 10 of Norm NBR 10004	**HW14**
D001	Dangerous residues for presenting inflammability	**HW10 HW08 HW09 HW14**
D002	Dangerous residues for presenting corrosively	**HW01 HW02 HW3**
D003	Dangerous residues for presenting reactivity	**HW01 HW02 HW03 HW07**
D004	Dangerous residues for presenting pathogenicity	**HW10 HW14**
D005 to D029	Listing 7 of Norm NBR 10004: dangerous residues characterized by the leaching test	**HW05 HW06 HW10 HW11**
K193	Shavings of leather tanned to chromium	**HW04**
K194	Leather Serragem and dust I contend chromium	**HW04**
K195	Silt of stations of treatment of effluent of tanning to chromium	**HW04**
F102	Residue of catalysers not specified in Norm NBR 10.004	**HW14**
F103	Deriving residue of industrial laboratories (chemical products) not specified in Norm NBR 10.004	**HW04 HW10**
F104	Not specified contaminated empty packings in Norm NBR 10.004	**HW14**
F105	Solvent contaminated (to specify solvent and the main contaminante)	**HW07**
D099	Other dangerous residues - to specify	**HW14**
F001 F0301	Listing 1 of Norm NBR 10004- admittedly dangerous residues - Classroom 1, of not-specific sources	**HW04 HW07**
F100	Bifenilas Policloradas - PCB`s. Packings contaminated with PCBs also transforming and capacitors	**HW07**
P001 to P123	Listing 5 of Norm NBR 10004 - dangerous residues for containing toxic substances acutely (remaining portions of packings contaminated with substances of listing 5; contaminated residues of spilling or ground, and products are of specification or products of commercialization forbidden of any constant substance in listing 5 of Norm NBR 10.004	**HW07**
K001 to K209	Listing 2 of Norm NBR 10004- admittedly dangerous residues of specific sources	**HW04 HW07**
K053	Remaining portions and you splodge of inks and pigments	**HW07**
K078	Residue of cleanness with solvent in the manufacture of inks	HW07
K081	Silt of ETE of the production of inks	**HW07 HW11**
K203	Residues of laboratories of research of illnesses	**HW10**
K207	It splodges of the used oil re-refining (it splodges acid)	**HW01 HW09**
U001 to U246	Listing 6 of Norm NBR 10004- dangerous residues for containing toxic substances (contaminated residues of spilling or ground; products are of specification or products of commercialization forbidden of any constant substance in listing 6 of Norm NBR 10.004	**HW14**

Table 3 : Factory Code

Factory Code	Description of subsector
F01	Beverage (soft drink, alcoholic) and vinegars
F02	Leathers, skins and similar
F03	Printing and graphical company
F04	Electric, electronic and communication materials
	4.1 Components
	4.2 Products (except copy machines)
	4.3 Copy machines and similars
F05	Wood
F06	Mechanical
	6.1 Watch
	6.2 Other mechanical industries
F07	Metallurgy
F08	Non metallic minerals
F09	Furniture
F10	Paper, cardboard, cellulose
F11	Rubber
F12	Food products
F13	Chemical
F14	Plastic material products
F15	Textile
F16	Clothing, fabric and travel goods
F17	Transport material
	17.1 Two wheel
	17.2 Naval
	17.3 Other transport material industry
F18	Construction
F19	Others
	19.1 Optical
	19.2 Toys
	19.3 Devices, equipment, and fotogr. accessories
	19.4 Pens and disposable razors
	19.5 Other several industries

Table 4: Code of Production Process

Process code	First Category	Second Category (Waste from production process)
P01	Wastes Resulting From Exploration, Mining, Quarrying, And Physical And Chemical Treatment of Minerals	Mineral Excavation/ Physical And Chemical Processing of Metalliferous Minerals/ Physical And Chemical Processing of Non-Metalliferous Minerals/ Drilling muds And Other Drilling Wastes
P02	Wastes From Agriculture, Horticulture, Aquaculture, Forestry, Hunting and Fishing, Food Preparation and Processing	Agriculture, Horticulture, Aquaculture, Forestry, Hunting And Fishing/ The Preparation And Processing of Meat, Fish And Other Foods of Animal Origin/ Fruit, Vegetables, Cereals, Edible Oils, Cocoa, Coffee, Tea And Tobacco Preparation And Processing; Conserve Production; Yeast And Yeast Extract Production, Molasses Preparation And Fermentation/ Sugar Processing/ The Dairy Products Industry/ The Baking and Confectionery Industry/ The Production of Alcoholic And Non-Alcoholic Beverages

P03	Wastes From Wood Processing And The Production of Panels And Furniture, Pulp, Paper And Cardboard	Wood Processing and The Production of Panels And Furniture/ Wood Preservation/ Pulp, Paper And Cardboard Production And Processing
P04	Wastes From The Leather, Fur And Textile Industries	The Leather And Fur Industry/ The Textile Industry
P05	Wastes From Petroleum Refining, Natural Gas Purification And Pyrolytic Treatment of Coal	Petroleum Refining/ The Pyrolytic Treatment of Coal/ Natural Gas Purification And Transportation
P06	Wastes From Inorganic Chemical Processes	The Manufacture, Formulation, Supply And Use (MFSU) of Acids/ The MFSU of Bases/ The MFSU of Salts And Their Solutions And Metallic Oxides/ Metal-Containing wastes Other Than Those Mentioned In 06 03/ Sludges From On-Site Effluent Treatment/ The MFSU of Sulphur Chemicals, Sulphur Chemical Processes And Desulphurisation Processes/ The MFSU of Halogens And Halogen Chemical Processes/ The MFSU of Silicon And Silicon Derivatives/ The MSFU of Phosphorous Chemicals And Phosphorous Chemical Processes/ The MFSU of Nitrogen Chemicals, Nitrogen Chemical Processes And Fertiliser Manufacture/ The Manufacture of Inorganic Pigments And Opacificiers/ Inorganic Chemical Processes Not Otherwise Specified
P07	Wastes From Organic Chemical Processes	The Manufacture, Formulation, Supply And Use (MFSU) of Basic Organic Chemicals/ The MFSU of Plastics, Synthetic Rubber And Man-Made Fibres/ The MFSU of Organic Dyes And Pigments/ The MFSU of Organic Plant Protection Products, Wood Preserving agents And Other Biocides/ The MFSU of Pharmaceuticals/ The MFSU of Fats, Grease, Soaps, Detergents, Disinfectants And Cosmetics/ The MFSU of Fine Chemicals And Chemical Products Not Otherwise Specified
P08	Wastes From The Manufacture, Formulation, Supply And Use (MFSU) of Coatings (Paints, Varnishes And Vitreous Enamels), Adhesives, Sealants And Printing Inks	Wastes From MFSU And Removal of Paint And Varnish/ Wastes From MFSU of Other Coatings (Including Ceramic Materials)/ Wastes From MFSU of Printing inks/ Wastes From MFSU of Adhesives And Sealants (Including waterproofing Products)/ Wastes Not Otherwise Specified In 08/ Wastes From The Photographic Industry/ Wastes From Power Stations And Other Combustion Plants (Except 19)
P09	Wastes From The Photographic and radiographic process	Wastes From The Photographic Industry and The Radiographic inductry
P10	Wastes From Thermal Processes	Power Stations And Other Combustion Plants/ The Iron And Steel Industry/ Aluminium Thermal Metallurgy/ Lead Thermal Metallurgy/ Zinc Thermal Metallurgy/ Copper Thermal Metallurgy/ Silver, Gold And Platinum Thermal Metallurgy/ Other Non-Ferrous Thermal Metallurgy/ Casting of Ferrous Pieces/ Casting of Non-Ferrous Pieces/ Manufacture of Glass And Glass Products/ Manufacture of Ceramic Goods, Bricks, Tiles And Construction Products/ Manufacture of Cement, Lime And Plaster And Articles And Products Made From Them/ Crematoria
P11	Wastes From Chemical Surface Treatment And Coating of Metals And Other Materials; Non-Ferrous Hydrometallurgy	Chemical Surface Treatment And Coating of Metals And Other Materials (For Example Galvanic Processes, Zinc Coating Processes, Pickling Processes, Etching, Phosphatising, Alkaline Degreasing, Anodising)/ Wastes From Non-Ferrous Hydrometallurgical Processes/ Sludges And Solids From Tempering Processes/ Wastes From Hot Galvanising Processes

P12	Wastes From Shaping And Physical And Mechanical Surface Treatment of Metals And Plastics	Shaping and Physical And Mechanical Surface Treatment of Metals And Plastics/ Water And Steam Degreasing Processes
P13	Oil Wastes And Wastes of Liquid Fuels (Except Edible Oils, And Those In Chapters 05, 12 And 19)	Hydraulic Oils/ Engine, Gear And Lubricating Oils/ Insulating and Heat Transmission Oils/ Bilge Oils/ Oil/Water Separator Contents/ Liquid Fuels/ Oil Wastes Not Otherwise Specified
P14	Waste Organic Solvents, Refrigerants and Propellants (except 07 and 08)	Waste Organic Solvents, Refrigerants And Foam/Aerosol Propellants
P15	Waste packing; Absorbents, Wiping Cloths, Filter Materials and Protective Clothing not Otherwise Specified	Packaging (Including Separately Collected Municipal Packaging Waste)/ Absorbents, Filter Materials, Wiping cloths And Protective Clothing
P16	Wastes Not Otherwise Specified In The List	End-of-Life Vehicles From Different Means of Transport (Including off-Road Machinery) And Wastes From Dismantling of End-of-Life Vehicles And Vehicle Maintenance (Except 13, 14, 16 06 And 16 08)/ Electrical And Electronic Equipment/ off-Specification Batches And Unused Products/ Waste Explosives/ Gases In Pressure Containers And Discarded Chemicals/ Batteries And Accumulators/ Transport Tank, Storage Tank And Barrel Cleaning/ Spent Catalysts/ Oxidising substances/ Aqueous Liquid Wastes Destined For off-Site Treatment/ Waste Linings And Refractories

MFSU: Manufacture, Formulation, Supply and Use

Table 5: Codes for Storage, internal treatment and disposal methods

Note 1 Storage Methods in Factory (For answer of Q 5-5-2)
S-1 Drums
S-2 Containers
S-3 Plastic bags/drums
S-4 Others（Specify）
Note 2 Internal Treatment Methods in Factory (For answer of Q 5-5-3 and Q 5-6-4)
T-1 Dewatering
T-2 Drying
T-3 Volume reduction (Baling, Pressing etc.)
T-4 Incineration
T-5 Crushing
T-6 Sorting
T-7 Reutilization
T-8 Others（Specify）
Note 3 Disposal Methods in Factory (For answer of Q 5-5-6 and Q 5-6-7)
D-1 Transport and final disposal at municipal landfill by own means of transportation.
D-2 Transportation final disposal at municipal landfill by private subcontractor.
D-3 Final disposal at factory's compound and or/its property land.
D-4 Long-time storage at factory's compounds awaiting external treatment/disposal.

D-5 Disposal by private subcontractor-treatment and disposal method is not known.
D-6 Reutilization by other parties, e.g. used at other factory as raw materials.
D-7 Others （Specify）

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2.3 Study of Health-care Waste Management in Medical Institutions

2.3.1 Outline of the Study

a. Study Objective

The study aims to clarify the current conditions of health-care waste management at generation sources in the PIM by visiting those hospitals (one location) and clinics on factory premises (nine locations) and conducting direct interviews to survey the types of waste generated, amount discharged and conditions of health-care waste management, etc.

b. Study Method

A local consultant (OPCA) was consigned to conduct the study. The local consultant visited and conducted interviews with medical institutions using a questionnaire form made by the study team.

The study team produced a draft of the questionnaire form to use as the basis for discussion with the C/P, and then revisions were made based on that discussion. The following items were included in the questionnaire:

Table 2-18: Content of the Medical Institution Survey

1. Basic Items	2. Current Waste Management	3. Comment/Notes
・ Location of Medical Institution ・ Medical Services Provided ・ No. of Employees ・ No. of Beds ・ Number of Inpatients/Outpatients ・ Others	The following items are surveyed, making a division between infectious/hazardous waste and common waste. ・ Generation amount ・ Separation at Source ・ Storage Methods and Containers Used ・ Discharge Methods and Containers Used ・ Treatment Methods (e.g. Incineration, Sterilization), if any, and other Methods ・ Contracted Collection Company and Collection Method ・ Location and Methods of Disposal ・ Others	・ Management system of infectious/hazardous waste ・ Knowledge of an implementation of regulations for health-care waste management ・ Reporting on infectious/hazardous waste management conditions, if any, and who is reported to. ・ Education, if any, and methods for employees to handle infectious/hazardous waste ・ Fees for Collection, Treatment, Disposal of infectious/hazardous waste ・ Awareness of environmental consideration ・ Others

2.3.2 Health-care Waste Categories

a. ABNT NBR 12808 (1993) and RDC 306/2004-ANVISA

Health-care waste (i.e. Health Service Waste) is regulated by the Brazilian Association of Technical Standards (ABNT) NBR 12808 and the National Health Surveillance Agency (ANVISA). Handling health-care waste is prescribed by both the ABNT NBR 12809 and the RDC 306/2004-ANVISA.

In this study the questionnaire for the medical institutions survey has been prepared based on the health-care waste categories described in the ABNT NBR 12809 and the survey was conducted using the questionnaire. After the questionnaire survey was completed, it was pointed out that the RDC 306/2004-ANVISA is being used at present. The results of the survey were, therefore, converted into the health-care waste categories described in the RDC 306/2004-ANVISA. The following table shows conversion of health-care waste categories of the RDC 306/2004-ANVISA and the ABNT NBR 12809.

Table 2-19: Conversion of Health-care Waste Categories between

RDC 306/2004-ANVISA			**ABNT NBR 12809**	
Group		Description	Class, Type	Description
1. Group A	A.1	Biologic	Class A, Type A.1	Biologic
			Class A, Type A.2	Blood and Derivates
	A.2	Animals	Class A, Type A.5	Contaminated animal
	A.3	Body part	Class A, Type A.3	Surgical, anatomopatologic and exudates
	A.4	Patient care etc.	Class A, Type A.6	Patient care
	A.5	Prions	Not applicable	---
2. Group B		Chemical etc.	Class B, Type B.2	Pharmaceutical waste
			Class B, Type B.3	Hazardous chemical waste
3. Group C		Radioactive waste	Class B, Type B.1	Radioactive waste
4. Group D		Common waste	Class C	Common waste
5. Group E		Piercing or Cutting	Class A, Type A.4	Piercing or Cutting

b. Health-care Waste Categories used in the Study

In this study, health-care waste was divided into five large groups according to RDC 306/2004-ANVISA. The details of each group are explained in the table below.

Table 2-20: Categories of Health-care Waste used in the Study

Waste Group	Description	
1. Group A:	Wastes with the possible presence of biological agents which, due to their characteristics of higher virus concentration, may present infection risk.	
	A.1	1. cultures and stocks of microorganisms; wastes from the manufacturing of biologic products, except the haemoderivates; disposal of vaccines of live or attenuated microorganisms; means of culture and instrumentals used for transfer, inoculation or mix of cultures; wastes from genetic manipulation laboratories; 2. wastes resulting from health care of individuals or animals, suspected or surely having biologic contamination by agents from class risk 4, microorganisms with epidemiologic relevance and risk of dissemination or causer or emerging disease which may become epidemiologically important or whose transmission mechanism is unknown; 3. transfusion bags containing blood or haemocomponents rejected due to contamination or bad conservation, or with the validity date expired, and those coming from incomplete collection; 4. residues of laboratory samples containing blood or corporeal liquids, recipients and materials resulting from health care process, containing blood or corporeal liquids in free form;
	A.2	1. carcass, anatomic parts, viscera and other wastes proceeding from animals submitted to experimental processes with inoculation of microorganisms, as well as their furring, and the corpses of animals suspected of carrying epidemiologically important microorganisms and holding dissemination risk, which have been submitted or not to anatomic-pathologic studied or diagnostic confirmation;

	A.3	1. anatomic parts (limbs) of human body; fecundation product without vital signs, weighing less than 500 grams or measuring less than 25 centimeters or pregnancy age lower than 20 weeks, not holding scientific or legal values and which has not been requested by the patient or family;
	A.4	1. disposed arterial, endoveined and dyaliser kits; 2. air filters and gases aspirated from contaminated area; filtering membrane from medical-nosocomial and research equipment, and other suchlike; 3. residues of laboratory samples and their recipients containing faeces, urine and secretions, proceeding from patients not carrying nor being suspect of carrying Class Risk 4 agents, and neither present epidemiologic relevance and dissemination risk, or microorganism causer of emerging disease which may become epidemiologically important or whose transmission mechanism is unknown or suspected of contamination with prions. 4. waste of adipose tissue coming from liposuction, liposculpture or another plastic surgery procedure which may generate this kind of waste; 5. recipients and materials resulting from health care process not containing blood or corporeal liquids in free form; 6. anatomic parts (organs and tissues) and other wastes coming from surgical procedures or anatomic-pathological studies or diagnosis confirmation; 7. carcasses, anatomic parts, viscera and other wastes proceeding from animals not submitted to experimental processes with the inoculation of microorganisms, as well as their furring; and 8. empty transfusion bags or containing pos-transfusion residual volume.
	A.5	1. organs, tissues, organic fluids, piercing or scratching materials and other materials resulting from health care to individuals or animals, suspect or carrying contamination with prions.
2. Group B:	Wastes containing chemicals which may present risk to public health or the environment, depending on their flammability, corrosiveness, reactivity and toxicity characteristics. a) hormonal and antimicrobial products; cystostatic; antineoplastic; immunesupressor; digital; immunemodulators; anti-retroviral, when disposed by health services, pharmacies, drugstores and medicine wholesalers or the apprehended ones and the wastes and the pharmaceutical inputs of medicines controlled by governmental Decree MS 344/98 and its updates; b) sanitation, disinfectants and disinfesting wastes; wastes containing heavy metals; reagents for laboratories, including the recipients contaminated by those; c) effluents from image processing equipment (developers and fixers); d) effluents from automatic equipment used in clinical analysis; and e) other products considered as hazardous, according to the classification of NBR 10.004 by ABNT (toxic, corrosive, inflammable and reactive).	
3. Group C:	Any materials resulting from human activities containing radionuclide in quantities superior to the elimination limits specified by the rules of the Nuclear Energy National Commission -CNEN and for which the reuse is either inadequate or nor foreseen. a) this group comprises any materials resulting from research and learning laboratories in health care area, clinical analysis and nuclear medicine and radiotherapy laboratories which may contain radionuclide in a quantity superior to the elimination limits.	
4. Group D:	Wastes which do not present biologic, chemical or radiological risk to health or the environment, and thus may be considered as domestic waste. a) toilet paper and diaper, feminine napkin, wastable clothes, leftovers of patients, material used in anti-sepsis and hemostasy, serum equipment and other suchlike not classified as A1; b) leftovers and cooking; c) leftovers of canteens; d) wastes coming from administrative areas; e) sweeping wastes, flowers, trimming and garden; and f) gypsum wastes coming from health care services.	
5. Group E:	Piercing or scratching materials such as: shaving blades, needles, scalps, glass ampoules, bits, endodontic fines, diamond points, scalpels blades, lancets; capillary tubes; micropipettes; blades and little laminas; spatulas; and all glass utensils broken in the laboratory (pipettes, blood collection tubes and Petri plates) and other suchlike.	

2.3.3 Selection of Target Medical Institutions

There are 475 factories in the factory list provided by SUFRAMA, and of those, 18 factories are located outside the target area, the MFZ. A total of 457 PIM factories in the MFZ area were contacted to confirm whether they had an attached clinic. The following results were

found according to their responses.

- Factories that responded by telephone: 334
- Factories that have closed: 17
- Factories that refused to reply: 25
- Factories that could not be reached by telephone: 81

In this survey, it was revealed that 440 factories are PIM factories operating in the MFZ, including those which could not be reached by telephone (which was likely due to a changed phone number, etc.) and excluding the 17 which have closed.

It was found that at least 1/3 of the total (35.3%), or 124 factories, have an attached clinic. Of those 124, nine within the PIM were chosen for direct interview using the prepared survey questionnaire. A summary of these medical facilities, including one general hospital in the PIM, is given below.

Table 2-21: Summary of Medical Facilities

Type	No. Surveyed	No. of Employees *1	No. of Beds	Avg. No. of Inpatients/Day	Avg. No. of Outpatients/Day
General Hospital	1	439	70	48	900 (*3)
Attached factory clinic	9	4.1 (*2)	1.2 (*2)	No reply	19 (*2)

Notes: *1: Including part-time employees
*2: Average of 9 clinics
*3: Of this number, 22 were emergency room outpatients

2.3.4 Execution of the Survey

A local consultant (OPCA) was consigned to conduct the study on 19 June 2009. Immediately after the contract was signed, the local consultant contacted all PIM factories approved by SUFRAMA by telephone, etc., and inquired about the existence of a clinic on premises, then selected the target medical facilities before beginning the direct interview process. Finally, working with the study team, the survey results were compiled by the end of August. The interview survey and summary of results was completed by the end of July, as planned, and the results were analyzed together with the study team in August before being summarized into a report.

Although questionnaire survey and analysis of the survey results were done base on the waste categories of ABNT NBR 12809, those have been revised based on the waste categories the designated by the RDC 306/2004-ANVISA.

2.3.5 Results of the Survey

The results of the questionnaire survey are given below.

a. General Information

Q.1. What is the number of employee (all staffs including doctors, nurses, etc. who work in the institution)?
Q.2. Category of the medical institution.

Base: Population = 10					
Q1 and Q2		Full time		Part time	
Category of the institution	Number	Total	Average	Total	Average
1. General Hospital	1	240	240	199	199
2. Clinic	9	25	2.8	12	1.3
Grand Total	10	265	---	211	---

Q.3. Type of institution:

Base: Population = 10		
Q3	Answer	%
1. Public	0	0.0
2. Private	10	100.0
3. Others	0	0.0
Total	10	100.0

Q.4. Outline of institution:

1. Number of beds [beds]

Base: Population = 10					
Category	Number	Number of Beds			
		Total	Average	Maximum	Minimum
1. General Hospital	1	70	---	---	---
2. Clinic	9	11	1.2	5	0
Total	10	81	---	---	---

2. Average bed occupation rate [%]
3. Average number of in-patients [patients /day]
4. Average number of out-patients [patients /day]

Base: Valid answer : General hospital = 1 , Clinic = 2			
Category	Average Occupation rate	Average Number of in-patients	Average Number of out-patients
	%	patients/day	patients/day
1. General Hospital	42	48	22
2. Clinic	No answer	No answer	19

b. Waste Management

b.1 Generation

Q.5. How many quantity do you generate common waste (Group D)?

Base: Valid answer : General hospital = 1 , Clinic = 8					
Category	Number	Quantity (kg/week)			
		Total	Average	Maximum	Minimum
1. General Hospital	1	658	---	---	---
2. Clinic	8[*1]	65.25	8.2	26.5	0.15

Total	9	723.25	---	---	---

（Note ）: 1 clinic did not an answer

Q.6. Please describe what types of hazardous health-care waste (Group A, B, C and E,) you generate and the approximate quantities of such wastes.

Base: Population 10

Types	Group A					Group B	Group C	Group D	Group E
No. of Medical institution	A1	A2	A3	A4	A5				
1	YES		YES	YES		YES		YES	YES
2	YES			YES				YES	YES
3	YES			YES		YES		YES	YES
4				YES				YES	
5				YES		YES		No answer	YES
6	YES		YES					YES	
7	YES			YES				YES	YES
8				YES		YES		YES	YES
9	YES			YES		YES		YES	
10				YES				YES	

Base: Population : General hospital = 1, Clinic = 9

Group		General Hospital		Clinic				
		Generation Yes/No	Quantity (kg/week)	Generation Yes	Total (kg/week)	Average (kg/week)	Maximum (kg/week)	Minimum (kg/week)
Group A	A.1	Yes	42.1	5	10.2	1.1	5.0	0.5
	A.2	No	0	0				
	A.3	Yes	56.8	1	6.1	0.7	6.1	6.1
	A.4	Yes	60.5	8	16.4	1.8	6.8	0.023
	A.5	---	---	---	---	---	---	---
Group B		Yes	11.7	4	17.3	1.9	15.8	0.023
Group C		No	0	0				
Group E		Yes	23.8	5	26.8	3.0	25.9	0.023
Total		---	194.9	---	76.8	8.5	---	---

b.2 Storage, Discharge, Collection

b.2.1. Collection system inside the Institution

Q.7. Specify the present waste collection system in your institution.
(Please tick in the following table)

a. We use a standard system with containers or colored bags with labels
b. Others

Base: Population : General hospital = 1, Clinic = 9

Group		General Hospital		Clinic		
		Yes/No	Answer	Generation Yes	a	b
Group A	A.1	Yes	a	5	1	4

A.2	No	---	0	0	0
A.3	Yes	a	1	1	0
A.4	Yes	a	8	2	6
A.5	---	---	---	---	---
Group B	Yes	a	4	2	2
Group C	No	---	0	0	0
Group E	Yes	a	6	2	3
Group D	Yes	a	9	5	4

Q.8. Describe the present container for collection of common/hazardous health-care waste in your institution.

(Please tick in the following table)

a. Plastic bag
b. Paper bag
c. Open container
d. Container with lid
e. Cardboard box
f. Others

Base: Population : General hospital = 1, Clinic = 9

Group		General Hospital		Clinic							
		Yes/No	Answer	Generation Yes	a	b	a & b	d	a & d	e	No answer
Group A	A.1	Yes	a & b	5	2			3			
	A.2	No	---	0							
	A.3	Yes	a & b	1				1			
	A.4	Yes	a & b	8	1	1	1	4			1
	A.5	---	---	---	---	---	---	---		---	---
Group B		Yes	a & b	4	1			1	1		1
Group C		No	---	0							
Group E		Yes	e	6				1		3	2
Group D		Yes	a & b	9	2			2			5

b.2.2. Storage

Q.9. How do you store common waste and hazardous health-care waste?

Base: Population = 10

Q9		Answer	%
1. We mix them all together.	(Go to Q.10)	1	10.0
2. We store them separately.	(Go to Q.11)	9	90.0
Total		10	100.0

Q.10. Why don't you separate hazardous health-care waste?

Base: Population = 1

Q10	Answer	%
1. There is no reason to separate them.	0	0.0
2. It is troublesome to separate them.	0	0.0
3. The waste collectors separate them.	0	0.0
4. Others (Description => No answer)	1	100.0
Total	100.0	100.0

Q.11. How do you store your waste within your institution?
(Please tick in the following table)

a. Plastic bag
b. Paper bag
c. Open container
d. Container with lid
e. Cardboard box
f. Others

Base: Population : General hospital = 1, Clinic = 9

Group		General Hospital		Clinic					
		Yes/No	Answer	Generation yes	a	a&b	d	e	No answer
Group A	A.1	Yes	a & d	5			3	1	1
	A.2	No	---	0					
	A.3	Yes	a & d	1			1		
	A.4	Yes	a & d	8		1	5		2
	A.5	---	---	---	---	---	---	---	---
Group B		Yes	a & d	4			3		1
Group C		No	---	0					
Group E		Yes	e	6			2	2	2
Group D		Yes	a & b	9	1		3		5

Q.12. Is there cool storage room or faculties for pathological wastes in your institution?

Base: Population = 9

Q12	Answer	%
1. Yes	0	0.0
2. No	9	100.0
Total	9	100.0

b.2.3. Disposal (Intermediate treatment and final disposal)

Q.13. What do you do with your waste?
(fill in first two columns of following table)

a. Place outside for collection by SEMMA/SEMULSP or other collectors
b. Directly carry the waste to a waste collection vehicle
c. Take the waste to waste collection point of SEMMA/SEMULSP or other collectors
d. SEMMA/SEMULSP or other collectors collects from institution (including own bin)
e. Bury on site
f. Open burning
g. Recycle
h. Incinerate by the incineration in the institution
i. Autoclave disinfection on site
j. Open dumping outside property
k. Other

Base: Population : General hospital = 1, Clinic = 9

Group		General Hospital		Clinic					
		Yes/No	Answer	Generation yes	c	d	c & d	g	No answer
Group A	A.1	Yes	d & i	5	1	4			
	A.2	No	---	0					

A.3	Yes	d	1			1		
A.4	Yes	d	8	1	3			4
A.5	---	---	---	---	---	---	---	---
Group B	Yes	b	4		2			2
Group C	No	---	0					
Group E	Yes	d	6		4			2
Group D	Yes	d & g	9	1	1	1	3	3

Q.14. For the health-care waste collection by SEMMA/SEMULSP or other collectors, how are they disposed of?

a. Disposed of to the Manaus city landfill together with other waste
b. Buried in a special pit at the landfill
c. Burned at the landfill
d. Incinerated at an incinerator
e. Others

Base: Population : General hospital = 1, Clinic = 9					
Group		General Hospital	Clinic		
		Answer	Generation yes	d	No answer
Group A	A.1	b&e	5	4	1
	A.2	---	0		
	A.3	b	1		
	A.4	b	8	5	3
	A.5	---	---	---	---
Group B	B.1	b	4	2	2
Group C	B.2	---	0		
Group E	B.3	b	6	5	3

Q.15. If you chose **g.** in Q.13, go to "Additional Sheet A".

A general hospital and three clinics are recycling some common waste (Group D).

Item	Valid answer	Quantity (Average) (kg/week)	Price (R$/kg)	Buyer	Method	Collection frequency
(1) Paper	3	2.1	---	Recycler	The Recycler collects	Weekly / Monthly
(2) Cardboard	3	18.1	0.03	Recycler	The recycler collects	Weekly / Bimonthly
(3) Glass bottles	0					
(4) Metal	0					
(5) Organic waste	0					
(6) Other	2	2.0	---	Recycler	The Recycler collects	Monthly

Q.16. If you chose **h.** in Q.13, please provide the following information for the incinerator.
- All medical institutions treat their waste through incineration.

Q.17. If you chose **i.** in Q.13, please provide the following information for the autoclave.
- The general hospital reported it treats its Group A.1 (Biologic) using an autoclave, however the specifications were not included.

Q.18. If you ticked **j.** in Q.13, where do you dump your waste outside your institution?
- None of the medical institution are disposing of waste via "open dumping".

b.2.4. Discharge

Q.19. How do you discharge health-care wastes?

Base: Population = 10		
Q19	Answer	%
1. We separate store but mix discharge.	2	20.0
2. We separate store and separate discharge.	8	80.0
3. We mix store and mix discharge.	0	0.0
Total	10	100.0

Q.20. In case of "**separate store but mix discharge**", who mixes them?

Base: Population = 2		
Q20	Answer	%
1. Collector	0	0.0
2. Our employee	2	100.0
3. Others	0	0.0
Total	2	100.0

Q.21. Please tick appropriate boxes on the answer table to indicate your discharge manner of health-care wastes.

Base: Population = 10

Group		General Hospital	Clinic				
			1. separated discharge	2. Mixed discharge			3. not generated
				same class*1	Group A, B and C*2	All class*3	
Group A	A.1	Separated	3		2		4
	A.2	Not generated	0				9
	A.3	Separated	1				8
	A.4	Separated	6		1		2
	A.5	---	---	---	---	---	---
Group B		Separated	2		2		5
Group C		Not generated	0				9
Group E		Separated	5	1	1		2
Group D		Separated and mixed	9				

Remark
*1 : Mixed discharge with other waste of the same class
*2 : Mixed discharge with Group A, Group B and Group C.
*3 : Mixed discharge with Group A, B, C, D and E.

b.2.5. Collection of Hazardous health-care waste

Q.22. Are you provided with a hazardous health-care waste collection service? (either direct collection or nearby waste collection points or direct pickup from institution – items **a, b, c or d** in Q.13)

Base: Population = 10		
Q22	Answer	%

1. Yes	10	100.0
2. No	0	0.0
Total	10	100.0

Q.23. Who collects your waste?

Base: Population = 10		
Q23	Answer	%
1. SEMMA/SEMULSP	1	10.0
2. Private company other than SEMMA/SEMULSP	9	90.0
3. Don't know	0	0.0
Total	10	100.0

Q.24. How often do you discharge your garbage and how often is it collected? (tick one)

Base: Population = 9

Q24		Group A		Group B and C	
		Discharge	Collection	Discharge	Collection
1.	Once daily	5	2	2	1
2.	Every 2-3 days				
3.	Every 4-5 days	1		1	
4.	Weekly	2	2	1	1
5.	Less than weekly		0		
6.	Irregularly		2		2
7.	Other	1	3	1	1

Q.25. Do you pay the SEMMA/SEMULSP or a private collector an official waste collection fee for hazardous health-care waste?

Base: Population = 10		
Q25	Answer	%
1. Yes	6	60.0
2. No	4	40.0
Total	10	100.0

If Yes, how much is this fee? And what type of wastes does it cover?

Base: Population = 6

Waste Type	Payment
Health-care waste	3.6 R$/kg (Average : 3 institutions) 210 R$/week (1 Institutions) 415 R$/month (2 institutions)

Q.26. Are you satisfied with the existing hazardous health-care waste collection and disposal service?

Base: Population = 10		
Q26	Answer	%
1. Yes	7	70.0
2. No	3	30.0
Total	10	100.0

If No, Why? (tick one or more)

Base: Population = 3			
		Answer	Why?
1.	Discharge system is poor (e.g. no bins, bins are broken or too small)		
2.	Waste collection point is too far away		
3.	Waste collection/sweeping is not properly done		
4.	Waste collection service/sweeping is irregular		
5.	Waste collection/sweeping frequency is too low		
6.	Collection time is too early or too late		
7.	Waste collection workers behave badly		
8.	Waste collection workers demand payment for waste collection	1	Due to the quantity of wastes generated being insignificant we pay for the price of one removal
9.	Waste collection fee of the SEMMA/SEMULSP or a private collector is too high	1	Due to the quantity of wastes generated being insignificant we pay for the price of a normal removal + transportation fee
10.	Lack of recycling		
11.	Problems with handling health-care waste		
12.	Other	2	- We lack a company to work with that kind of waste to carry out the incinerations process - The updating of the requested documents takes too much time

Q.27. How many times have you complained about the hazardous health-care waste collection service in the last year?

Base: Population = 10		
Q27	Answer	%
1. None	10	100.0
2. Once only	0	0.0
3. Several times	0	0.0
4. More than five times	0	0.0
Total	10	100.0

Q.28. Is any staff member of your institution responsible for ensuring that hazardous health-care waste is collected and disposed of properly?

Base: Population = 10		
Q28	Answer	%
1. Yes	10	100.0
2. No	0	0.0
Total	10	100.0

b.2.6. Improvements to hazardous health-care waste collection and disposal

(1) General

Q.29. What improvements would you like to see to hazardous health-care waste collection and disposal? (Please tick one or more and priorities the top three improvements you would like to see (1 = first priority, 2 = second priority, 3 = third priority)

Base: Population = 8	
Q29	Priority

		First	Second	Third
1.	Improved waste discharge system			
2.	Shorter distance to waste collection point			
3.	More reliable waste collection service			
4.	Improved collection frequency	1		
5.	Greater recycling of waste	1		1
6.	Improved collection and disposal of health-care waste			
7.	Improvement of landfill operation	2	1	
8.	Education to change people's bad habits	3	4	1
9.	Other	1		

Q.30. Improved waste collection and disposal will cost additional money. Who do you think should pay these costs? (tick one or more)

Base: Population = 9		
Q30	Answer	%
1. Amazonas state	3	30.0
2. Manaus city	2	20.0
3. Individual medical institution	3	30.0
4. Other	2	20.0
Total	10	100.0

Q.31. Suppose that you are satisfied with the hazardous health-care waste management service, either as is or as a result of improvement. Think for a moment about the largest amount of money that your medical institution would be willing to pay each month as the collection fee.

Base: Population = 5			
Valid Answer	Average (R$/month)	Maximum (R$/month)	Minimum (R$/month)
5	145	500	25

Q.32. If the current hazardous health-care waste collection fee is more than this amount, your medical institution will not be able to afford to pay and will not be able to use the waste collection service. If you are still not willing to pay the current waste collection fee, explain the reason why below:

Base: Population = 10		
Q32	Answer	%
1. I pay	0	0.0
2. I don't pay.	10	100.0
Total	10	100.0

(2) Training and Instructions

Q.33. Is there some written instruction to separate and manage hazardous health-care waste in the institution?

Base: Population = 10			
	Q33	Answer	%
1. Yes		10	100.0
2. No	(Go to Q.35)	0	0.0
	Total	10	100.0

Q.34. How often the staff of waste management is trained as a caution against contaminated or hazardous health-care waste?

Base: Population = 10		
Q34	Answer	%
1.Only at the start of the job	2	20.0
2.Once a year	5	50.0
3. Very often, please explain how often	3	30.0
4. Never	0	0.0
Total	10	100.0

(3) Environmental education and general cleanliness

Q.35. Has anyone of this institution received any health and environmental education or information relating to hazardous health-care waste? Yes/No
If YES, no of people: [_____]

Base: Population = 10					
Q35-1	Answer	%	Number of people		
			Average	Maximum	Minimum
1. Yes	8	80.0	336	1,500	1
2. No	2	20.0	---	---	---
Total	10	100.0	---	---	---

And where did this information come from?

Base: Population = 10		
Q35	Answer	%
1. School	0	0.0
2. Leaflets/posters, etc.	3	30.0
3. Medical worker/centre/hospital	4	40.0
4. Community organization/NGO	0	0.0
5. Newspaper	0	0.0
6. Radio program	0	0.0
7. TV program	0	0.0
8. SEMMA/SEMULSP	0	0.0
9. Government of Amazonas State	0	0.0
10. Federative Republic of Brazil (e.g. Ministry of Health, Ministry of Environment, etc.)	1	10.0
11. Other	6	60.0
Total	14	---

Q.36. Do you think that a campaign to raise the awareness of people for maintaining a cleaner city and environment is necessary? (tick one)

Base: Population = 10		
Q36	Answer	%
1. Very necessary	9	90.0
2. Somewhat necessary	1	10.0
3. Not very necessary	0	0.0
4. Not necessary at all	0	0.0
Total	10	100.0

c. Financial Matter

Q.37. How much do you pay for hazardous health-care waste collection services per month?

Q.38. How much do you pay for common waste (Class C) collection services per month?
Amount of money: [_____] R$/month

Base: Population = 10					
Group		Answer	Collection fee (R$/month)		
			Average	Maximum	Minimum
Group A	A.1	3	107	280	15
	A.2	0			
	A.3	0			
	A.4	5	265	500	8.4
	A.5	---	---	---	---
Group B		3	29	50	8.4
Group C		0			
Group E		6	120	270	8.4
Group D		3	609	1,643	170

d. Cooperation for Waste Management

Q.39. Coping with wastes requires efforts of not only the municipality but also the general public. Do you think there is something which your institution can do for good waste management?

Base: Population =		
Q39	Answer	%
1.Very necessary	10	100.0
2. Somewhat necessary	0	0.0
3. Not very necessary	0	0.0
4. Not necessary at all	0	0.0
Total	10	100.0

Q.40. What do you think your institution can do? (plural answer question)

Base: Population =		
Q40	Answer	%
1. Discharging wastes neatly.	7	70.0
2. Minimizing waste generation.	8	80.0
3. Reusing wastes.	5	50.0
4. Recycling wastes.	5	50.0
5. Treating toxic/infectious wastes appropriately.	5	50.0
6. Raising the environmental awareness of the public.	10	100.0
7. Providing information to the public.	4	40.0
8. Researching activities.	2	20.0
9. Others	0	0.0
Total	46	100.0

Q.41. Do you think the medical institutions should cooperate with the country and/or municipality in managing wastes?

Base: Population = 10		
Q41	Answer	%
1.Yes	10	100.0
2. No	0	0.0
3. I don't know.	0	0.0
4. Others	0	0.0
Total	10	100.0

Q.42. How is the trend of your cost for waste management?

Base: Population = 10		
Q42	Answer	%
1. It is getting significantly higher.	2	20.0
2. It is getting higher.	4	40.0
3. It is relatively stable.	2	20.0
4. It is getting lower.	1	10.0
5. Others	0	0.0
No answer	1	10.0
Total	10	100.0

Q.43. How do you give the priority on the management of your wastes?

Base: Population = 10		
Q43	Answer	%
1. We give very high priority.	7	70.0
2. We give moderate priority.	3	30.0
3. We give little priority.	0	0
4. Others	0	0
Total	10	100.0

Q.44. Do you feel you need a support from the government or municipality or any other relevant organizations for the management of your waste? (plural answer question)

Base: Population = 10		
Q44	Answer	%
1. Yes, we need financial support.	3	30.0
2. Yes, we need technical support.	5	50.0
3. Yes, we need support of other kinds	2	20.0
4. No, we don't.	1	10.0
5. Others	0	0.0
Total	11	100.0

- The medical institutions which answered (3.) indicated a need for the following support.

1. Basic sanitation
2. Government support for the awareness of the population and installation of more collectors for recycling in strategic points.

e. Other

Q.45. Do your medical institution use radioactive material or Source?

Base: Population = 10			
	Q45	Answer	%
1. Yes	go to "Additional Sheet B"	0	0.0
2. No		10	100.0
	Total	10	100.0

Q.46. If there any additional comments you would like to make about solid waste management provision and your needs, please comment below:

- One (1) medical institution provided the following comment.

1. The payment is for both common and health-care waste.

f. Results of Waste Amount, Generation Rate and Waste Streams

f.1 Generation Amount of Health-care Waste in ABNT NBR 12809 Category

The generation amount of health-care waste in ABNT NBR 12809 Category for the 10 medical institutions is given below.

Table 2-22: Amount of Health-care Waste (in ABNT NBR 12809 Category) Generated by Target Medical Institutions

Unit: kg/day

Category of Health-care Waste	General Hospital	Clinics (*1)
Class A: Infectious Waste	**26.16**	**0.96**
A.1. Infectious waste	4.19	0.16
A.2. Blood and derivates	1.83	0.01
A.3 Surgical, anatomo-pathologic and exudates	8.11	0.10
A.4 Piercing or cutting	3.40	0.43
A.5 Contaminated animal	---	---
A.6 Patient care	8.63	0.26
Class B: Special Waste	**1.67**	**0.27**
B.1 Radioactive waste	---	---
B.2 Pharmaceutical waste	1.00	0.11
B.3 Hazardous chemical waste	0.67	0.16
Total of Class A and B (Hazardous Waste)	**27.83**	**1.22**
Class C: Common Waste	**94.0**	**1.17 (*2)**
Total	**121.83**	**2.40**

Note: *1: Average number for 9 clinics

*2: This number is less than the amount of hazardous health-care waste generated. The reason being that it is discharged as non-process, non-hazardous waste from another place within the factory, and the clinic does not that this discharge into consideration. One clinic did not respond.

f.2 Generation Amount of Health-care Waste in RDC 306/2004-ANVISA Category

The generation amount of health-care waste in RDC 306/2004-ANVISA Category for the 10

medical institutions is given below.

Table 2-23: Amount of Health-care Waste (in RDC 306/2004-ANVISA Category) Generated by Target Medical Institutions

Unit: kg/day

Category of Health-care Waste	General Hospital	Clinics
Group A	**22.76**	**0.52**
A.1. Biologic	6.01	0.16
A.2. Animals	---	---
A.3 Body part	8.11	0.10
A.4 Patient care etc.	8.64	0.26
A.5 Prions	---	---
Group B: Chemical etc.	**1.67**	**0.27**
Group C: Radioactive	**---**	**---**
Group E: Piercing or Cutting	**3.40**	**0.44**
Total of Group A, B, C and E (Hazardous Waste)	**27.83**	**1.22**
Group D: Common waste	**94.00**	**1.17**
Total	**121.83**	**2.40**

f.3 Number of Factories with a Clinic

124 factories of 334 surveyed have a clinic within their compound. It is estimated 163 (= 124 x 440/334) factories have a clinic in PIM in total.

f.4 Generation Rate and Amount of Health-care Waste Generated from Factories in PIM

As 163 factories have a clinic in PIM in total, the generation amount of health-care waste generated from factories in PIM and generation rate per an employee is calculated as follows:

Generation Amount of Factories in PIM = Generation Rate per a Clinic x 163

Generation Rate per an Employee = Generation Amount of Factories in PIM / Number of Employees in PIM (116,192)

Table 2-24: Generation Rate and Amount of Health-care Waste Generated from Factories in PIM

Group		Description	Generation Rate per a Clinic (kg/clinic/day)	Generation Amount of Factories in PIM (kg/day)	Generation Rate per an Employee (g/employee/day)
1.Group A	A.1	Biologic	0.16	26.1	0.22
	A.2	Animals	0.00	0.00	0.00
	A.3	Body part	0.10	16.3	0.14
	A.4	Patient care etc.	0.26	42.4	0.36
	A.5	Prions	---	---	---
2. Group B		Chemical etc.	0.27	44.1	0.38
3. Group C		Radioactive waste	0.00	0.00	0.00
4. Group E		Piercing or Cutting	0.44	71.9	0.62
Hazardous Health-care Waste Sub-total			1.23	200.8	1.73
5. Group D		Common waste	1.17	191.1	1.64
Total			2.40	391.9	3.36

The amount of health-care waste generated in PIM including a general hospital is shown in the table below.

Table 2-25: Amount of Health-care Waste Generated in PIM

Unit: kg/day

Category	Whole Factories in PIM (B x 440 /334) (kg/day)	General Hospital (kg/day)	Whole PIM (E = C + D) (kg/day)
Group A	84.8	22.7	107.5
Group B	44.0	1.7	45.7
Group C	0.0	0.0	0.00
Group E	71.7	3.4	75.1
Hazardous Health-care Waste Total	200.5	27.8	228.3
Class D	190.7	94.0	284.7
Health-care Waste Total	391.2	121.8	513.0

f.5 Health-care Waste Generation

Health-care waste generation from factories in PIM excluding a general hospital is as follows:

- Hazardous Health-care Waste: 200.5 kg/day
- Non-hazardous Health-care Waste: 190.7 kg/day
- Total Health-care Waste: 391.2 kg/day

Given the above information, the daily generation amount from the target area (PIM), including the one general hospital, of hazardous and non-hazardous health-care waste is estimated as follows:

- Hazardous Health-care Waste: 228.3 kg/day
- Non-hazardous Health-care Waste: 284.7 kg/day
- Total Health-care Waste: 513.0 kg/day

f.6 Present Health-care Waste Management Stream

The present health-care waste management stream in PIM, according to the survey of medical institutions, is shown in the following figures.

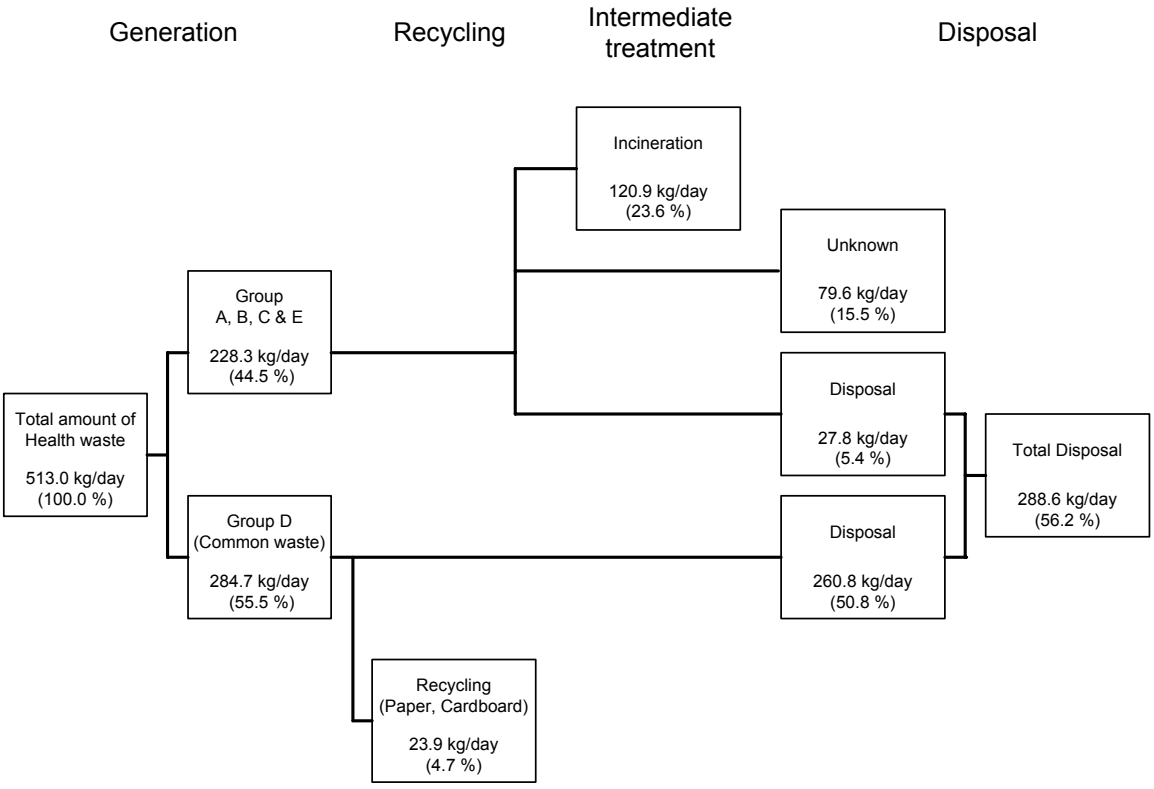

Figure 2-7: Health-care Waste Management Stream in PIM including General Hospital

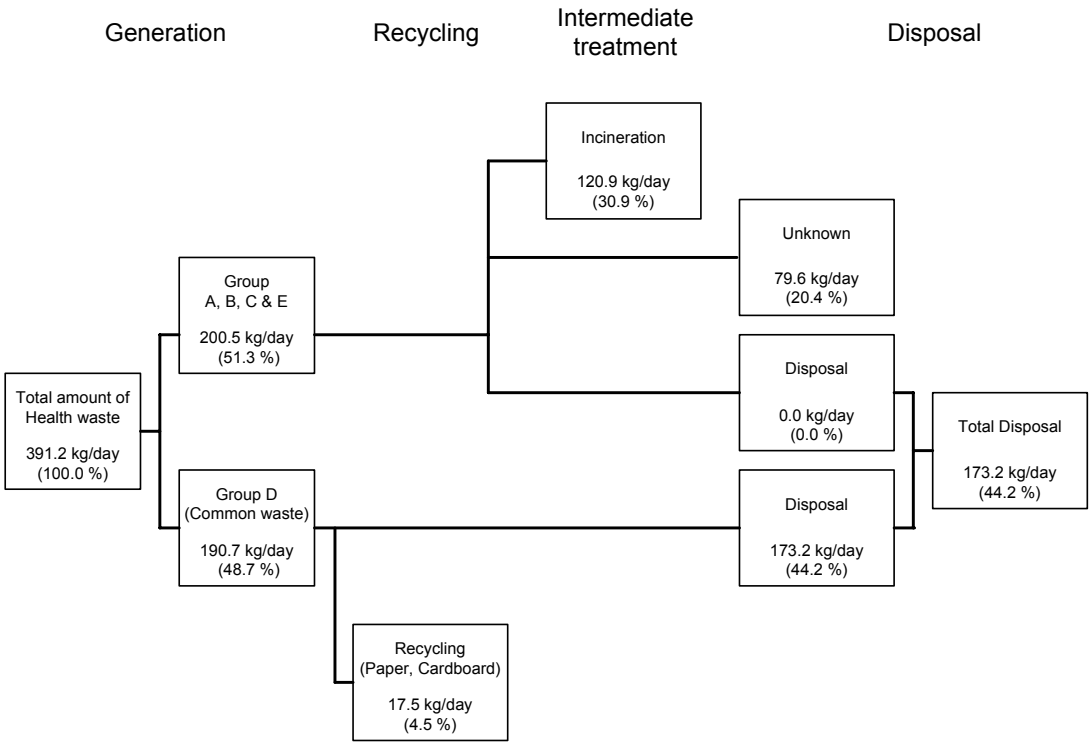

Figure 2-8: Health-care Waste Management Stream in PIM excluding General Hospital

2.3.6 Questionnaire of Medical Institution Survey

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Introduction of the Medical Institution Survey

"The Study for the Development of an Integrated Solution related to Industrial Waste Management in the Industrial Pole of Manaus" is being carried out by JICA (Japan International Cooperation Agency) Study Team with the cooperation of SUFRAMA.
The questionnaire survey to the medical institutions is being carried out by SUFRAMA and by the JICA Study Team. The purpose of this survey is to understand the generation amount of common waste and hazardous health-care waste, the waste management practices of the medical institutions in PIM in terms of segregation, storage, discharge, collection, treatment and final disposal, and the opinions of the institutions for the improvement of health-care waste management.
The health-care waste generated in a medical institution in this context is divided into Class A : Infectious waste (hazardous health-care waste), Class B : Special waste (hazardous health-care waste), and Class C : Common waste (non-hazardous health-care waste). The results of this survey, together with other engineering investigations (Factory survey, Waste management company survey, etc.), will be used for the formulation of Waste stream (Waste Stream) for PIM.
Your institution has been selected to participate in this survey. The questionnaire should be answered by a responsible person on SWM in your institution. It should take about 1-2 hours to complete. All answers are confidential and your help is greatly appreciated.

Questionnaire to Medical Institutions

No.

1_General Information

Date : _____

Name of the medical institution : _____
Name of interviewee : _____
Position within this medical institution : _____
Address : _____
Phone and facsimile number : Phone _____
: Fax _____
E-mail : Address _____
Name of Interviewer : _____

1_2 General Information

Q.1. What is the number of employee (all staffs including doctors, nurses, etc. who work in the institution)? full-time [_____] persons
part-time [_____] persons

Q.2. Category of the medical institution.
[ ] 1. General hospital
[ ] 2. Clinic
[ ] 3. Others (specify :_____)

Q.3. Type of institution:
[ ] 1. Public
[ ] 2. Private
[ ] 3. Others (specify: _____)

Q.4. Outline of institution:
1. Number of beds : [_____] beds
2. Average bed occupation rate : [_____] %
3. Average number of in-patients : [_____] patients /day
4. Average number of out-patients : [_____] patients /day

2_Waste Management

2_1 Definition of waste generated in medical institutions

The **NBR 12808** defines the **waste generated in a medical institution** as "health-care waste". In this questionnaire it is divided 3 classes i.e. **Class A. Infectious waste, Class B. Special waste** and **Class C. Common waste.**.

A detailed classification of health-care waste is summarized in the table below.

Waste Class	Waste Type	Description
1. Class A: Infectious Waste	Type A.1 Biologic	Culture, inoculums, mix of micro organisms and inoculated culture from clinical or research laboratory, expired or out of use vaccine, filter of gases vacuumed up from areas contaminated with infectious agents and any waste contaminated by such materials.
	Type A.2 Blood and derivates	Blood bag after transfusion with expired date or positive serology, blood sample for analysis, serum, plasma and other sub products.
	Type A.3 Surgical, anatomopatologic and exudates	Tissue, organ, fetus, anatomic parts, blood and other organic liquids arisen from surgeries, necropsy and other waste contaminated by such materials.
	Type A.4 Piercing or cutting	Needle, ampoule, pipette, bistoury blade

		and glass.
	Type A.5 Contaminated animal	Skeleton or part on inoculated animal, exposed to pathogenic microorganisms or possessing infectious contagious disease, as well as other waste which could have been in touch with those.
	Type A.6 Patient care	Secretions, excretions and other organic liquids coming from patients, as well as the waste contaminated by such material, including leftovers.
2. Class B: Special waste	Type B.1 Radioactive waste	Radioactive or material contaminated with radionuclide coming from clinical analysis laboratories, nuclear medicine services and radiotherapy (see Resolution CNEN-NE- 6.05).
	Type B.2 Pharmaceutical waste	Expired, contaminated, prohibited or not used medicine.
	Type B.3 Hazardous chemical waste	Toxic, corrosive, flammable, explosive, reactive, genotoxic or mutagenic waste, as per NBR 10004.
3. Class C: Common waste		All those not fitting types A and B and which, due to their similarity to domestic waste, offer no additional risk to public health. Such as, administrative activity waste, sweeping and garden cleaning and leftovers with have not been in touch with patients.

Source : NBR 12808 : Waste from health care units – Classification (Jan 1993)

2_2 Generation

The interviewer should get enough information to estimate generation amount of each waste!! For this purpose in case the answer is bags/week, please specify the volume of a bag.

[_____] litters/bag

If you are not sure of the weight or volume, please estimate the number of garbage loads (e.g. handcarts, containers) collected from your institution per week: [_____]

Q.5. How many quantity do you generate common waste (Class C)?

Class	Quantity	unit (kg/day or kg/week)
Class C (Non-hazardous health-care waste)		

Q.6. Please describe what types of common waste and hazardous health-care waste you generate and the approximate quantities of such wastes.

Types		Yes/No	Quantity (units)	
			kg/week	liter/week
Class A	A.1 Infectious waste			
	A.2 Blood and derivates			
	A.3 Surgical, anatomopatologic and exudates			
	A.4 Piercing or cutting			
	A.5 Contaminated animal			
	A.6Patient care			

Class B	B.1 Radioactive waste			
	B.2 Pharmaceutical waste			
	B.3 Hazardous chemical waste			

2_3 Storage, Discharge, Collection

2_3_1 Collection system inside the Institution

Q.7. Specify the present waste collection system in your institution.
(Please tick in the following table)
c. We use a standard system with containers or colored bags with labels
d. Others

Waste Class / Types		Main method	Other method, if any (specify)
Class A	A.1 Infectious waste	a.	b.
	A.2 Blood and derivates	a.	b.
	A.3 Surgical, anatomopatologic and exudates	a.	b.
	A.4 Piercing or cutting	a.	b.
	A.5 Contaminated animal	a.	b.
	A.6Patient care	a.	b.
Class B	B.1 Radioactive waste	a.	b.
	B.2 Pharmaceutical waste	a.	b.
	B.3 Hazardous chemical waste	a.	b.
Class C		a.	b.

Q.8. Describe the present container for collection of common/hazardous health-care waste in your institution.
(Please tick in the following table)
a. Plastic bag
b. Paper bag
c. Open container
d. Container with lid
e. Cardboard box
f. Others

Waste Class / Types		Main method	Other method, if any (specify)
Class A	A.1 Infectious waste	a. b. c. d. e.	f.
	A.2 Blood and derivates	a. b. c. d. e.	f.
	A.3 Surgical, anatomopatologic and exudates	a. b. c. d. e.	f.
	A.4 Piercing or cutting	a. b. c. d. e.	f.
	A.5 Contaminated animal	a. b. c. d. e.	f.
	A.6Patient care	a. b. c. d. e.	f.
Class B	B.1 Radioactive waste	a. b. c. d. e.	f.
	B.2 Pharmaceutical waste	a. b. c. d. e.	f.
	B.3 Hazardous chemical waste	a. b. c. d. e.	f.
Class C		a. b. c. d. e.	f.

2_3_2 Storage

Q.9. How do you store common waste and hazardous health-care waste?
[ ] 1. We mix them all together. (Go to Q.10)
[ ] 2. We store them separately. (Go to Q.11)

Q.10. Why don't you separate hazardous health-care waste?

[ ] 1. There is no reason to separate them.
[ ] 2. It is troublesome to separate them.
[ ] 3. The waste collectors separate them.
[ ] 4. Others (specify :_____)

Q.11. How do you store your waste within your institution?
(Please tick in the following table)
a. Plastic bag
b. Paper bag
c. Open container
d. Container with lid
e. Cardboard box
f. Others

Waste Class / Types		Main method	Other method, if any (specify)
Class A	A.1 Infectious waste	a. b. c. d. e.	f.
	A.2 Blood and derivates	a. b. c. d. e.	f.
	A.3 Surgical, anatomopatologic and exudates	a. b. c. d. e.	f.
	A.4 Piercing or cutting	a. b. c. d. e.	f.
	A.5 Contaminated animal	a. b. c. d. e.	f.
	A.6Patient care	a. b. c. d. e.	f.
Class B	B.1 Radioactive waste	a. b. c. d. e.	f.
	B.2 Pharmaceutical waste	a. b. c. d. e.	f.
	B.3 Hazardous chemical waste	a. b. c. d. e.	f.
Class C		a. b. c. d. e.	f.

Q.12. Are there cool storage room or faculties for pathological wastes in your institution?
[ ] 1. Yes.
[ ] 2. No.

2_3_2 Disposal (Intermediate treatment and final disposal)

Q.13. What do you do with your waste?
(fill in first two columns of following table)
a. Place outside for collection by SEMMA/SEMULSP or other collectors
b. Directly carry the waste to a waste collection vehicle
c. Take the waste to waste collection point of SEMMA/SEMULSP or other collectors
d. SEMMA/SEMULSP or other collectors collects from institution (including own bin)
e. Bury on site
f. Open burning
g. Recycle
h. Incinerate by the incineration in the institution
i. Autoclave disinfection on site
j. Open dumping outside property
k. Other (specify :_____)

Waste Class / Type		Main method	Other method, if any	Disposal by local authority (Q.14)
Class A	A.1 Infectious waste	a. b. c. d. e. f. g. h. i. j.	k.	
	A.2 Blood and derivates	a. b. c. d. e. f. g. h. i. j.	k.	

	A.3 Surgical, anatomopatologic and exudates	a. b. c. d. e. f. g. h. i. j.	k.	
	A.4 Piercing or cutting	a. b. c. d. e. f. g. h. i. j.	k.	
	A.5 Contaminated animal	a. b. c. d. e. f. g. h. i. j.	k.	
	A.6 Patient care	a. b. c. d. e. f. g. h. i. j.	k.	
Class B	B.1 Radioactive waste	a. b. c. d. e. f. g. h. i. j.	k.	
	B.2 Pharmaceutical waste	a. b. c. d. e. f. g. h. i. j.	k.	
	B.3 Hazardous chemical waste	a. b. c. d. e. f. g. h. i. j.	k.	
Class C		a. b. c. d. e. f. g. h. i. j.	k.	

Q.14. For the health-care waste collection by SEMMA/SEMULSP or other collectors, how are they disposed of? (fill in right-hand side of above table)

a. Disposed of to the Manaus city landfill together with other waste
b. Buried in a special pit at the landfill
c. Burned at the landfill
d. Incinerated at an incinerator
e. Other (specify :_____).

Q.15. If you chose **g.** in Q.13, go to "Additional Sheet A".

Q.16. If you chose **h.** in Q.13, please provide the following information for the incinerator.

Information	Description
1. Location:	
2. Capacity (furnace volume (m^3) and waste burning capacity (kg/h):	
3. Description (e.g. no of chambers, operating principle):	
4. Combustion fuel:	
5. Height of chimney	
6. Proximity of living/working spaces to incinerator:	
7. Scrubbing/filtering of exhaust gases: Yes/No	
8. Normal operating hours:	
9. Ash disposal (amount and frequency):	
10. Age:	
11. Reliability (no of days out of service per year; average outage time):	
12. Problems:	

Q.17. If you chose **i.** in Q.13, please provide the following information for the autoclave.

Information	Description
1. Location:	
2. Type	
3. Capacity (Treatment volume (m3) and waste capacity (kg/h):	
4. Description (e.g. no of autoclave, operating principle):	
5. Normal operating hours:	
6. Average daily treatment amount (kg/day):	
7. Disposal method of treated waste	
8. Reliability (no of days out of service per yr; average outage time):	
10. Problems:	

Q.18. If you ticked **j.** in Q.13, where do you dump your waste outside your institution?

[ ] 1. On banks of igarape/river, or in igarape/river

[ ] 2. On vacant land
[ ] 3. Other (specify :_____).

2_3_4 Discharge

Q.19. How do you discharge health-care wastes?
[ ] 1. We separate store but mix discharge.
[ ] 2. We separate store and separate discharge.
[ ] 3. We mix store and mix discharge.

Q.20. In case of "**separate store but mix discharge**", who mixes them?
[ ] 1. Collector
[ ] 2. Our employee
[ ] 3. Others (specify:_____)

Q.21. Please tick appropriate boxes on the answer table to indicate your discharge manner of health-care wastes.

Class/Type of waste		1. separated discharge	2. mixed discharge			3. not generated
			same class*1	Class A and B*2	All class*3	
Class A	A.1 Infectious waste					
	A.2 Blood and derivates					
	A.3 Surgical, anatomopatologic and exudates					
	A.4 Piercing or cutting					
	A.5 Contaminated animal					
	A.6Patient care					
Class B	B.1 Radioactive waste					
	B.2 Pharmaceutical waste					
	B.3 Hazardous chemical waste					
Class C						
Remark	*1 : Mixed discharge with other waste of the same class *2 : Mixed discharge with class A and B *3 : Mixed discharge with class A, B and C					

2_3_5 Collection of Hazardous health-care waste

Q.22. Are you provided with a hazardous health-care waste collection service? (either direct collection or nearby waste collection points or direct pickup from institution – items **a, b, c or d** in Q.13)
[ ] 1. Yes
[ ] 2. No – Do you want to receive a waste collection service?
– Answer: [ ] 1. Yes / [ ] 2. No – then go to Next Section (2.3.6)

Q.23. Who collects your waste?
[ ] 1. SEMMA/SEMULSP
[ ] 2. Private company other than SEMMA/SEMULSP
[ ] 3. Don't know

Q.24. How often do you discharge your garbage and how often is it collected? (tick one)

	Class A		Class B	
	Discharge	Collection	Discharge	Collection
1. Once daily				
2. Every 2-3 days				
3. Every 4-5 days				

4.	Weekly				
5.	Less than weekly				
6.	Irregularly				
7.	Other				

Q.25. Do you pay the SEMMA/SEMULSP or a private collector an official waste collection fee for hazardous health-care waste?

[ ] 1. Yes
[ ] 2. No

If Yes, how much is this fee? And what type of wastes does it cover?

Answer	Waste Type	Payment (R$/week)

If necessary, calculate as [____] R$/vehicle x [_____] loads per week

Q.26. Are you satisfied with the existing hazardous health-care waste collection and disposal service?

[ ] 1. Yes
[ ] 2. No

If No, Why? (tick one or more)

		Answer	Why?
1.	Discharge system is poor (e.g. no bins, bins are broken or too small)		
2.	Waste collection point is too far away		
3.	Waste collection/sweeping is not properly done		
4.	Waste collection service/sweeping is irregular		
5.	Waste collection/sweeping frequency is too low		
6.	Collection time is too early or too late		
7.	Waste collection workers behave badly		
8.	Waste collection workers demand payment for waste collection		
9.	Waste collection fee of the SEMMA/SEMULSP or a private collector is too high		
10.	Lack of recycling		
11.	Problems with handling health-care waste		
12.	Other		

Q.27. How many times have you complained about the hazardous health-care waste collection service in the last year?

[ ] 1. None
[ ] 2. Once only
[ ] 3. Several times
[ ] 4. More than five times

Q.28. Is any staff member of your institution responsible for ensuring that hazardous health-care waste is collected and disposed of properly?

[ ] 1. Yes
[ ] 2. No

If you answered Yes, please explain position of persons and their duties below

Name and position of person: [ ]
Please describe their duties: [_____]

2_3_6 Improvements to hazardous health-care waste collection and disposal

1.General

Q.29. What improvements would you like to see to hazardous health-care waste collection and disposal? (Please tick one or more and priorities the top three improvements you would like to see (1 = first priority, 2 = second priority, 3 = third priority)

	Tick	Priority
1. Improved waste discharge system		
2. Shorter distance to waste collection point		
3. More reliable waste collection service		
4. Improved collection frequency		
5. Greater recycling of waste		
6. Improved collection and disposal of health-care waste		
7. Improvement of landfill operation		
8. Education to change people's bad habits		
9. Other (specify:)		

Q.30. Improved waste collection and disposal will cost additional money. Who do you think should pay these costs? (tick one or more)

[ ] 1. Amazonas state
[ ] 2. Manaus city
[ ] 3. Individual medical institution
[ ] 4. Other (specify :_____)

Q.31. Suppose that you are satisfied with the hazardous health-care waste management service, either as is or as a result of improvement. Think for a moment about the largest amount of money that your medical institution would be willing to pay each month as the collection fee.

Amount of money: [_____] R$/month

Q.32. If the current hazardous health-care waste collection fee is more than this amount, your medical institution will not be able to afford to pay and will not be able to use the waste collection service. If you are still not willing to pay the current waste collection fee, explain the reason why below:

Reasons:……..

2.Training and Instructions

Q.33. Is there some written instruction to separate and manage hazardous health-care waste in the institution?

[ ] 1.Yes
[ ] 2.No (Go to Q.35)

Q.34. How often the staff of waste management is trained as a caution against contaminated or hazardous health-care waste?

[ ] 1.Only at the start of the job
[ ] 2.Once a year
[ ] 3.Very often, please explain how often _____
[ ] 4.Never

3. Environmental education and general cleanliness

Q.35. Has anyone of this institution received any health and environmental education or information relating to hazardous health-care waste? Yes/No

If YES, no of people: [_____]

And where did this information come from?

[ ] 1. School
[ ] 2. Leaflets/posters, etc.
[ ] 3. Medical worker/centre/hospital
[ ] 4. Community organization/NGO [name:_____]
[ ] 5. Newspaper
[ ] 6. Radio program

[ ] 7. TV program
[ ] 8. SEMMA/SEMULSP
[ ] 9. Government of Amazonas State
[ ] 10. Federative Republic of Brazil (e.g. Ministry of Health, Ministry of Environment, etc.)
[ ] 11. Other (specify :_____)

Q.36. Do you think that a campaign to raise the awareness of people for maintaining a cleaner city and environment is necessary? (tick one)
[ ] 1.Very necessary
[ ] 2. Somewhat necessary
[ ] 3. Not very necessary
[ ] 4. Not necessary at all

3_Financial Matter

Q.37. How much do you pay for hazardous health-care waste collection services per month?

Answer Table for health-care waste		
Type of waste		Collection fee (R$/month)
Class A	A.1 Infectious waste	
	A.2 Blood and derivates	
	A.3 Surgical, anatomopatologic and exudates	
	A.4 Piercing or cutting	
	A.5 Contaminated animal	
	A. 6Patient care	
Class B	B.1 Radioactive waste	
	B.2 Pharmaceutical waste	
	B.3 Hazardous chemical waste	

Q.38. How much do you pay for common waste (Class C) collection services per month?
Amount of money: [_____] R$/month

4_Cooperation for Waste Management

Q.39. Coping with wastes requires efforts of not only the municipality but also the general public. Do you think there is something which your institution can do for good waste management?
[ ] 1. Yes.
[ ] 2. No.
[ ] 3. I don't know.
[ ] 4. Others (specify: _____)

Q.40. What do you think your institution can do? (plural answer question)
[ ] 1. Discharging wastes neatly.
[ ] 2. Minimizing waste generation.
[ ] 3. Reusing wastes.
[ ] 4. Recycling wastes.
[ ] 5. Treating toxic/infectious wastes appropriately.
[ ] 6. Raising the environmental awareness of the public.
[ ] 7. Providing information to the public.
[ ] 8. Researching activities.
[ ] 9. Others (specify: _____)

Q.41. Do you think the medical institutions should cooperate with the country and/or

municipality in managing wastes?
[ ] 1. Yes.
[ ] 2. No.
[ ] 3. I don't know.
[ ] 4. Others (specify: _____)

Q.42. How is the trend of your cost for waste management?
[ ] 1. It is getting significantly higher.
[ ] 2. It is getting higher.
[ ] 3. It is relatively stable.
[ ] 4. It is getting lower.
[ ] 5. Others (specify: _____)

Q.43. How do you give the priority on the management of your wastes?
[ ] 1. We give very high priority.
[ ] 2. We give moderate priority.
[ ] 3. We give little priority.
[ ] 4. Others (specify: _____)

Q.44. Do you feel you need a support from the government or municipality or any other relevant organizations for the management of your waste? (plural answer question)
[ ] 1. Yes, we need financial support.
[ ] 2. Yes, we need technical support.
[ ] 3. Yes, we need support of other kinds (specify: _____)
[ ] 4. No, we don't.
[ ] 5. Others (specify: _____)

5_Other

Q.45. Do your medical institution use radioactive material or Source?
[ ] 1. Yes
[ ] 2. No
If you tick "Yes", go to "Additional Sheet B".

Q.46. If there any additional comments you would like to make about solid waste management provision and your needs, please comment below:
[_____]

Thank-you very much for your co-operation

"Additional Sheet A"

Recycling: ONLY answer this section if you ticked Q.13 (g).

Write your answers to the following questions in the table below:

1. What items do you recycle? (specify any other materials in the blank cells)
2. How much do you recycle per week?
3. What price do you sell these items for?
4. Who do you sell/give these materials to? (e.g. individual collector, shop, middleman, industry)
5. How does this recycling system work? (put a, b, etc. in method column)

a. Take directly to shop for refund
b. Give to collector who comes to premises
c. Take directly to middlemen for sale
d. Take directly to community group/NGO for sale
e. Take directly to industry for sale
f. Other – specify in table

6. How often are these materials collected/taken for recycling? (daily, 2-3 times per week, weekly, monthly, other, irregularly)

Item	Quantity (kg/week)	Price (R$/kg)	Buyer	Method	Collection frequency
(1) Paper					
(2) Cardboard					
(3) Glass bottles					
(4) Metal					
(5) Organic waste					
(6) Other					

・Additional space for answers: [_____]

・Contact details (address/telephone numbers for buyers): [_____].

7. Are there any problems with this recycling system? Answer: Yes/No
If YES, please explain why below: [ ].

"Additional Sheet B"

Radioactive material/source: ONLY answer this section if you ticked Q.45 (1 Yes).

1. For what purpose do you use the radioactive materials/source?
Please describe your purpose : [_____]
2. What kind of radioactive materials/source do you use? : [_____]
Please describe radioactive materials/source : [_____]
3. How do you store the radiation source?
   a. It is stored inside of the controlled area with special container.
   b. It is stored inside of the controlled area and installed inside of the X-ray equipment.
   c. Others (specify :_____)
4. Do you generate radioactive waste?
   [ ] 1. Yes
   [ ] 2. No
   If yes, please answer the following questions.
5. How many kilograms of radioactive waste do you generate in a year?

Generation source	Kind of radioactive waste	Amount of radioactive waste (kilograms/year)
1. Clinical analysis laboratories 2. Nuclear medicine services 3. Radiotherapy 4. Other (specify)		

6. How do you treat and dispose the radioactive waste?
   a. It is stored inside of the controlled area of our compound with special container.
   b. It is entrusted to the contractor for disposal outside.
   c. Others (Specify : _____)
   If the answer is b. or c., please answer the following questions.
7. How do you transport the radioactive waste?
   a. We transport it by ourselves.
   b. We entrust outside transporter for radioactive waste

c. Others (Specify : .....)

8. How do you dispose the radioactive waste?
   a. Final disposal facilities of Federal government.
   b. Final disposal facilities of State government.
   c. Others (Specify : .....)
   d. I don't know.

********** Please Go Back! **********

****

2.4 Study of Construction Waste Management

2.4.1 Outline of the Study

a. Study Objective

The study aims to clarify the generation of construction waste, its disposal and management at PIM factories (including those outside of the DI) where construction projects exist.

b. Study Method

A local consultant (OPCA.) was consigned to conduct the study. The local consultant used a questionnaire produced by the Japanese study team and conducted interviews with those in charge of construction at factories.

The study team produced a draft questionnaire, which was discussed with the C/P and then revisions were made as necessary. The questionnaire contained the following items

- Overview of construction work, contract amount for work, type of work, number of workers
- Generation amount of construction waste
- Type of construction waste
- Final disposal aspects
- Recycling aspects
- Others

2.4.2 Construction Waste Categories

a. Construction Waste Categories in CONAMA Resolution 307

The National Environment Council (CONAMA) issued Resolution 307 in the form of guidelines for construction waste management on 5 July 2002. Construction wastes are categorized in CONAMA Resolution 307 as shown in the following table.

Table 2-26: Construction Waste Categories in CONAMA Resolution 307

Class	Description
Class A:	The reusable or recyclable waste as aggregates, such as:
	a) from construction, demolition, refitting and repair of pavement and other infrastructure constructions, including land preparation;
	b) from the construction, demolition refitting and repair of edifications: ceramic components (bricks, blocks, tiles, insulation planks, etc.), cement and concrete;
	c) from manufacturing and/or demolition process of concrete pre-modulated pieces (blocks, pipes, gutter, etc.) produced in the construction sites.
Class B	The recyclable waste for other purposes, such as: plastics, paper/carton, metals, glass, wood and others.
Class C	Waste which has no economically feasible technology or applications which may allow it to be recycled/recovered, such as the products arisen from plaster.
Class D	Hazardous waste arisen from construction process, such as paints, solvents, oils and so forth, or those contaminated or harmful to health arisen from

	demolitions, refitting and repairs of radiology clinics, industrial facilities and others, as well as tiles and other objects and materials containing asbestos or other products harmful to health. *(new text given by Resolution n. 348/04)*.

b. Target Wastes

The target wastes are construction wastes generated by works at PIM factories which are designated in CONAMA Resolution 307.

c. Construction Waste Categories used in the Study

The waste categories in CONAMA Resolution 307 identify criterion for whether or not certain construction waste is recyclable. Thus, it would be difficult to get a detailed picture what kinds of waste were being generated if the survey were conducted based on these categories. The study team discussed the matter with the C/P and decided upon 43 materials (see below) into which construction waste could be categorized and used for the survey. In addition, it was determined in which of the 4 classes given in CONAMA Resolution 307 these 44 wastes would be placed.

- Excavated soil, concrete debris, asphalt debris, brick debris, glass tile and ceramic materials, foam polystyrene, vinyl materials, synthetic rubber, used tires, plastic sheet, vinyl sheet, iron-bar, steel materials, small metal waste, old temporary scaffoldings and fences, natural rubber waste, sludge, mud, plaster boards, packaging material which organic materials stick to, lead battery, wood debris of demolish waste, timber form for concreting, scaffolding material, interior timber materials, packing materials (such as cardboard), wall paper, cloth and old rags, rope, carpet, machine oil, heavy oil, asphalt, waterproof sheet, ash of materials used for construction (such as old rags, cardboard, timber), materials containing asbestos, materials which are sprayed with asbestos, transformer, condenser, stabilizer for fluorescent light, sulfuric acid, coolant for a freezer, volatile oil, kerosene, diesel oil, mixed waste.

The 44 construction waste categories and the questions asked are presented in the Section 2.4.6 of this report.

2.4.3 Selection of Target Factories

The 457 factories located in the MFZ in the factory list provided by SUFRAMA, were contacted to confirm whether they had conducted any construction projects in the past year, from June 2008 to May 2009. The following results were found according to their responses.

- Factories that responded by telephone: 334
- Factories that have closed: 17
- Factories that refused to reply: 25
- Factories that could not be reached by telephone: 81

In this survey, it was revealed that 440 factories are PIM factories operating in the MFZ, including those which could not be reached by telephone (which was likely due to a changed phone number, etc.) and excluding the 17 which have closed.

It was found that, of the 334 factories, 123 factories, over one-third (36.8%), have conducted construction projects between June 2008 and May 2009. Ten of the 123 factories were chosen at random for direct interview using the prepared survey questionnaire. A summary of these

factory construction projects is given below.

Table 2-27: Summary of Construction Projects

Type of Construction Project	No. of Respondents	Ratio (%)
1. New construction	2	20.0
2. Additional construction	0	0.0
3. Demolition	0	0.0
4. Renovation	6	60.0
5. Others *1	2	20.0
Total	10	100.0

(Note) *1: In detail,
1. Installation of a waste water treatment facility (WWTF)
2. Construction of a retaining wall and drainage of the rain water.

2.4.4 Execution of the Survey

A local consultant (OPCA) was consigned to conduct the study on 19 June 2009. Immediately after the contract was signed, the local consultant contacted all PIM factories approved by SUFRAMA by telephone, etc., and inquired about any construction works that took place over the past year, before selecting the target factories and beginning the direct interview process. The direct interview survey and compiling the survey result were completed as planned by the end of July, and then, working with the study team, the survey results were analyzed in August before being summarized into a report.

2.4.5 Results of the Survey

The results from these responses are as follows.

a. General Information

Q.1. Type of the project

Base: Population = 10		
Q1	Answer	%
1. New construction	2	20.0
2. Additional construction	0	0.0
3. Demolition	0	0.0
4. Renovation	6	60.0
5. Others	2	20.0
Total	10	100.0

Others : 1. Installation of the WWTF(Waste water treatment facility)
2. Construction of a retaining wall and drainage of the rain water.

Q.2. Type of the construction work

Base: Population = 10		
Q2	Answer	%
1. Manufacturing building	3	30.0
2. Office building	0	0.0

3. Manufacturing/Office building	2	20.0
4. Others	5	50.0
Total	10	100.0

- Others were indicated in the responses as follows.

Base: Population = 5
1. Renovation of the canteen
2. Warehouse annex factory
3. Renovate canteen/expansion production/installation of the wastewater treatment system
4. Renovation of the canteen
5. Kitchen

Q.3. Scale of the project:

Base: Population = 10					
Q3		Answer	Average	Maximum	Minimum
1. Total floor area	m^2	10	3,159	10,000	25
2. Total project amount	R$	10	1,551,000	13,000,000	800
	R/m^2$	10	432	1,300	14
3. Construction period	month	10	2.3	6.0	0.1

Q.4. Do you have construction license of this project?

Base: Population = 10		
Q4	Answer	%
1. Yes	6	60.0
2. No	4	40.0
Total	10	100.0

Q.5. Do you make "Construction Waste Management Integrated Plan (CWMP) of this project?

Base: Population = 10		
Q5	Answer	%
1. Yes	5	50.0
2. No	5	50.0
Total	10	100.0

b. Waste Management

b.1 Construction waste management

Q.6. How many quantity do you generate common waste (not construction waste) from site office?

Construction area was set as shown in the following table in order to survey the related generation amount, and the generation amount for common waste was calculated according

to each range.

Base: Population = 9						
Range of Construction area		Answer	Average Area (m^2)	Generation amount (kg/day)		
				Average	Maximum	Minimum
1. Small	< 500 m^2	3	102	47.0	100	5
2. Middle	500-5000 m^2	3	1,551	296.0	529	50
3. Large	> 5000 m^2	2	8,705	18.0	33	3
Total		9	3,453	133.1	529	3

note: 1 factory did not provide an answer concerning the generation amount of their common waste

Q.7. Interviewee shall fill the following an answer sheets according to the construction waste type.

<How to fill in the answer sheets>

The name of the construction wastes are listed on the left-hand side of **the answer sheet**. Please tick the box next to any construction waste that is presently generated at your site or will be in the future. Then continue to write the details in Q7-2 through Q7-8.

(1) Generated waste

< Please tick the generated waste in your site.>

Base: Population = 10			
Waste No	Waste materials generated in your site 1	Generated waste in target factories	Number of Answer
01	Excavated soil	x	5
02	Concrete debris	x	7
03	Asphalt debris	x	1
04	Brick debris	x	5
05	Glass		
06	Tile and ceramic materials	x	2
07	Foam polystyrene		
08	Vinyl materials		
09	Synthetic rubber		
10	Used tires		
11	Plastic sheet, vinyl sheet	x	1
12	Iron-bar, steel materials	x	5
13	Small metal waste	x	6
14	Old temporary scaffoldings and fences, etc		
15	Natural rubber waste		
16	Sludge, mud		
17	Plaster boards		
18	Packaging material which organic materials stick to.		
19	Lead battery		
20	Wood debris of demolish waste	x	4
21	Timber form for concreting	x	1
22	Scaffolding material	x	1
23	Interior timber materials	x	2
24	Packing materials like cardboard for construction materials, etc.	x	5
25	Wall paper, etc.		
26	Cloth and old rags		

27	Rope		
28	Carpet, rug		
29	Machine oil	x	1
30	Heavy oil		
31	Asphalt		
32	Waterproof sheet		
33	Ash of materials used for construction such as old rags, cardboards, timbers, etc.	x	2
34	Materials containing asbestos		
35	Materials which asbestos sprayed		
36	Transformer		
37	Condenser		
38	Stabilizer for fluorescent light		
39	Sulfuric acid (neutralizing discharged water)		
40	Coolant for a freezer		
41	Volatile oil		
42	Kerosene		
43	Diesel oil		
44	Mixed construction waste	x	2
Total		16	48

(2) Waste code in CONAMA 307

< Describe the waste code according to the waste classification CONAMA 307, if known.>

Base: Population = 10

Waste No	Waste materials generated in your site	Total Number of Answer	Classification of CONAMA Resolution 307 (05 July 2002)			
			Class A	Class B	Class C	Class D
01	Excavated soil	5	5			
02	Concrete debris	7	7			
03	Asphalt debris	1	1			
04	Brick debris	5	5			
06	Tile and ceramic	1	1			
11	Plastic/vinyl sheet	1		1		
12	Iron-bar, steel materials	5	4	1		
13	Small metal waste	5	2	3		
17	Plaster boards	1	1			
20	Wood debris	3	2	1		
21	Timber form	1		1		
22	Scaffolding material	1		1		
23	Interior timber	3	2	1		
24	Packing (cardboard)	4	2	2		
29	Machine oil	1	1			
33	Ash	2	2			
44	Mixed construction waste	2	2			
Total		48	37	11	0	0

(3) Generation amount

< How many tons (or kg) of this construction waste is generated in your site? Please enter the amount of generated wastes.>

The following is the total amount of waste generated for 10 construction works.

<Calculation of the average daily generation amount for construction waste>

=> The generation amount of construction waste is for construction works during a one-year period from June 2008 to May 2009. The amount generated during this construction period as indicated by each factory was totaled and, taking 1 year for 365 days, the average daily generation amount was calculated. The following table shows the average daily generation amount for 10 factories for each type of waste.

Breakdown of Construction Waste Generation Amount according to CONAMA code categories (total 10 companies)

Base: Population = 10

Waste No	Waste materials generated in your site	Generation Amount	Classification of CONAMA Resolution 307 (05 July 2002)			
		kg/day	Class A	Class B	Class C	Class D
01	Excavated soil	90.4	90.4			
02	Concrete debris	147.5	147.5			
03	Asphalt debris	171.2	171.2			
04	Brick debris	8.3	8.3			
06	Tile and ceramic	0.0	0.0			
11	Plastic/vinyl sheet	1.2		1.2		
12	Iron-bar, steel materials	0.7	0.4	0.3		
13	Small metal waste	1.6	0.1	1.5		
17	Plaster boards	0.1	0.1			
20	Wood debris	3.7	2.8	0.8		
21	Timber form	0.6		0.6		
22	Scaffolding material	3.4		3.4		
23	Interior timber	3.2	2.9	0.3		
24	Packing (cardboard)	2.6	0.3	2.3		
29	Machine oil	0.2	0.2			
33	Ash	0.5	0.5			
44	Mixed construction waste	1,846.6	1,846.6			
Total		2,281.4	2,271.2	10.3		

(4) Recycling/Reuse

< Do you sell it? To whom?>

Base: Population = 10

Waste No	Waste materials generated in your site	Total Number of Answer	Sell ?	
			Yes	No
01	Excavated soil	5		5
02	Concrete debris	7		7
03	Asphalt debris	1		1
04	Brick debris	5		5
06	Tile and ceramic	1		1
11	Plastic/vinyl sheet	1		1
12	Iron-bar, steel materials	5	1	4
13	Small metal waste	5	1	4
17	Plaster boards	1		1
20	Wood debris	3	1	2
21	Timber form	1		1
22	Scaffolding material	1		1

23	Interior timber	3	1	2
24	Packing (cardboard)	4	1	3
29	Machine oil	1		1
33	Ash	2		2
44	Mixed construction waste	2		2
Total		48	5	43

One of the 10 factories (five items) responded that they are selling it.
< Do you give it to somebody? To whom and where?>

Base: Population = 10

Waste No	Waste materials generated in your site	Total Number of Answer	Give ?	
			Yes	No
01	Excavated soil	5	2	3
02	Concrete debris	7	4	3
03	Asphalt debris	1		1
04	Brick debris	5	4	1
06	Tile and ceramic	1	1	
11	Plastic/vinyl sheet	1	1	
12	Iron-bar, steel materials	5	3	2
13	Small metal waste	5	3	2
17	Plaster boards	1	1	
20	Wood debris	3	1	2
21	Timber form	1	1	
22	Scaffolding material	1	1	
23	Interior timber	3	1	2
24	Packing (cardboard)	4	3	1
29	Machine oil	1		1
33	Ash	2		2
44	Mixed construction waste	2	2	
Total		48	28	20

6 of the 10 factories (14 items) responded that they offer these to a number of companies.

(5) Transport
< How is the construction waste carried from your site to the outside?>
a. Own truck.
b. Truck of an employed sub-contractor
c. Manaus city
d. Other

Most construction waste is transported by a sub-contractor. Also, the waste item, Ash, is collected by Manaus city collection service.

Base: Population = 10

Waste No	Waste materials generated in your site	Total Number of Answer	Answer			
			a	b	c	d
01	Excavated soil	5		4		1
02	Concrete debris	7		7		
03	Asphalt debris	1		1		

04	Brick debris	5		5		
06	Tile and ceramic	1		1		
11	Plastic/vinyl sheet	1		1		
12	Iron-bar, steel materials	5		5		
13	Small metal waste	5	1	4		
17	Plaster boards	1		1		
20	Wood debris	3		3		
21	Timber form	1		1		
22	Scaffolding material	1		1		
23	Interior timber	3		3		
24	Packing (cardboard)	4		4		
29	Machine oil	1		1		
33	Ash	2			2	
44	Mixed construction waste	2		2		
Total		48	1	44	2	1

(6) Manifest

< Do you use a manifest for construction waste?>

Base: Population = 48

Q7-6	Category of Waste	Answer	sub-total
a. Yes	Brick debris	2	
	Concrete debris	2	
	Excavated soil	1	
	Interior timber	1	
	Iron-bar, steel materials	2	
	Packing (cardboard)	1	
	Timber form	1	
	Plaster boards	1	11
b. No	Ash	2	
	Asphalt debris	1	
	Brick debris	2	
	Concrete debris	4	
	Excavated soil	4	
	Interior timber	2	
	Iron-bar, steel materials	2	
	Machine oil	1	
	Mixed construction waste	2	
	Packing (cardboard)	2	
	Plastic/vinyl sheet	1	
	Scaffolding material	1	
	Small metal waste	4	
	Wood debris	2	30
c. I don't know.	Brick debris	1	
	Concrete debris	1	
	Iron-bar, steel materials	1	
	Packing (cardboard)	1	
	Small metal waste	1	
	Tile and ceramic	1	

Wood debris	1	7
Total	48	

(7) Disposal
< Where do you dispose of it?>
a. Manaus city disposal site
b. Private disposal site
c. Other
d. I don't know.

Base: Population = 10

Waste No	Waste materials generated in your site	Total Number of Answer	Answer			
			a	b	c	d
01	Excavated soil	5	3	1	1	
02	Concrete debris	7	5	1		1
03	Asphalt debris	1	1			
04	Brick debris	5	3	1		1
06	Tile and ceramic	1				1
11	Plastic/vinyl sheet	1	1			
12	Iron-bar, steel materials	5	2	1	1	1
13	Small metal waste	5	1	1	2	1
17	Plaster boards	1	1			
20	Wood debris	3		1	1	1
21	Timber form	1	1			
22	Scaffolding material	1	1			
23	Interior timber	3	1	1	1	
24	Packing (cardboard)	4	2		1	1
29	Machine oil	1		1		
33	Ash	2	2			
44	Mixed construction waste	2	2			
Total		48	26	8	7	7

c. Results of Waste Amount, Generation Rate and Waste Stream

c.1 Generation Amount of Construction Waste

In the year from June 2008 to May 2009, the amount of construction waste generated from construction projects at the 10 factories came to a total of 832.7 tons, as shown in column A in the following table. Moreover, the amount generated per day is shown in column B (B = A/365).

Table 2-28: Generation Amount of Construction Waste from Survey of 10 Factories

Waste No	Description of Waste	Total Number of Answer	**A.** Generation Amount (kg)	**B.** Generation Amount (kg/day)	Classification & Generation of Waste by CONAMA Resolution 307 (kg/day)			
					Class A	Class B	Class C	Class D
01	Excavated soil	5	32,985	90.4	90.4			
02	Concrete debris	7	53,830	147.5	147.5			

03	Asphalt debris	1	62,500	171.2	171.2			
04	Brick debris	5	3,015	8.3	8.3			
06	Tile and ceramic	1	10	0.0	0.0			
11	Plastic/vinyl sheet	1	430	1.2		1.2		
12	Iron-bar, steel materials	5	250	0.7	0.4	0.3		
13	Small metal waste	5	571	1.6	0.1	1.5		
17	Plaster boards	1	20	0.1	0.1			
20	Wood debris	3	1,335	3.7	2.8	0.8		
21	Timber form	1	200	0.6		0.6		
22	Scaffolding material	1	1,230	3.4		3.4		
23	Interior timber	3	1,150	3.2	2.9	0.3		
24	Packing (cardboard)	4	960	2.6	0.3	2.3		
29	Machine oil	1	74	0.2	0.2			
33	Ash	2	165	0.5	0.5			
44	Mixed construction waste*1	2	674,000	1,846.6	1,846.6			
	Total	48	832,725	2,281.4	2,271.2	10.3	0.0	0.0

Note: *1: Large-scale construction projects were confirmed at two factories which took place over the course of 6 months and 1 year produced a large amount of construction waste.

c.2 Number of Factories in PIM

123 factories of 334 surveyed have a construction works within their compound. It is estimated 162 (= 123x 440/334) factories have a construction works in PIM in total.

c.3 Generation Rate and Amount of Factories in PIM

As 162 factories have a construction works in PIM in total, the generation amount of construction waste from factories in PIM and generation rate per employee is calculated as follows:

Generation Amount of Factories in PIM
= Generation Rate per a factory with construction works x 162

Generation Rate per an Employee
= Generation Amount of Factories in PIM / Number of Employee in PIM (116,192)

Table 2-29: Generation Rate and Amount of Factories in PIM

Waste No	Description of Waste	Generation Rate per a factory (kg/factory/day)	Portion (%)	Generation Amount of Factories in PIM (C=Bx440/334) (ton/day)	Generation Rate per an Employee (kg/employee/day)
1	Excavated soil	9.04	4.0	1.46	0.013
2	Concrete debris	14.75	6.5	2.39	0.021
3	Asphalt debris	17.12	7.5	2.77	0.024
4	Brick debris	0.83	0.4	0.13	0.001
6	Tile and ceramic	0.003	0.0	0.00	0.000
11	Plastic/vinyl sheet	0.12	0.1	0.02	0.000
12	Iron-bar, steel materials	0.07	0.0	0.01	0.000

13	Small metal waste	0.16	0.1	0.03	0.000
17	Plaster boards	0.01	0.0	0.00	0.000
20	Wood debris	0.37	0.2	0.06	0.001
21	Timber form	0.06	0.0	0.01	0.000
22	Scaffolding material	0.34	0.1	0.06	0.001
23	Interior timber	0.32	0.1	0.05	0.000
24	Packing (cardboard)	0.26	0.1	0.04	0.000
29	Machine oil	0.02	0.0	0.00	0.000
33	Ash	0.05	0.0	0.01	0.000
44	Mixed construction waste	184.66	80.9	29.91	0.257
	Total	228.18	100.0	36.95	0.318

From the above, it was estimated that the daily generation amount of construction waste in the target area (PIM/MFZ) is 37.0 ton/day. The categorization according to CONAMA Resolution 307 for construction waste which is generated is as follows. Note that there was no hazardous construction waste confirmed in this study.

- Class A (reusable or recyclable as aggregate): 36.8 ton/day
- Class B (recyclable as material other than aggregate): 0.2 ton/day
- Class C (not economically feasible for recycling): 0.0 ton/day
- Class D (hazardous): 0.0 ton/day

c.4 Present Construction Waste Management Stream

The Present construction waste management stream in PIM, according to the survey of construction works, is shown in the following figure.

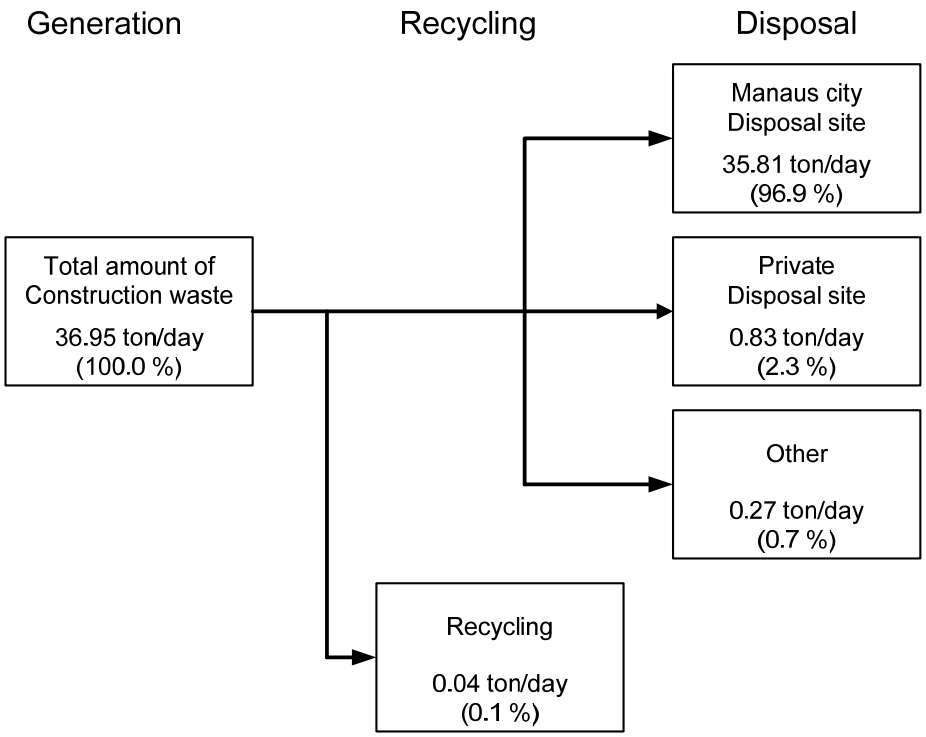

Figure 2-9: Construction Waste Management Stream in PIM

2.4.6 Questionnaire of Construction Work Survey

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Introduction of Survey for Construction Waste（Draft）

"The Study for the Development of an Integrated Solution related to Industrial Waste Management in the Industrial Pole of Manaus" is being carried out by JICA (Japan International Cooperation Agency) Study Team with the cooperation of SUFRAMA.
The purpose of this survey is to understand the generation amount of the construction wastes in Industrial District (DI) excluding those generated outside SUFRAMA jurisdiction and the waste management practices of the construction sites in DI excluding those outside SUFRAMA jurisdiction in terms of storage, segregation, discharge, collection, treatment and final disposal.
The results of this survey, together with other engineering investigations (Factory survey, Waste management company survey, etc.), will be used for the formulation of Waste stream (Waste Stream) for PIM. Your construction work has been selected to participate in this survey. The questionnaire should be answered by a responsible person on Waste Management in your works. It should take about 1-2 hours to complete. All answers are confidential and your help is greatly appreciated.

Questionnaire to Construction Work's

No.

a. General Information

Date : _____
Name of company : _____

Name of the project : _____
Address of the project site : _____
License number of the project : _____
Name of Interviewee : _____

a.1 General Information

Q.1. Type of the project
[ ] 1. New construction
[ ] 2. Additional construction
[ ] 3. Demolition
[ ] 4. Renovation
[ ] 5. Others (Specify : _____)

Q.2. Type of the construction work
[ ] 1. Manufacturing building
[ ] 2. Office building
[ ] 3. Manufacturing/Office building
[ ] 4. Others (specify : _____)

Q.3. Scale of the project:
1. Total floor area : [_____] m^2
2. Total project amount : [_____] R$
3. Construction period : [_____] week/mouth/year

Q.4. Do you have construction license of this project?
[ ] 1. Yes
[ ] 2. No

Q.5. Do you make "Construction Waste Management Integrated Plan (CWMP) of this project?
[ ] 1. Yes
[ ] 2. No

b. Waste Management

b.1 Definition of waste generated in construction work

A. Waste

CONAMA's 307 Resolution (05 July 2002) classified the waste generated in construction work as "construction waste". In this questionnaire it is divided into 4 classes: Class A, Reusable or Recyclable waste as aggregates ; Class B, Recyclable waste for other purposes; Class C, Waste which has no economically feasible technology or applications which may allow it to be recycled/recovered; and Class D, Hazardous waste arisen from construction waste.

A detailed classification of construction waste is summarized in the table below.

Class	Description
Class A:	The reusable or recyclable waste as aggregates, such as:
	a) from construction, demolition, refitting and repair of pavement and other infrastructure constructions, including land preparation;
	b) from the construction, demolition refitting and repair of edifications: ceramic components (bricks, blocks, tiles, insulation planks, etc.), cement and concrete;
	c) from manufacturing and/or demolition process of concrete pre-modulated pieces (blocks, pipes, gutter, etc.) produced in the construction sites.
Class B	The recyclable waste for other purposes, such as: plastics, paper/carton, metals, glass, wood and others.
Class C	Waste which has no economically feasible technology or applications which may allow it to be recycled/recovered, such as the products arisen from plaster.
Class D	Hazardous waste arisen from construction process, such as paints, solvents,

	oils and so forth, or those contaminated or harmful to health arisen from demolitions, refitting and repairs of radiology clinics, industrial facilities and others, as well as tiles and other objects and materials containing asbestos or other products harmful to health. *(new text given by Resolution n. 348/04)*.

Source）CONAMA's 307 Resolution, from 05 July 2002, Published in the Federal Government Journal n. 136, on 17 July 2002, Section 01, pages 95-96

B. Reuse

To use waste again, or repeatedly, without transforming and/or modifying, or only with simple treatment (e.g. use a used bottle after rinsing).

C. Recycle

To use waste again as raw material (including as energy source) with chemical, physical and/or biological processing (e.g. producing compost from food waste, manufacturing cement using wastewater sludge).

b.2 Construction waste management

Q.6. How many quantity do you generate common waste (not construction waste) from site office?

	Quantity	unit (kg/day or kg/week)
Common waste form your site office		

Q.7. Interviewee shall fill the following an answer sheets according to the construction waste type.

<How to fill in the answer sheets>

The name of the construction wastes are listed on the left-hand side of **the answer sheet**. Please tick the box next to any construction waste that is presently generated at your site or will be in the future. Then continue to write the details in Q7-2 through Q7-8.

Q7-1	Name of Generated Waste	Please tick the generated waste in your site.
Q7-2	Waste Code in CONAMA 307	Describe the waste code according to the waste classification CONAMA 307, if known.
Q7-3	Generation Amount	How many tons (or kg) of this construction waste is generated in your site? Please enter the amount of generated wastes.
Q7-4	Recycling/Reuse: Do you sell it? To whom?	
Q7-5	Recycling/Reuse: Do you give it to somebody? To whom and where?	
Q7-6	Transport: How is the construction waste carried from your site to the outside? a. Own truck. b. Truck of an employed sub-contractor c. Manaus city d. Other	
Q7-7	Manifest: Do you use a manifest for construction waste? a. Yes b. No. c. I don't know.	
Q7-8	Disposal: Where do you dispose of it? a. Manaus city disposal site b. Private disposal site c. Other d. I don't know.	

Answer Sheet for Generated Construction waste

	Q7-1	Q7-2	Q7-3	Q7-4	Q7-5	Q7-6	Q7-7	Q7-8
Waste materials generated in your site	Is it/Will it be generated in your site? (please tick)	CONAMA Classification Code (Class A,B, C and D)	Generation amount?	Do you sell it? To whom?	Do you give it somebody? To whom and where?	How is the construction waste transported?	Do you use a manifest? a. Yes b. No c Don't know	Where do you dispose of it? a. Manaus city b. Private site c. Other d. Don't know
1. Excavated soil								
2. Concrete debris								
3. Asphalt debris								
4. Brick debris								
5. Glass								
6. Tile and ceramic materials								
7. Foam polystyrene								
8. Vinyl materials								
9. Synthetic rubber								
10. Used tires								
11. Plastic sheet, vinyl sheet								
12. Iron-bar, steel materials								
13. Small metal waste								
14. Old temporary scaffoldings and fences,								
15. Natural rubber waste								

	Q7-1	Q7-2	Q7-3	Q7-4	Q7-5	Q7-6	Q7-7	Q7-8
Waste materials generated in your site	Is it/Will it be generated in your site? (please tick)	CONAMA Classification Code (Class A,B, C and D)	Generation amount?	Do you sell it? To whom?	Do you give it somebody? To whom and where?	How is the construction waste transported?	Do you use a manifest? a. Yes b. No c Don't know	Where do you dispose of it? a. Manaus city b. Private site c. Other d. Don't know
16. Sludge, mud								
17. Plaster boards								
18. Packaging material which organic materials stick to.								
19. Lead battery								
20. Wood debris of demolish waste								
21. Timber form for concreting								
22. Scaffolding material								
23. Interior timber materials								
24. Packing materials like cardboard for construction materials, etc.								
25. Wall paper, etc.								
26. Cloth and old rags								
27. Rope								
28. Carpet, rug								

	Q7-1	Q7-2	Q7-3	Q7-4	Q7-5	Q7-6	Q7-7	Q7-8
Waste materials generated in your site	Is it/Will it be generated in your site? (please tick)	CONAMA Classification Code (Class A,B, C and D)	Generation amount?	Do you sell it? To whom?	Do you give it somebody? To whom and where?	How is the construction waste transported?	Do you use a manifest? a. Yes b. No c Don't know	Where do you dispose of it? a. Manaus city b. Private site c. Other d. Don't know
29. Machine oil								
30. Heavy oil								
31. Asphalt								
32. Waterproof sheet								
33. Ash of materials used for construction such as old rags, cardboards, timbers, etc.								
34. Materials containing asbestos								
35. Materials which asbestos sprayed								
36. Transformer								
37. Condenser								
38. Stabilizer for fluorescent light								
39. Sulfuric acid (neutralizing discharged water)								
40. Coolant for a freezer								
41. Volatile oil								

	Q7-1	Q7-2	Q7-3	Q7-4	Q7-5	Q7-6	Q7-7	Q7-8
Waste materials generated in your site	Is it/Will it be generated in your site? (please tick)	CONAMA Classification Code (Class A,B, C and D)	Generation amount?	Do you sell it? To whom?	Do you give it somebody? To whom and where?	How is the construction waste transported?	Do you use a manifest? a. Yes b. No c Don't know	Where do you dispose of it? a. Manaus city b. Private site c. Other d. Don't know
42. Kerosene								
43. Diesel oil								

---------- Thank you very much !! ----------

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2.5 Study of Radioactive Waste Management

2.5.1 Outline of the Study

a. Study Objective

The study aims to clarify the current management practices of radioactive waste management by visiting PIM factories where radioactive materials are used and there is a possibility that wastes will be generated, and conducting interviews to assess the types of radioactive materials used, the management conditions, and whether or not radioactive waste is generated.

b. Study Method

The management of radioactive waste was confirmed with stakeholders that attended the first weekly meeting in the study. There it was revealed that a single entity, the National Commission of Nuclear Energy, Ministry of Science and Technology (CNEN), manages radioactive waste, with the exception of small-scale businesses in the medical sector. Still, it became apparent that the management practices of radioactive materials used by businesses in the target area (MFZ) are unclear.

Thus, members of the study team visited the CNEN headquarters in Rio de Janeiro to conduct an interview. There it was discovered that there are 14 institutions using radioactive materials in Manaus, as shown in the table below.

Table 2-30: Institutions in PIM that use radioactive material

No	Purpose of Use	Reg No.	Institution
1	Large-sized irradiators	14522	Amazonas State Hematology and Hemotherapy Foundation
2	Nuclear medicine (with non-sealed sources)	11649	Amazonas State Nuclear Medicine and Ultrasonography Center
3		14234	Rio Solimões Institutional Support Foundation – UNISOL
4	Nuclear measurers – Process control -	13686	Amapoly Industria e Comercio Ltda
5		14606	Brasil Norte Bebidas Ltda
6		14386	Cervejarias Kaiser Brasil S/A - Manaus/Am
7		14569	Cia de Bebidas das Americas - Ambev - Filial Manaus
8		14579	Microservice Tecnologia Digital da Amazônia Ltda
9	Research	12546	Amazon National Research Institute - INPA
10	Prospection of Oil	10571	Schlumberger Servicos de Petroleo Ltda – Urucu
11	Radiotherapy	11457	FCECON – Oncology Control Center Foundation
12		14886	IMAM - Instituto de Mama do Amazonas Ltda
13	Analytical techniques	13760	COIMPA Industrial Ltda
14		14932	Instituto Nokia de Tecnologia

(Note) *1: Listed in the "Profile of the Companies with Projects Approved by SUFRAMA - Dez/2008"

Eight of the 14 facilities listed above were selected and visited for direct interviews. The study team provided a draft questionnaire form, which was used as the basis for discussion with the C/P, and then revised. The questionnaire contained the following items:

- Existence of usage permit and management standards
- Intended purpose for radioactive materials
- Types and management of radioactive materials
- Whether or not radioactive waste is generated
- Types of radioactive waste and generation amount
- Treatment and disposal methods of radioactive wastes
- Other

c. Basic Concepts of Radioactive Waste Management

The management of radioactive materials in general, whether as ore, product or waste, should fulfill the rules set by CNEN – Nuclear Energy National Commission. Complementarily, the use and operation of radioactive products and equipment should follow the rules of the environmental, medical and work authorities.

The concept of *waste* set by CNEN was amended by CONAMA (Res. 358/2005) and by ANVISA (RDC 306/2004) in their resolutions concerning to health-care wastes, among which are in the radioactive wastes and the respective wastes in Group C.

We consider as *radioactive wastes* the materials "which contain radionuclide in quantities superior to the exemption limits set in CNEN-NE-6.02, and for which the reuse is either not fit or not forecasted". The *low and medium radiation wastes* are those which contain, "predominantly, Beta and Gamma emission radionuclide with around 30 years half-life, with quantities and Alpha emissions equal or inferior to 3.7×10^3 Bq/g, and whose heat rates do not exceed $2kW/m^3$".

"The radioactive wastes cannot be considered *wastes* until the necessary decay time to reach the elimination limit is gone".

The *decay rate* or *half-life* of the nuclide contained in the material are data in the tables of CNEN, and the time of use, plus the provisory storage should be sufficient so the nuclide may drop to a radioactivity level equal or inferior to the one ordinarily present in nature and thus causes no harm to living beings – in that sense the waste becomes a *waste*, whose disposal will now depend on their chemical characteristics. An eventual intervention to reduce the radioactive activity of the waste to that acceptable level would be a *treatment* of the waste. Licensed enterprises may deliver to institutions authorized and supervise by CNEN for the storage and maybe treatment, their low or medium activity wastes, mainly sealed sources or also opened ones, in that case when the decay demands a very long and inconvenient for the generating enterprise.

High radioactivity wastes do not result from the current medical or industrial use, but from strict uses, such as nuclear reactors fuel. It may be feasible to reprocess it for other purposes, in specialized plants, or it may require a special chemical treatment, maybe followed by vitrification, stowage and storage in warehouses. There is no high radioactive *waste processing plant* in Brazil.

d. Origin of Radioactivity and Current Use Sources

Some chemical elements may be presented with instable nuclei due to the excess of energy, and they are called *radioactive*, or *radio-isotope* when they refer to a same element with different atomic masses. That exceeding energy may be emitted from the nucleus as particles (matter), so called *alpha and beta radiations*, or as electromagnetic waves, the *gamma radiations*, of the same nature as the transmission waves of radio, television and X-ray.

The radioactive activity is measured by the velocity of the disintegration of the instable atoms of the radioactive element, which is 1 Bq (one Becquerel); the multiple equal to 3.7×10^{10}Bq is 1 Ci (one Curie).

The radioactive sources emit particles or nuclear radiations which originate in the nucleus of the atoms, the Alpha, Beta and Gamma radiations. The X-ray machines are electromagnetic waves, atomic radiations of the same nature as the gamma radiations, but do not originate in the nucleus of an atom: they are radiations or energy lost in the braking of electrons launched by a high voltage accelerator against atoms. The X-ray equipment are not radioactive materials, but sources which, during their operation, emit those radiations as hazardous as gamma radiations and, because of that, require the attentions and rules of CNEN.

Ioning radiations are applied in industry, medicine, teaching and scientific research, using for that *sealed and non-sealed* or opened radioactive sources, as well as *X-ray equipment and particles accelerators*.

A sealed source is a radioactive material solidly incorporated in inert solid matter in into a hermetically closed and resistant to mechanic or thermal shocks inert capsule, in such a way it cannot be opened unless it is destroyed. Sealed sources are used in beta and neutron X-rays, industrial gamography, level, density or thickness measurers, radio-therapy, sterilization of clinical products, preservation of food, chemical and elements analysis, field ore analysis, and many other applications.

A non-sealed or open source is used in very small quantities, in liquid form, and very rarely as gas. It has a wide application for medical diagnosis, being injected into the blood to be followed from outside by a detecting device; and in healing medicine, irradiating a cancer in the thyroid, for instance. Besides that and many other applications in diagnosis and medical treatments, the open sources are used in the industry to measure flows, speed of fluids in pipes or filtering system, detection of leakages, and other applications.

CNEN authorizes the enterprises which propose to install and operate radioactive equipment, authorizes and controls the purchasing and use of radioactive materials, as well as the storage, treatment and elimination of the resulting wastes. CNEN keeps and makes available for verification, the registration data of the authorized enterprises and professionals qualified to work with radioactive materials, once the licensed facilities need a radioprotection supervisor registered by the organization.

Through such record were selected the enterprises aimed for the research we show from now on.

2.5.2 Legislation and Management

a. Establishment of CNEN by Laws 4118/62 and 6189/74

The basic Brazilian legislation states in **laws 4118/62 and 6189/74**, which establish the monopoly of the Federacy over research and permit of nuclear ores, the industrialization and commerce of all nuclear ores, products and sub-products.

The aforementioned laws create the Nuclear Energy National Commission-**CNEN** as a federal government office, granting it exclusive Power to set guidelines, safety rules, regulate, license, authorize and monitor all industrial, commercial, service and research activities, as well as the use and waste of all radioactive or radioactive contaminated material, including equipment, instruments and tools. Law 6189/74 grants competence to **CNEN** so it may produce radio-isotopes, radioactivity substances and nuclear sub-products, and trade them; and creates the Brazilian Nuclear Companies Inc.-**NUCLEBRÁS** to set the industrial rules over the other nuclear products, as a monopoly.

Not only the radioactive (and nuclear) facilities are under the control of CNEN, but also all radioactive material, from the purchasing and use up to the final destination.

The purchasing of a radioactive material can only be done by licensed enterprises and require an authorization from CNEN, to buy them both in Brazil and abroad – by the way, the Brazilian customs monitor and inform CNEN about a possible entrance of radioactive material.

Environmental License and others necessary for medical and industrial institutions operating radioactive equipment are granted by the regulating authorities, which rectify the concepts and requirements of CNEN, helping with the monitoring and surveillance of the activities.

The management of radioactive wastes in some facilities should be permanent, followed by a main *Radio-Protection Supervisor*, providing a substitute Supervisor so the activities will never lack surveillance. Those professionals should be certified by CNEN, which on regular basis holds tests in several cities of Brazil, with that purpose.

The person in charge for the adoption and fulfillment of the protection measures for human health and the environment exposed to the radiation to be emitted, and the supervisor, are in the Operation Authorization issued by CNEN to the industry or institution, always with a set deadline.

b. Related Legislation for Management of Radioactive Materials

CNEN is the regulating entity to receive and dispose the radioactive wastes, authorize other institutions to store and provide the elimination of low and medium radioactivity wastes, under its supervision, or to re-export wastes of products purchased abroad. There are three institutions authorized by CNEN: IEN – Nuclear Energy Institute (RJ), IPEN – Energy and Nuclear Research Institute (SP) and CDTN – Nuclear Technology Development Center (MG), all licensed to receive sealed source wastes, and non-sealed sources whose decay deadline is too long for temporary storage in the generating enterprise.

The rules and regulating positions applied to radioactive facilities, their equipment and operation, are the following:

CNEN NN 6.01 Requirements for the registration of individuals for the preparation, use and handling of radioactive sources.

CNEN NE 6.02 Licensing of radioactive facilities. PR 6.02 /001 Presentation of reports for the licensing of high-sized irradiators. (Regulating Position with specific requirements demanded in CNEN NN 6.01)

CNEN NE 6.05 Management of radioactive wastes in radioactive facilities

CNEN NE 6.06 Selection and choice of locations to store radioactive wastes

CNEN NE 6.09 Acceptance criteria for the disposal of low and medium radiation level radioactive wastes

CNEN NE 5.01 Transport of radioactive materials
PR 5.01 /001 Transport of radioactive by motorcycles in all national territory

CNEN NE 6.04 Operation of industrial X-ray services

CNEN NN 4.01 Radiologic safety and protection requirements for mining-industrial facilities

CNEN NE 3.02 Radio-protection services

CNEN NN 3.05 Radio-protection and safety requirements for nuclear medicine services

CNEN NE 3.06 Radio-protection and safety requirements for radio-therapy services

CNEN NN 3.03 Quality Certification of Radio-protection Supervisors
PR 3.03 / 001 - Working Areas of the Radio-protection Supervisors

CNEN NN 3.01 Basic Guidelines of radiologic protection
PR 3.01 /001 Exclusion, exemption and sparing requirements criteria for radiologic protection
PR 3.01 /002 Ponderation factors for the radiologic protection greatnesses
PR 3.01 /003 Coefficients of dosages for individuals exposed to radiation at work
PR 3.01 /004 Restriction of dosage, occupational reference levels and classification of areas
PR 3.01 /005 Criteria for the calculations of effective dosage arisen from the individual monitoring
PR 3.01 /006 Protection measures and intervention criteria in emergency situations
PR 3.01 /007 Intervention and action levels for chronic exposure
PR 3.01 /008 Environmental radiologic monitoring program
PR 3.01 /009 Model for the elaboration of environmental radiologic monitoring reports
PR 3.01 /010 Dosage levels for the notification of CNEN
PR 3.01 /011 - Dosage Coefficients for Public Exposure

For the management of wastes generated in *health services*, the following complementary resolutions should be taken into account:

- Resolution CONAMA 358 /2005 - Treatment and final disposal of health-care wastes
- Resolution ANVISA /RDC 306 /2004 – Management of health-care wastes

In national extent, the following laws should be taken into account:

- Law 6,453 /1977 Civil Liability Law
- Law 6,938 /1981 Environment National Policy
- Law 6,189 /1974 Law about nuclear issues (alters Law 4,118 /77)
- Law 4,118 /1962 Nuclear Energy National Policy; creates CNEN.

- Law 10,308 /2001 Radioactive Wastes Storage

c. Licensing by CNEN

c.1 General

Every company or institution which intends to use any radioactive material or radioactive source should require a Previous Approval from CNEN for the place proposed for such activity. Once the Previous Approval is granted, request the Authorization so the activity may become effective. The termination of the activity at a place should also be communicated to CNEN, informing the destination foreseen for the wastes, which will require the approval and surveillance of CNEN. Each activity requires a specific License or Authorization.

The frequent administrative acts are:

- Authorization to Purchase Radioactive Material
- Operation Authorization
- Renewal of the Operation Authorization
- Authorization Modification
- Operation Removal

and the demanded documents are the following:

- Authorization Request
- Radiologic Protection Plan
- Wastes Management Plan
- Decommissioning Plan.

c.2 Requirements and procedures for licensing according to the type of facilities and the source

The requirements and procedures for the licensing are in **CNEN NE 6.02,** and were set per type of facilities and the source they will use, being classified as follows:

c.2.1. Facilities which use sealed radioactive sources:

Group I: facilities which use large-sized sealed sources in radiation induced industrial processes.

Group II: facilities which use sealed sources for industrial radio-therapy or X-ray.

Group III: facilities which use sealed sources for other purposes other than those mentioned above.

c.2.2. Facilities which use non-sealed radioactive sources:

Group IV, V or VI: facilities where radionuclide whose classes and total activity limits specified in Table 1 presented in **CNEN NE 6.02** are manipulated, used or stored.

c.2.3. Facilities which use particle accelerators:

Group IX: facilities which use large-sized X-ray machines or particle accelerators.

Group X: facilities which use equipment other than those mentioned in Group IX.

c.3 Licensing process of radioactive facilities

The general licensing process of radioactive facilities involves, as the case may be, the request from the solicitor and the issuance by CNEN, of the following:

c.3.1. For GROUP I facilities:

- Previous Approval
- Construction License
- Authorization to purchase radioactive material
- Operation Authorization

c.3.2. For GROUP II facilities:

- Construction License
- Authorization to purchase radioactive material
- Operation Authorization

c.3.3. For GROUP III facilities:

- Authorization to purchase radioactive material
- Operation Authorization

c.4 Free from the licensing process

Will be **free from the licensing process** set in this Rule, the facilities which comprehend, at any moment:

(a) Specific activity radioactive substances inferior to 0.0027 mCi/g (100 Bq/g) or natural solid radioactive substances of specific activity inferior to 0.014 mCi/g (500 Bq/g);

(b) Radionuclide whose total activities, within each class, do not exceed the following amounts:

Class A	0.1 mCi
Class B	1 mCi
Class C	10 mCi
Class D	100 mCi

(c) Equipment which emit ioning radiation with energy inferior to 5 keV.

In the case of facilities working with radionuclide (other than Th nat and U nat) belonging to different classes, the exemption criteria is decided by means of the calculation of the resulting ioning energy, for which the NE 6.02 provides a formula.

It is important to notice every enterprise or facilities where radiation sources are produced, used, transported or stored are defined as ***radioactive facilities*** – except: a) nuclear facilities (objective of **CNEN NE 1.04**) and b) vehicles which transport radiation sources, when they do not integrate the vehicles.

c.5 Termination of License

The radioactive facilities which decide to **terminate** their activities should request from CNEN the **cancelling of the Authorization** for the operation, by means of a request form followed by at least the information below, besides the fulfillment of determinations contained in specific Rules:

(a) destination to be given to the radioactive material and other sources of radiation;

(b) destination to be given to the records to be kept;

(c) technical and administrative procedures for the total decontamination of the facilities.

The licensing of large-sized facilities for the irradiation of food should follow specific requirements set in **CNEN NE 6.02**.

c.6 Wastes Management Plan

The Wastes Management Plan is highly important and should be formulated according to CNEN NE 6.05, which:

- Sets general criteria and basic requirements concerning the management of radioactive wastes in radioactive facilities;
- Presents in its scope the classification of the wastes with Beta, Gamma and Alpha emitters, both liquid and solid, as well as the general requirements for Wastes Management, i.e., the segregation, stowage and identification;
- Specifies the criteria to be followed as for the transport, provisory storage and elimination of radioactive wastes;
- Presents the limits to be followed concerning the elimination of liquid, solid and gaseous wastes from some facilities, bound to the approval based on the analysis of the pertinent environmental factors.

2.5.3 Selections of the Survey Target Institutions

The records in CNEN of companies and institutions licensed for activities with radioactive sources, shows the following companies located in **Manaus**:

Type	Number of Factories/Institutions
Large-sized Irradiators	1
Nuclear Medicine (with non-sealed sources)	2
Nuclear Measurers - Process Control	5
Research	1
Oil Prospection	1
Radiotherapy	2
Analytical Techniques	2
Total	14

Based on the records of CNEN, the following were selected for visitation and interview with the person in charge:

- Five enterprises located in Industrial District which use sealed sources in their industrial process (nuclear measurers and level controllers):
- Two enterprises located in DI which apply analytical techniques:
- One enterprise out of Industrial District which used non-sealed source (radio- isotope) in image medical diagnosis:

2.5.4 Execution of the Survey

A questionnaire was elaborated to be answered by the people in charge during visitation to the enterprise. The visitations were set by the team in charge of the survey after formal request by SUFRAMA, and took place from 13 July 2009 to 05 August 2009.

The questionnaires were answered during the interviews according to the documents which compose in the Section 2.5.6 of this Report, and the answers are summarized in both charts below:

2.5.5 Results of the Survey and Findings

Analysis of the above survey results was carried out according to the questions found in the questionnaire sheet. The findings by the visit of target institutions are summarized below.

a. Findings by the visit of target institutions

The survey showed all enterprises are properly authorized by CNEN by operation authorization valid for 1 to 3 years, in which the Legal Representative is pointed out, and in almost all of them it is the Radio-protection Supervisor. Nevertheless, the industries use relatively simple sealed sources, mainly for measurement and spectrum, and maybe because of that it has no permanent supervisors, only eventual or periodic ones instead – different to what is set by the rules of CNEN.

CENUSA (Amazonas State Nuclear Medicine and Ultrasonography Center) uses open sources (radioisotope) for medical diagnosis by image, that is why it has a doctor who is at the same time the representative and the professional registered in CNEN for radioactive operations.

It is important to notice the radioactive particles last only for a few hours and the person who receives them will eliminate them in the urine or faeces. The restrooms of CENUSA are located in controlled areas; they show signs concerning hygienic and double flush, according to the rules of CNEN. The non-sealed sources are stored in adequate containers, up to the sufficient decay, when then they become radioactive waste and are disposed.

In all enterprises, the sources operate or are stored in controlled areas, inside the respective equipment, devices or special containers. The sealed sources are replaced at the end of their shelf-life, when they become wastes; they GO to a licensed destination, by the very producer of the product.

b. Summary of Questionnaire Results

- Survey Target

Purpose of use (Type)	Number of target
Nuclear measurers - control of nuclear measuring processes	5
Analytical Techniques	2
Nuclear medicine	1
Total	8

Q.1 Do you have a license of radioactive material use and a control/management document for radioactive material?

Base : Population = 8		
Q1	Answer	%

a. Yes	8	100.0
b. No	0	0.0
Total	8	100.0

Q.2 For what purpose do you use the radioactive material?

Base : Population = 8		
Q2	Answer	%
a. For medical purpose	1	12.5
b. For check of the product of my factory	7	87.5
c. For check of the construction works	0	0.0
d. Others	0	0.0
Total	8	100.0

- The following table shows the specifics as given in the responses.

Answer of Q2	Specify	Answer
a.	Dyagnosis	1
b.	Filling level inspection/ measurement	4
	Measurement of the PVC sailcloth in the process	1
	Products dimension control	1
	B- Verification of the solder	1

Q.3 Information on Radioactive Material Used

Q.3.1 What kind of radioactive material do you use?

Base : Population = 8		
Q3.1	Answer	%
Americium (Am)	3	37.5
Krypton (Kr)	1	12.5
Cesium (Cs)	1	12.5
CRT (uses no radiation)	1	12.5
CRT-Be (Beryllium)	1	12.5
Technetium (Tc)	1	12.5
Total	8	100.0

Q.3.2 Of which radioactivity unit do you use?

Base : Population = 8		
Q3.2	Answer	%
a. Bq	4	50.0
b. Ci	2	25.0
c. MSV	1	12.5
d. not use	1	12.5
Total	8	100.0

Q.3.3 Is the radiation source sealed?

Base : Population = 8		
Q3.3	Answer	%
a. Yes	6	75.0
b. No	1	12.5
c. Others (The Lamp)	1	12.5
Total	8	100.0

Q.3.4 How do you store the radiation source?

Base : Population = 8		
Q3.4	Answer	%
a. It is stored inside of the controlled area with special container.	3	37.5
b. It is stored inside of the controlled area and installed inside of the X-ray equipment.	3	37.5
c. Others	2	25.0
Total	8	100.0

- Specifics of the targets listed as other in the responses are as follows.

*installed in a level measurement device
*installed in a device within the controlled area

Q.3.5 Where is the X-ray equipment used?

Base : Population = 8		
Q3.5	Answer	%
a. In the controlled area.	7	87.5
b. In the open air	0	0.0
c. Others	1	12.5
Total	8	100.0

- Specifics of the targets listed as other in the responses are as follows.

*radio-isotope injected in the patient

Q.4 Do you generate radioactive waste?

Base : Population = 8		
Q4	Answer	%
a. Yes	0	0.0
b. No	8	100.0
Total	8	100.0

<All survey targets responded they have no radioactive waste, so the following questions did not require responses.>

Q.5 What kind of radioactive waste do you generate?

Q.6 How many kilograms of radioactive waste do you generate in a year?

Q.7 How do you treat and dispose the radioactive waste?

Q.8 How do you transport the radioactive waste?

Q.9 How do you dispose the radioactive waste?

2.5.6 Questionnaire of Radioactive Waste Generation Survey

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Questionnaire to the Radioactive Waste Generation Source

Q.1 Do you have a license of radioactive material use and a control/management document for radioactive material?
a. Yes.
b. No.
If yes, please show us them.

Q.2 For what purpose do you use the radioactive material?
a. For medical purpose
(Please specify :)
b. For check of the product of my factory
(Please specify :)
c. For check of the construction works
(Please specify :)
d. Others
(Please specify :)

Q.3 Information on Radioactive Material Used

Q.3.1 What kind of radioactive material do you use?
(Please specify :)

Q.3.2 Of which radioactivity unit do you use?
a. Bq
b. Ci

Q.3.3 Is the radiation source sealed?
a. Yes
b. No

Q.3.4 How do you store the radiation source?
a. It is stored inside of the controlled area with special container.
b. It is stored inside of the controlled area and installed inside of the X-ray equipment.
c. Others (Specify : .....)

Q.3.5 Where is the X-ray equipment used?
a. In the controlled area
b. In the open air
c. Others (Specify : .....)

Q.4 Do you generate radioactive waste?
a. Yes.
b. No.
If yes, please answer the following questions.

Q.5 What kind of radioactive waste do you generate?
a. Spent radioactive material (Please specify :)
b. Substance contaminated by radioactive material (Please specify :)
c. Others (Please specify :)

Q.6 How many kilograms of radioactive waste do you generate in a year?

a. (Specify : 1. unit : kg/year)
b. (Specify : 2. unit : kg/year)
c. (Specify : 3. unit : kg/year)

Q.7 How do you treat and dispose the radioactive waste?
a. It is stored inside of the controlled area of our compound with special container.
b. It is entrusted to the contractor for disposal outside.
c. Others (Specify :)
If the answer is b. or c., please answer the following questions.

Q.8 How do you transport the radioactive waste?
a. We transport it by ourselves.
b. We entrust outside transporter for radioactive waste
c. Others (Specify :)

Q.9 How do you dispose the radioactive waste?
a. Final disposal facilities of Federal government.
b. Final disposal facilities of State government.
c. Others (Specify :)
d. I don't know.

Radio-protection Supervisor - …..……

Person in charge of the plant - …….....

****

2.5.7 Current Conditions and Issues for Radioactive Waste Management

a. Classification of the Radioactive Wastes

a.1 Classification by CNEN

The rule CNEN NE 6.05 - Management *of radioactive wastes in radioactive facilities* classifies the wastes in categories, as per the **physical state, nature of the radiation, concentration and exposure rate**. They result in **two classes**: wastes with beta or gamma emitters, and wastes with alpha emitters, sub-divided in categories, as seen below:

a.1.1. Wastes with Beta/Gamma Emitters

Liquid Wastes

The liquid wastes containing beta and/or gamma emitters, and in which the eventual alpha emitters have a total concentration inferior to $3.7x10^8$ Bq/m^3 (10^2 Ci/m^3), are classified in the following categories, according to the levels of concentration (Table 1).

Table 2-31: Classification of liquid wastes with beta/gamma emitters

CATEGORY	CONCENTRATION	
	(Bq/m^3)	(Ci/m^3)
Low Radiation Level (LBN)	$c \leq 3,7x10^{10}$	$c \leq 1$
Medium Radiation Level (LMN)	$3,7x10^{10} < c \leq 3,7x10^{13}$	$1 > c \leq 10^3$
High Radiation Level (LAN)	$c > 3,7x10^{13}$	$c > 10^3$

Solid Wastes

The solid wastes containing beta and/or gamma emitters, and in which the eventual alpha emitters have a total concentration inferior to 3.7×10^8 Bq/m^3 (10^2 Ci/m^3), are classified in the following categories, according to the exposure level on the surface of the waste:

Table 2-32: Classification of solid wastes with beta/gamma emitters

CATEGORY	NA RATE EXPOSURE (X) SURFACE	
	µC/kg · h	R/h
Low Radiation Level (SBN)	X ≤ 50	X ≤0,2
Medium Radiation Level (SMN)	50 < X ≤ 500	0,2 < X ≤ 2
High Radiation Level (SAN)	X > 500	X > 2

Gaseous Wastes

The gaseous wastes are classified in the following categories, according to the concentration levels.

Table 2-33: Classification of gaseous wastes with beta/gamma emitters

CATEGORY	CONCENTRATION (c)	
	(Bq/m^3)	(Ci/m^3)
Low Radiation Level (GBN)	c ≤ 3,7	c≤1010
Medium Radiation Level (GMN)	$3,7 < c \leq 3,7x10^4$	$10^{10} > c \leq 10^6$
High Radiation Level (GAN)	$c > 3,7x10^4$	$c > 10^6$

a.1.2. Wastes with Alpha emitters

Liquid Wastes

The liquid wastes containing alpha emitters in concentrations superior to $3.7x10^8$ Bq/m^3 (10^2 Ci/m^3) are classified in the following categories, according to the concentration levels.

Table 2-34: Classification of liquid wastes of alpha emitters

CATEGORY	CONCENTRATION (c)	
	(Bq/m^3)	(Ci/m^3)
Low Radiation Level Alpha (LaBN)	$3,7x10^8$ $c \leq 3,7x10^{10}$	$10^2 < c \leq 1$
Medium Radiation Level Alpha LaMN)	$3,7x10^{10} < c \leq 3,7x10^{13}$	$1 < c \leq 10^3$
High Radiation Level Alpha (LaAN)	$c > 3,7x10^{13}$	$c > 10^3$

Solid Wastes

The solid wastes containing alpha emitters in concentrations superior to $3.7x10^8$ Bq/m^3 (10^2 Ci/m^3) are classified in the following categories, according to the concentration levels.

Table 2-35: Classification of solid wastes of alpha emitters

CATEGORY	CONCENTRATION (c)	
	(Bq/m^3)	(Ci/m^3)
Low Radiation Level Alpha (SaBN)	$3,7x10^8 < c \leq 3,7x10^{11}$	$10^2 < c \leq 10$
Medium Radiation Level Alpha (SaMN)	$3,7x10^{11} < c \leq 3,7x10^{13}$	$10 < c \leq 10^3$
High Radiation Level Alpha (SaAN)	$c > 3,7x10^{13}$	$c > 10^3$

a.2 Classification of the Health Radioactive Wastes

The Resolution of CONAMA n. 358/2005, **does not apply** to **sealed** radioactive sources (Art.1 sole §), but to opened sources and health and research institutions in that area, with their respective equipment and activities.

The radioactive wastes defined by CNEN form the Group C of this Resolution, and should follow the rules of CNEN until the necessary decay takes place so they may go the biologic, chemical or common wastes category and start following the determinations for the group they belong to (Art.23 §2).

The Health-care Wastes Management Plan should forecast all the guidance and attaining procedures.

Resolution RDC 306/2004 of ANVISA – Sanitary Surveillance National Agency reassures and details the definitions of CNEN and CONAMA:

> GROUP C – In this group are the radioactive wastes or the wastes contaminated with radionuclide, coming from clinical analysis laboratories, nuclear medicine and radio-therapy services, according to the resolution of CNEN-6.05.
>
> 12.1.1 – The solid radioactive wastes should be stowed into a container made from a rigid material, internally covered with a resistant plastic bag and identified according to item 12.2.1.
>
> 12.1.2 – The liquid radioactive wastes should be stowed in bottles holding up to two liters or in barrels made from a material compatible with the stored liquid, of plastic always than possible, resistant, rigid and stanching, with a screwed cover, sealed, stowed in an unbreakable material tray and with a depth sufficient to contain, under the due safety rate, the total volume of the waste, and identified according to item 10.2...
>
> 12.1.3 – The piercing and cutting materials contaminated with radionuclide, should be disposed separately, in the place where they were generated, right after use, in stanching containers, rigid, with cover, properly identified, being utterly prohibited to empty such containers to be reused....
>
> 12.2.1 - Group C is represented by the international ioning radiation symbol in yellow background labels with black contour, reading RADIOACTIVE WASTE, indicating the main risk such material presents, beside information about the content, name of the radioactive element, decay time, generation date, name of the generating unit, according to the rules of CNEN NE 6.05 and others CNEN may determine.
>
> 12.2.3 – After the decay of the radioactive element to the elimination level set CNEN NE 6.05, the label RADIOACTIVE WASTE should be removed and replaced with another label, according to the Group of the waste it fits in.

The Resolution guides the on-site treatment and storage, which can be done in the very manipulation room or in a specific room identified as *decay room*. The selection of the storage place, taking into account the half-lives, the activities of the radioactive elements and the volume of waste generates, should be defined in the Facilities Radio-Protection Plan.

Such plan should also inform the preliminary treatment of the excrements, the stowage, identification and conservation of contaminated food, until he decay is completed. That should be done in the controlled manipulation area or in a decay room provided with armored walls or, in that very room, store the wastes in individual armored containers.

There are specific demands for nuclear medicine activities.

The decay room should have controlled access. It should be identified and have restrict access, provided with the means to assure safety conditions against the action of natural phenomena, and comply with the Radio-Protection Plan approved by CNEN for the installation.

b. Radioactive Wastes Management

b.1 General Information

As stated in the Section 2.5.2 *Legislation and Administration*, CNEN has got the exclusive legal competence in Brazil to set guidelines, license, authorize and monitor every activity, installation, equipment, instrument and tool which may use radioactive material or material contaminated with radiation – whether ore, product or waste, national or foreigner. The legislation also grants CNEN the legal competence to produce and commercialize radio-isotope, radioactive substances and nuclear sub-products.

CNEN elaborates and makes available to all, free of charge in the internet, technical rules, instructions for the procedures and licensing, as well as didactical material concerning the issue. Provides the licensed enterprises and registered professionals by means of courses it holds on regular basis for the surveillance or handling of radioactive activities and sources. It is meant to highlight that, in order to facilitate an efficient and current control, the licenses are issued with a validity limited to a short period, expressing in them the Radio-protection Supervisor and the Person in Charge of the activities.

CNEN is the competent entity to receive and dispose the radioactive wastes, even authorizing other institutions to do so under its supervision. Today the authorized entities are, IEN (RJ), IPEN (SP) and CDTN (MG) to store and carry out the elimination of low or medium radiation intensity sealed sources; the authorization also comprises the non-sealed source with long-term decay, which may present difficult practical provisory storage in the enterprise which used it. It may also authorize the re-exports to the foreign vendor. The disposal of radioactive wastes in a place determined by CNEN, without the intention of removing them, is defined as *disposal*.

High radioactivity wastes are generated in nuclear facilities only, where they are stored for elimination out of Brazil.

Radioactive Waste (or simply Waste) is defined as a material resulting from human activities which contain radio-nuclides in quantity superior to the exemption limit specified in *Rule CNEN NE6.02 Licensing of Radioactive Facilities*, and for which the reuse is either improper or not foreseen.

Radioactive Facilities is the enterprise where radiation sources are produced, processed, handled, used, transported or stored, except:

a) the Nuclear Facilities defined in *Rule CNEN NE1.04, Licensing of Nuclear Facilities*; and b) the vehicles which transport radiation sources.

Radioactive Material is the material which contains ioning radiation emitting substances.

The disposal of a radioactive material from a “non sealed source” may be done after the sufficient decay in the sanitary sewer system, if it is liquid, or in a sanitary landfill if it is solid. The time of use plus the provisory storage of the source should be sufficient for the nuclide to decay to a radioactivity level which may not cause harm to living beings, which is equal or inferior to what is ordinarily noticed in nature. That period and the decay rate (or half-life) of the nuclides are presented in tables made available by CNEN.

The rule ***CNEN NE 6.05 – Management of Radioactive Wastes in Radioactive Facilities*** guides the generator of those wastes so it may elaborate its **Radiologic Protection Plan**, which is necessary for the installation licensing and purchasing and use authorization of the material. In it is the **Wastes Management Plan**, which has to do with its management, provisory storage and destination.

Rule NE-6.05:

- Sets general criteria and basic requirements concerning the management of radioactive wastes in radioactive facilities;
- Presents in its scope the classification of the wastes as Beta and Gama emitters and with solid and liquid Alfa emitters, as well as the Wastes Management general requirements, i.e., the segregation and stowage and the identification;
- Specifies the criteria to be followed as for the transportation, provisory storage and the elimination of radioactive wastes;
- Shows the limits to be followed as for the elimination of liquid, solid and gaseous wastes from some facilities, bound to obtaining a report based on the analysis of the pertinent environmental factors.

The Wastes Management Plan shows:

- Storage Area Description
- Procedures for Segregation, Stowage,
- Identification, Storage, Elimination, Transfer
- Training
- Records
- Emergency situations

The Radioactive Wastes Management is defined as the set of administrative activities and techniques involved in the collection, segregation, handling, treatment, stowage, transport, storage, control and disposal of radioactive wastes.

b.2 Management of Radioactive Wastes in the Generation Source

Rule CNEN NE 6.05 sets, among other items -

1. General Requirements

1.1 The wastes should be physically separated from any other materials.

1.2 The wastes initially submitted to segregation which cannot be removed from the facilities, should be placed in proper containers and stored until they may be transferred or eliminated, as per the specific requirements.

1.3 The containers meant both for segregation and collection, transport and storage of wastes should have the international symbol of radiation, in a visible and clear way.

1.4 The place for the provisory storage of waste should be included in the installation project.

2. Segregation

2.1 The segregation of wastes should be done in the same place they are produced, taking the

following characteristics into account:

a) Solid, liquid and gaseous;

b) Short or long shelf-life (T1/2 > 60 days);

c) Compactable or non-compactable;

d) Organic or inorganic;

e) Spoiling or pathogenic, if that is the case;

f) Other hazardous characteristics (exclusivity, combustibility, inflammability, pyreforicity, corrosiveness and chemical toxicity).

2.2 After segregation and **stowage** in proper containers (sub-section 3), the wastes must be **identified** according to Annex A and **classified** according to the 09 categories of Section 4. The **eliminated** wastes must be **registered** (Section 06) according to the form (Annex C).

3. Containers

3.1 The containers for segregation, collection or provisory storage should fulfill the physical, chemical, biological and radiologic characteristics they are meant for.

3.2 The containers for the provisory storage of wastes must have their integrity conditions assured and, if necessary, they should be replaced.

3.3 The containers meant for internal transport should not present external superficial contamination in level superiors to those specified in Annex B.

3.4 The containers meant both for segregation and collection, transport and storage of wastes should be properly sealed and have its content identified (item 2.2) with all data of Annex A.

4. Transport

4.1 The vehicles used for internal transport f wastes should have proper fixation means for the containers so they are not damaged.

4.2 The vehicles, after the internal transport services, should be monitored and, if needed, they should be decontaminated.

4.3 The external transport of wastes is regulated by the current Radioactive Materials Transport Rule.

5. Provisory Storage

The area of the facilities meant for the provisory storage of wastes, as applicable, should:

a) keep the wastes in safety, from the physical and radiologic point of view, **until they can** be removed to a place set by CNEN;
b) have a system which may allow the **control** of the release of radioactive material into the environment;
c) have an area **monitoring** system;
d) be located **far** from the normal working areas, being **fenced** and **identified,** with the **access restricted** to authorized personnel;
e) have waterproof and easily decontaminating walls and floors;
f) have **blindage** for the outside so it may fulfill the radio-protection requirements;
g) have **ventilation**, **exhausting** and **filtering** systems;
h) have means of **avoiding** the **dispersion** of the material **by animals**;
i) present a **clear delimitation** of the restrict areas and, if necessary, areas reserved

for individual monitoring and decontamination;
j) have a **tanks** and floor **drains** systems for the collection of liquids arisen from leakages, decontamination, etc;
k) have means to **avoid the spoiling** of organic materials;
l) provide **safety** against the action of events caused by **natural phenomena**;
m) have **physical barriers** aiming for minimizing the dispersion and migration of radioactive material into the environment;
n) in order to facilitate the handling of the materials and minimize the exposure of workers, have proper **procedures**, always **visible** on walls, notice-boards and other visible areas;
o) have physical protection and radio protection **preliminary plans**, as well as **procedures** for **emergency situations**.

6. Treatment

Any treatment of radioactive wastes is bound to approval of CNEN, in conformity with the specific rules for each type of facilities.

7. Elimination

7.1 The elimination of liquid, solid and/or gaseous wastes from some facilities, following certain limits, is bound to getting an approval from CNEN based on the technical analysis of the pertinent environmental factors.

7.2 The elimination of liquid wastes into the sewer should follow the following requirements:

a) the waste must be promptly soluble or easily absorbed by water;
b) the quantity of each radionuclide released **every day** by the facilities into the sewer should not exceed the highest of the following numbers: the quantity diluted in the average daily sewer volume released by the facilities, should result in an average concentration equal to the limits specified in Table 6, Column 1; ten times the limit specified in Table 6, Column 3;
c) the quantity of each radionuclide released **a month**, when diluted by the average monthly volume of sewer released by the facilities, should have a concentration inferior to the limits specified in Table 6, Column 1;
d) the total **annual** quantity of radionuclide, excluding H3 and C14, released in to the sewer, should not exceed 3.7×10^{10} Bq (lCi);
e) the **annual** quantity of H3 and C14, released into the sewer, should not exceed 18.5×10^{10} Bq (5Ci) and 3.7×10^{10} Bq (1Ci), respectively.

7.3 The elimination of **excrement** of patients submitted to radio isotopic therapy should be done according to the specific instructions set by CNEN.

7.4 The elimination of **solid** wastes **into the domestic waste collection system** should have its specific activity limited to 7.5×10^{4} Bq/kg (2 mCi/kg).

7.5 The elimination of **gaseous** wastes into the atmosphere should be done in concentrations inferior to those specified in Table 6 Column 2, and should be previously authorized by CNEN .

8. Transfer

The transfer of wastes from some facilities is exclusively allowed for a place in the Country determined by CNEN, or with its authorization for another country.

The Rule sets the obligation to keep the updated record and inventory of the wastes, and imposed periodic inspections for each licensed enterprise.

9. Records and Inventories

9.1 In **any** facilities, updated records of all wastes should be kept, describing:

a) identification (2.2) of the waste and location of the container in which it is kept;
b) precedence and destination;
c) external and internal transfer;
d) eliminations, particularizing the released daily activities;
e) other safety information.

9.2 Any **modification** or **correction** done in the data contained in the records should be clearly justified and documented.

9.3 The records, as well as the documents related to the corrections, should be **kept in the** facilities.

9.4 **On regular basis**, as per the determinations contained in the operation authorization, the **inventory variations** control of all radioactive material should be sent to **CNEN**, including the wastes, according to the form (Annex C).

10. Inspections and Auditing

10.1 The facilities should facilitate the access of **inspectors of CNEN or its authorized representatives** so inspections and auditing may be carried out.

10.2 CNEN may, at its own discretion, determine the **suspension or cancelling of the operation authorization**, in the cases of the non-fulfillment of requirements of this or other applicable rules.

Annexes mentioned and contained in Rule NE 6.05 -

Annex A - Form for the identification of wastes contained in each container

Annex B – Maximum allowed levels of removable radioactive contamination in the containers.

Annex C – Variation control of the radionuclide inventory

Annex D - Table 6 of the elimination of radioactive wastes. This table presents three frequent use columns:

Column 01 and Column 03 - concentration and/or maximum allowed activity for the elimination of solid wastes into the sewer (subsection 5.7.2).

Column 02 - maximum allowed concentration for the elimination of gaseous wastes into the atmosphere previously authorization by CNEN.

b.3 Management of Radioactive Wastes out of the Generation Source

The responsibility of the generator of radioactive wastes is up to their total and definitive elimination. It is kept during the external transportation units they are received the collecting company, if that one is licensed by CNEN for the purpose defined in the authorization previously granted by this entity to the generator.

The generator should strictly fulfill the rules fit to it – particularly those concerning the correct classification of the waste, its package and identification, and the transport – and demand from the collector the evidence of its current licensing, as well as the reception and destination certification authorized by CNEN for the waste, whether it is a storage, treatment or elimination.

Every transfer to another place should be registered in the origin, as set in **NE 6.05**

Management of Radioactive Wastes in Radioactive Facilities.

The following rules hold special interest:

CNEN **NE 5.01** Transport of radioactive materials

CNEN **NE 6.09** Criteria for the acceptance for the disposal of low and medium radiation level radioactive wastes

And also concepts set in CNEN **NE 6.06** Selection and choice of local for the storage of radioactive wastes -

Initial storage – temporary storage of radioactive wastes in the facilities which have generated them.

Storage of radioactive wastes – facilities meant for the storage of radioactive wastes.

Final storage – area meant for receiving, following the criteria set by CNEN, the radioactive wastes coming from initial storage, intermediate storage, and provisory storage.

Intermediate storage – area meant for receiving and eventually for the stowage of radioactive wastes, with the objective of using them in the future, or removing them for the final storage, following the acceptance criteria and other rules set by CNEN.
Provisory storage – area meant for receiving radioactive waste coming from an area struck by accidents with radioactive materials up to their transfer, in maximum safety conditions, to another storage area.

Deposition – placement of radioactive waste in places approved by the regulating authorities, without the intention of removing them.

The Wastes Management Plan informs the procedures for packaging, identification, provisory and final storage or eventual treatment, and the consequent transport. It is meant to remind ***CNEN NE 6.05*** defines:

5.6 TREATMENT – Any treatment of radioactive wastes is bound to approval by CNEN, according to specific rules for each type of facilities.

5.7 ELIMINATION -

5.7.1 The elimination of liquid, solid and/or gaseous wastes from some facilities, following certain limits, is bound to obtaining approval from CNEN, based on the technical analysis of the pertinent environmental factors.

5.8 TRANSFER – The transfer of wastes from some facilities is exclusively allowed for a place in the Country determined by CNEN or under its authorization for another country.

On the other hand, ***CNEN-NN-6.09*** adds –

4.17 Identification of the Package – The identification of the package should present no mistakes, be visible and permanent, and it should also assure the correspondence with the documents which may have the information about the product.

4.18 Configuration of the Package – The wastes stowage packages should follow a standard and be compatible with the handling, transport and disposal procedures.

5.3 Package – For means of disposal, no package may be used without previous approval by CNEN.

5.3.1 Disposal package project – The project of any package should be submitted to the

approval of CNEN.

5.3.2 Over package –

5.3.2.1 Whenever needed or recommendable, it will be allowed to place a package inside another one, the so celled over package.

5.3.2.2 The empty spaces between packages and over packages should be filled. The filling procedure and the material to be used should be submitted to the previous approval of CNEN.

5.3.2.3 The over packages will be bound to the same requirements demanded for the packages.

5.4 Packed -

5.4.1 Identification – The packages should present no mistake and be accurately identified and marked in a legible and durable way according to the radiologic characteristics, as well as origin. The identification should also include the weight in such a way it may assure the correspondence with the documents containing the information about the waste.

5.4.2 Records of Packages – All packages should have a documentation registering their physical, chemical, radiologic and mechanic characteristics, as well as their origin. Besides those data, the following information should also be provided, as applicable: a) description of the treatment process; b) degradation 0of the matrix; and other ones described in the rule.

c. Final Remarks

The radioactive wastes deserve a clear and defined attention by only one Regulating Authority, working complementarily only, in its specific extents, the other authorities which deal with the environment, work safety, health care, and the manufacturing and agricultural industries.

That Regulating Authority, CNEN, provides the rules and many didactically organized information, free of charge in the internet, as well as training and professional registration assessments, working not only as technicians in their enterprises, but also as spokespeople of CNEN. The demand for licensing and authorization by the central authority for the implantation and operation of facilities and equipment, as well as deactivation, is the most important safety and monitoring instrument of all the implanted facilities.

Organized as such, the Administration of the radioactive materials, including the wastes, may be relatively simple and safe. Failures may happen more than everything due to the *deceitful* factor the small quantity of generated wastes is, which lead to neglecting the rules fulfillment.

Last but not least, is it meant to notice the radioactive deactivation turns a **refused material** into **waste** to be classified according to its chemical, biologic and physical characteristics – not always inert – when they their management and adequate destination will be decided upon.

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3. Present Generation of Industrial Waste

3 Present Generation of Industrial Waste

3.1 Previous Studies

A number of PIM factories have been submitting a waste inventory (WI) to SUFRAMA since 2002. SUFRAMA subsequently has compiled the WI from 2005 to 2008 as shown in the following table.

Table 3-1: Inquiries and Answers for Waste Inventory

Item	2005	2006	2007	2008
Questionnaires Sent	186	223	229	229
No. of Respondents	102	94	126	110
Ratio of Response (%)	54.8	42.2	55.0	48.0
Did not answer	84	129	103	129

Table 3-2: Generation Rate from Responding Factories

Unit: ton/year

Waste Type	2005	2006	2007	2008
Factories that responded	102	94	126	110
1. Non Industrial Waste	4,286.6	5,950.4	6,581.0	5,268.3
2. Various	37,565.6	35,226.4	38,250.9	41,058.4
3. Rubber and sludge	1,847.2	8,742.4	4,292.0	4,852.2
4. Contaminated waste	338.0	291.3	17,195.0	2,935.7
5. Dangerous residues	6,858.5	2,583.5	2,093.8	2,112.9
6. Metallic waste	9,432.7	43,769.1	33,913.3	30,351.8
7. Liquid waste	1,549.0	6,856.5	662.1	5,658.7
Total	61,877.7	103,419.5	102,988.0	92,238.0

The above attempt to analyze the WI received, shown above, did not clarify the overall generation of waste in PIM in terms of characteristics and quantity, nor the actual conditions of management of those wastes.

3.2 Generation Amount

3.2.1 Factories Surveyed

The following table shows the 134 factories that were surveyed in order to create this report. At present, this is 30.5% of the total number of factories (440) operating in PIM/MFZ.

Table 3-3: Detail on Factories Surveyed

Factory code	Industrial District (DI)			Outside DI			Total number of factory	Surveyed number of factories
	Number of Factory			Number of Factory				
	Part	Part	Sub-	Part	Part	Sub-		

	1	2	total	1	2	total	(A)	Number (B)	% (B/A)
F01	3		3	12		12	15	5	33.3
F02									
F03	6		6	3	7	10	16	6	37.5
F04	64	1	65	51	5	56	121	65	53.7
F05	2		2				2	0	0.0
F06	19		19	9		9	28	17	60.7
F07	23	2	25	19	3	22	47	19	40.4
F08		1	1	2	3	5	6	1	16.7
F09	1		1	3	1	4	5	2	40.0
F10	7		7	6		6	13	7	53.8
F11	2		2	1		1	3	0	0.0
F12				4	9	13	13	3	23.1
F13	13	2	15	15	4	19	34	12	35.3
F14	31	2	33	35	7	42	75	24	32.0
F15				1		1	1	0	0.0
F16				2		2	2	0	0.0
F17	15		15	16	2	18	33	19	57.6
F18		1	1	2	3	5	6	0	0.0
F19	7		7	5	8	13	20	7	35.0
Total	193	9	202	186	52	238	440	187	42.5

a. Responses on the Generation Amount of Industrial Waste

Of the 187 factories surveyed, 170 supplied valid answers to their amount of industrial waste generated (17 factories only answered the general items). The following table shows the answers of 170 factories indicating a total of 1,876 wastes. However, of this number, estimations for the amount of Item B: Health-care Waste and Construction Waste were done in separate surveys, and are therefore excluded. Since the effluent is not included in waste categories in this study, it is also excluded. The amount of effluent generated is as follow:

- Generation amount for target factories: 104,588 m^3 per year/ 286.5 m^3 per day
- Generation amount for all PIM factories: 270,698 m3 per year/ 741.6 m3 per day

Here, items indicated "m^3 per year" were converted to 1 ton/m^3.

Table 3-4: Responses for Industrial Waste Generation Amount

Factory Code	A. Number of Wastes by Responding Factories	B. Eliminated Waste Items (Health-care, Construction, Effluent)	C. No. of Wastes used to estimate waste amount	D. Items showing ton/year from Items in C	E. Items showing m3/year
F01	40	1	39	38	1
F02	0	0	0	0	0
F03	54	1	53	50	3
F04	771	34	737	677	60
F05	0	0	0	0	0
F06	173	8	165	154	11

F07	136	2	134	118	16
F08	23	1	22	22	0
F09	2	0	2	2	0
F10	53	7	46	42	4
F11	0	0	0	0	0
F12	13	0	13	12	1
F13	88	1	87	79	8
F14	203	10	193	173	20
F15	0	0	0	0	0
F16	0	0	0	0	0
F17	221	7	214	197	17
F18	0	0	0	0	0
F19	99	3	96	92	4
Total	**1,876**	**75**	1,801	1,656	145

b. Number of Employees

The number of employees among the 170 factories that provided answers to the amount of industrial waste generated are given, along with the total number of employees at all factories in the study area.

Table 3-5: Number of Employees from Responding Factories and All Factories in Study Area

Factory Code	Factory survey		All factories in study area		Rate (C=A/B x 100)
	Number of Factories	Number of Workers (A)	Number of Factories	Number of Workers (B)	
F01	5	2,127	15	2,975	71.5
F02	-	-	0	0	
F03	6	342	16	843	40.6
F04	60	22,269	121	37,765	59.0
F05	-	-	2	348	
F06	17	4,250	28	5,464	77.8
F07	18	3,651	47	6,003	60.8
F08	1	519	6	698	74.4
F09	2	208	5	445	46.7
F10	6	612	13	1,789	34.2
F11	-	-	3	133	
F12	3	253	13	538	47.0
F13	12	335	34	1,355	24.7
F14	18	5,555	75	9,625	57.7
F15	-	-	1	20	
F16	-	-	2	589	
F17	16	32,383	33	43,937	73.7
F18	-	-	6	440	
F19	6	1,458	20	3,225	45.2
Total	**170**	**73,962**	440	116,192	**63.7**

c. Tabulating the Amount of Industrial Wastes Generated

Responses from 170 factories were used to estimate the total generation amount of industrial waste, and divided into 4 major categories of waste, were then tabulated according to the 19 factory codes and different waste codes.

- Industrial waste generated from a Non-Production Process which is Non-Hazardous: Non-PP / Non-HIW Table 3-6
- Industrial waste generated from a Non-Production Process which is Hazardous: Non-PP / HIW Table 3-7
- Industrial waste generated from a Production Process which is Non-Hazardous: PP / Non-HIW Table 3-8
- Industrial waste generated from a Non-Production Process which is Non-Hazardous: PP / HIW Table 3-9

d. Generation Rate

Using the employees as the base, the generation rate (kg/year/employee), as mentioned above in the tabulation of generation amount for industrial waste of 170 factories, was classified into 4 categories, 19 factory codes and individual waste codes to calculate using Table 3-5: Number of Employees.

- The generation rate for non-production process, non-hazardous wastes (Non-PP / Non-HIW). Table 3-10
- The generation rate for non-production process, hazardous wastes (Non-PP / HIW). Table 3-11
- The generation rate for production process, non-hazardous wastes (PP / Non-HIW). Table 3-12
- The generation rate for production process, hazardous wastes (PP / HIW). Table 3-13

As for the generation rate of the factory code, of which rate this survey could not get, the average generation rate for factory code obtained from all factories was applied.

e. Generation Amount

The generation amount of industrial wastes from PIM/MFZ was calculated by multiplying the number of employees from each factory code by the above mentioned generation rate from industrial wastes generated. The resulting estimation of industrial waste generated from PIM/MFZ is as follows. The details are given in Table 3-14.

1.	Non-PP / Non-HIW:	61,479.0 ton/year, or	168.4 ton/day
2.	Non-PP / HIW:	13,970.0 ton/year, or	38.3 ton/day
3.	PP / Non-HIW:	110,751.6 ton/year, or	303.4 ton/day
4.	PP / HIW:	41,085.4 ton/year, or	112.6 ton/day
	Total	**215,925.5 ton/year,**	**591.5 ton/day**

This generation amount does not greatly conflict with the tabulated results from the SUFRAMA waste inventory.

Table 3-6: Tabulation of Responses for Industrial Waste Generation Amount (Non-PP / Non-HIW)

Non-Production Process – Non HIW (Unit : ton/year)														
Factory code	NH01	NH02	NH03	NH04	NH05	NH06	NH07	NH08	NH09	NH10	NH11	NH12	NH!3	Total
F01	82.6	1,039.0	226.0	81.0	7.0				-	921.0	59.0	233.0	222.0	2,870.6
F02														
F03	3.7		4.3	0.9	0.1	0.1			2.2				17.5	28.8
F04	1,570.7	1,192.3	3,648.6	581.2	3.6	17.5			337.1	83.4	28.7	67.7	3,390.9	10,921.7
F05														
F06	187.1	556.5	832.6	131.8	166.0				23.0	0.8	12.0		458.4	2,368.2
F07	224.1	44.0	769.0	201.2		0.7			243.6	820.6			417.3	2,720.5
F08		57.9	2.6	9.9	4.5					0.4			20.2	95.5
F09														
F10	1,128.1	227.7	60.1	44.2		0.3			5,412.3				153.9	7,026.6
F11														
F12			0.1										-	0.1
F13	18.0		5.7	5.3					0.1	-		0.6	14.9	44.6
F14	101.4	254.4	593.8	24.4		3.3			96.7	3.0		39.0	501.1	1,617.1
F15														
F16														
F17	1,605.4	23.5	428.8	406.1	2.0	0.3	0.1			0.1	29.4		1,952.3	4,448.0
F18														
F19	27.0		55.9	140.2	38.0	2.0							102.4	365.5
Total	4,948.1	3,395.3	6,627.5	1,626.2	221.2	24.2	0.1	-	6,115.0	1,829.3	129.1	340.3	7,250.9	32,507.2

Table 3-7: Tabulation of Responses for Industrial Waste Generation Amount (Non-PP / HIW)

Non-Production Process – HIW (Unit : ton/year)																	
Factory code	HW01	HW02	HW03	HW04	HW05	HW06	HW07	HW08	HW09	HW10	HW11	HW12	HW13	HW14	HW15	HW16	Total
F01			0.1						3.5		13.0				90.6	1.3	108.5
F02																	
F03	0.0						0.1		0.2					2.8		0.2	3.2
F04				0.8			37.2		25.7		736.0				794.8	6.7	1,601.1
F05																	
F06							0.2		0.2		953.6			2.0	12.1	2.5	970.5
F07							0.3		108.8		64.0		199.0	68.0		7.9	447.9
F08																0.9	0.9
F09																	
F10									13.8		16.0				12.1	0.9	42.9
F11																	
F12																	
F13					0.0		0.1		0.1						0.1	0.0	0.3
F14							12.0		1,898.1	0.0	2,024.1			61.1	157.8	514.8	4,667.8
F15																	
F16																	
F17									405.3		32.0			2.0	5.1	0.7	445.2
F18																	
F19									0.0						1.0	0.2	1.3
Total	0.0		0.1	0.8	0.0		49.8		2,455.6	0.0	3,838.7		199.0	135.9	1,073.6	536.0	8,289.6

Table 3-8: Tabulation of Responses for Industrial Waste Generation Amount (PP / Non-HIW)

Production Process – Non HIW (Unit : ton/year)														
Factory code	NH01	NH02	NH03	NH04	NH05	NH06	NH07	NH08	NH09	NH10	NH11	NH12	NH!3	Total
F01	102.8			190.9				117.0	33.0				947.0	1,390.6
F02														
F03			479.3	0.0		0.6			98.0					577.9
F04		720.0	9,631.5	3,489.1	0.4				2,022.8	1,210.0		9.5	878.3	17,961.6
F05														
F06		91.0	522.7	219.7					4,826.2	7.0			1,556.2	7,222.8
F07		440.3	385.8	230.5					9,783.4	0.3	34.0		2.2	10,876.5
F08													436.7	436.7
F09				15.0										15.0
F10		7.2	2,493.8	16.8					2.9				543.4	3,064.2
F11														
F12	2.0	12.2	57.6	67.3					3,328.0				106.6	3,573.6
F13		30.9	27.3	99.8	0.1			27.0	66.3	0.0			109.2	360.6
F14		81.7	712.3	4,119.5	2.1				22.2	0.2		0.3	272.6	5,210.9
F15														
F16														
F17	6.0	1,552.7	3,437.2	1,605.5	18.0		0.5		6,328.8	1.0	327.0	0.5	845.8	14,123.0
F18														
F19		238.1	102.8	57.6	6.0		39.0		130.4				135.3	709.2
Total	110.8	3,174.0	17,850.4	10,111.7	26.6	0.6	39.5	144.0	26,642.0	1,218.6	361.0	10.3	5,833.1	65,522.4

Table 3-9: Tabulation of Responses for Industrial Waste Generation Amount (PP /HIW)

Production Process – HIW (Unit : ton/year)																	
Factory code	HW01	HW02	HW03	HW04	HW05	HW06	HW07	HW08	HW09	HW10	HW11	HW12	HW13	HW14	HW15	HW16	Total
F01							2.0		43.0								45.0
F02																	0.0
F03	0.0		0.0	3.2			2,056.7		2.1					1,052.7	198.3		3,313.1
F04	1.9		3.6	280.1			166.5	40.1	109.8	0.1				25.0	356.2	181.8	1,165.3
F05																	0.0
F06							70.6	3.6	548.4		31.0			123.1	89.5	60.1	926.2
F07							9.1		38.6		15.2		33.0	289.1	371.6	70.0	826.6
F08									1.6								1.6
F09								51.0									51.0
F10							67.0				131.3			65.0	11.0		274.3
F11																	0.0
F12			1.8											59.2			61.0
F13							10.9		1.2	2.3					19.0		33.4
F14					26.2		210.9	49.9	31.6		3.0	0.5		85.1	134.6	47.0	588.7
F15																	0.0
F16																	0.0
F17	56.0			392.0	20.0		1,551.3	78.0	1,447.3		388.0	56.0		6,805.3	574.1	341.2	11,709.2
F18																	0.0
F19							28.3		9.1	0.5	50.0			12.9	207.4	0.1	308.2
Total	58.0		5.5	675.4	46.2		4,173.3	222.5	2,232.7	2.9	618.5	56.5	33.0	8,517.5	1,961.5	700.2	19,303.5

Table 3-10: Generation Rate (Non-PP / Non-HIW)

Generation rate (Non-Production Process – Non HIW) (Unit: kg/year/person)														
Factory code	NH01	NH02	NH03	NH04	NH05	NH06	NH07	NH08	NH09	NH10	NH11	NH12	NH13	Total
F01	38.8	488.5	106.3	38.1	3.3				0.0	433.0	27.7	109.5	104.4	1,349.6
F02	---	---	---	---	---	---	---	---	---	---	---	---	---	---
F03	10.8		12.6	2.6	0.3	0.3			6.4				51.2	84.2
F04	70.5	53.5	163.8	26.1	0.2	0.8			15.1	3.7	1.3	3.0	152.3	490.3
F05*1	66.9	45.9	89.6	22.0	3.0	0.3	0.0		82.7	24.7	1.7	4.6	98.0	439.4
F06	44.0	130.9	195.9	31.0	39.1				5.4	0.2	2.8		107.9	557.2
F07	61.4	12.1	210.6	55.1					66.7	224.8			114.3	745.0
F08	0.0	111.6	5.0	19.1	8.7					0.8			38.9	184.1
F09*1	66.9	45.9	89.6	22.0	3.0	0.3	0.0		82.7	24.7	1.7	4.6	98.0	439.4
F10	1,843.3	372.1	98.2	72.2		0.5			8,843.6				251.5	11,481.4
F11*1	66.9	45.9	89.6	22.0	3.0	0.3	0.0		82.7	24.7	1.7	4.6	98.0	439.4
F12*1			0.4										0.0	0.4
F13	53.7		17.0	15.8					0.3	0.0		1.8	44.5	133.1
F14	18.3	45.8	106.9	4.4		0.6			17.4	0.5		7.0	90.2	291.1
F15*1	66.9	45.9	89.6	22.0	3.0	0.3	0.0		82.7	24.7	1.7	4.6	98.0	439.4
F16*1	66.9	45.9	89.6	22.0	3.0	0.3	0.0		82.7	24.7	1.7	4.6	98.0	439.4
F17	49.6	0.7	13.2	12.5	0.1	0.0	0.0			0.0	0.9		60.3	137.3
F18*1	66.9	45.9	89.6	22.0	3.0	0.3	0.0		82.7	24.7	1.7	4.6	98.0	439.4
F19	18.5		38.3	96.2	26.1	1.4							70.2	250.7
Avg rate: 170 factories	66.9	45.9	89.6	22.0	3.0	0.3	0.0		82.7	24.7	1.7	4.6	98.0	439.4

Note: *1: There are few factories with this factory code, so it was not possible in this study to obtain the generation rate for the amount generated from the Non-PP / Non-HIW category of waste in this table. Therefore, generation rate of these factory codes are calculated by dividing A (total generation amount of each 13 category of waste) by B (number of employees of 127 factories which gave the answers). Also, some items show 0.0 even though there were generation amounts reported, but the generation rate was so small that it is shown as 0.0.

Table 3-11: Generation Rate (Non-PP / HIW)

Non-Production Process – HIW (Unit : ton/year)																	
Factory code	HW01	HW02	HW03	HW04	HW05	HW06	HW07	HW08	HW09	HW10	HW11	HW12	HW13	HW14	HW15	HW16	Total
F01			-						0.5		6.1				11.8	0.6	19.0
F02																	
F03							-		-					5.8		0.6	6.4
F04	-			-			1.7		2.6		37.4			2.6	41.8	0.6	86.7
F05	-			-	-		0.7		33.2	-	51.9		2.7	1.8	14.5	7.2	112.0
F06							-		-		224.4			0.5	2.8	0.6	228.3
F07							0.1		30.5		17.5		54.5	18.6	17.9	2.2	141.3
F08																1.7	1.7
F09	-	-		-	-	-	0.7	-	33.2	-	51.9	-	2.7	1.8	14.5	7.2	112.0
F10									22.5		26.1				19.8	1.5	69.9
F11	-	-	-	-	-	-	0.7	-	33.2	-	51.9	-	2.7	1.8	14.5	7.2	112.0
F12	-	-	-	-	-	-	0.7	-	33.2	-	51.9	-	2.7	1.8	14.5	7.2	112.0
F13					-		0.3		0.3						0.3	-	0.9
F14							2.2		336.0	-	347.1			0.7	3.7	91.6	781.3
F15	-	-	-	-	-	-	0.7	-	33.2	-	51.9	-	2.7	1.8	14.5	7.2	112.0
F16	-	-	-	-	-	-	0.7	-	33.2	-	51.9	-	2.7	1.8	14.5	7.2	112.0
F17									12.5		1.0			0.1	0.2		13.8
F18	-	-	-	-	-	-	0.7	-	33.2	-	51.9	-	2.7	1.8	14.5	7.2	112.0
F19									-						0.7	0.1	0.8
Total	-	-	-	-	-	-	0.7	-	33.2	-	51.9	-	2.7	1.8	14.5	7.2	112.0

Table 3-12: Generation Rate (PP / Non-HIW)

Generation rate (Production Process – Non HIW) (Unit: kg/year/person)														
Factory code	NH01	NH02	NH03	NH04	NH05	NH06	NH07	NH08	NH09	NH10	NH11	NH12	NH13	Total
F01	-			41.3				55.0	15.5				-	111.8
F02														
F03			1,399.7	-		-			286.5					1,686.2
F04		32.3	458.1	235.3	-	-			90.9	54.3		0.4	39.5	910.8
F05*1	1.5	42.9	241.3	136.7	0.4	-	0.5	1.9	360.2	16.5	4.9	0.1	78.9	885.8
F06		21.4	123.0	51.7					1,135.6	1.6			366.2	1,699.5
F07	28.2	120.6	105.7	65.9					2,399.3	0.1	-		260.0	2,979.8
F08	-	-	-	-					-				841.4	841.4
F09*1				72.1										72.1
F10		11.8	4,074.8	27.5					4.7				887.9	5,006.7
F11*1	1.5	42.9	241.3	136.7	0.4	-	0.5	1.9	360.2	16.5	4.9	0.1	78.9	885.8
F12*1	7.9	48.2	227.7	266.0					13,154.2				421.3	14,125.3
F13		92.2	94.3	297.9	0.3			80.6	197.9	-			326.0	1,089.2
F14		14.7	24.7	372.8	0.4				3.3	-		0.1	49.0	465.0
F15*1	1.5	42.9	241.3	136.7	0.4	-	0.5	1.9	360.2	16.5	4.9	0.1	78.9	885.8
F16*1	1.5	42.9	241.3	136.7	0.4	-	0.5	1.9	360.2	16.5	4.9	0.1	78.9	885.8
F17	0.2	47.9	106.1	52.4	0.6		-		227.0	-	11.1	-	26.1	471.4
F18*1	1.5	42.9	241.3	136.7	0.4	-	0.5	1.9	360.2	16.5	4.9	0.1	78.9	885.8
F19		163.3	71.4	243.1	4.1		26.7		90.9				92.8	692.3
Avg rate: 170 factories	1.5	42.9	241.3	136.7	0.4	-	0.5	1.9	360.2	16.5	4.9	0.1	78.9	885.8

Note: *1: There are few factories with this factory code, so it was not possible in this study to obtain the generation rate for the amount generated from the Non-PP / Non-HIW category of waste in this table. Therefore, generation rate of these factory codes are calculated by dividing A (total generation amount of each 13 category of waste) by B (number of employees of 170 factories which gave the answers). Also, some items show 0.0 even though there were generation amounts reported, but the generation rate was so small that it is shown as 0.0.

Table 3-13: Generation Rate (PP /HIW)

Non-Production Process – HIW (Unit : ton/year)																	
Factory code	HW01	HW02	HW03	HW04	HW05	HW06	HW07	HW08	HW09	HW10	HW11	HW12	HW13	HW14	HW15	HW16	Total
F01							0.9		20.2								21.1
F02																	
F03				9.4			299.1		6.1					4.7	579.8		899.1
F04	0.1		0.2	12.6			97.0	1.8	5.2	-				50.2	18.2	10.2	195.5
F05	0.8		0.1	9.1	0.6		56.4	3.0	30.2	-	8.4	0.8	0.4	115.2	26.5	10.9	262.4
F06							16.6	0.8	129.0		7.3			29.0	21.1	39.1	242.9
F07							2.5		3.8		4.2		-	76.0	101.8	19.2	207.5
F08									3.1								3.1
F09								245.2									245.2
F10							109.5				214.5			106.2	18.0		448.2
F11	0.8		0.1	9.1	0.6		56.4	3.0	30.2	-	8.4	0.8	0.4	115.2	26.5	10.9	262.4
F12			7.1											234.0			241.1
F13							32.8		3.6	6.9					56.7	-	100.0
F14					4.7		30.8	9.0	4.5	-	0.5	0.1	-	7.9	13.6	0.4	71.5
F15	0.8		0.1	9.1	0.6		56.4	3.0	30.2	-	8.4	0.8	0.4	115.2	26.5	10.9	262.4
F16	0.8		0.1	9.1	0.6		56.4	3.0	30.2	-	8.4	0.8	0.4	115.2	26.5	10.9	262.4
F17	1.7			12.1	0.6		47.9	2.4	45.5		12.0	1.7	1.0	210.5	17.7	10.5	363.6
F18	0.8		0.1	9.1	0.6		56.4	3.0	30.2	-	8.4	0.8	0.4	115.2	26.5	10.9	262.4
F19							19.3		6.2	0.3	34.3			8.8	149.7		218.6
Total	0.8		0.1	9.1	0.6		56.4	3.0	30.2	-	8.4	0.8	0.4	115.2	26.5	10.9	262.4

Table 3-14: Amount of Industrial Waste Generated from PIM/MFZ

Unit: ton/year

Factory Code	Non production process		Production process		Total
	Non-HIW	HIW	Non-HIW	HIW	
F01	4,015.0	56.5	332.6	62.8	4,466.9
F02	-	-	-	-	-
F03	71.1	5.4	1,421.4	757.9	2,255.8
F04	18,516.2	3,274.3	34,396.2	7,383.1	63,569.8
F05	153.0	38.9	308.2	91.2	591.3
F06	3,044.5	1,247.4	9,286.0	1,327.3	14,905.2
F07	4,472.2	848.4	17,887.8	1,245.6	24,454.0
F08	128.6	1.2	587.3	2.2	719.3
F09	195.5	49.9	32.1	109.1	386.6
F10	20,540.3	125.1	8,957.0	801.8	30,424.2
F11	58.3	14.9	118.0	34.8	226.0
F12	0.2	60.4	7,599.5	129.7	7,789.8
F13	180.3	1.2	1,475.9	135.4	1,792.8
F14	2,801.9	7,506.9	4,475.7	688.2	15,472.7
F15	8.8	2.2	17.6	5.2	33.8
F16	258.8	66.0	521.8	154.7	1,001.3
F17	6,032.6	606.3	20,712.0	15,975.3	43,326.2
F18	193.2	49.3	389.8	115.6	747.9
F19	808.5	2.6	2,232.7	705.0	3,748.8
Total	61,479.0	13,956.9	110,751.6	29,724.9	215,912.4
ton/day	168.4	38.3	303.4	81.4	591.5

f. Flow of Industrial Waste Management

The waste streams for seven types of industrial waste are given below for:

1. All industrial wastes generated from PIM — Figure 3-1
2. Non-HIW generated from PIM — Figure 3-2
3. HIW generated from PIM — Figure 3-3
4. Non-Production Process, Non-Hazardous Industrial Waste: — Figure 3-4
5. Non-Production Process, Hazardous Industrial Waste: — Figure 3-5
6. Production Process, Non-Hazardous Industrial Waste: — Figure 3-6
7. Production Process, Hazardous Industrial Waste: — Figure 3-7

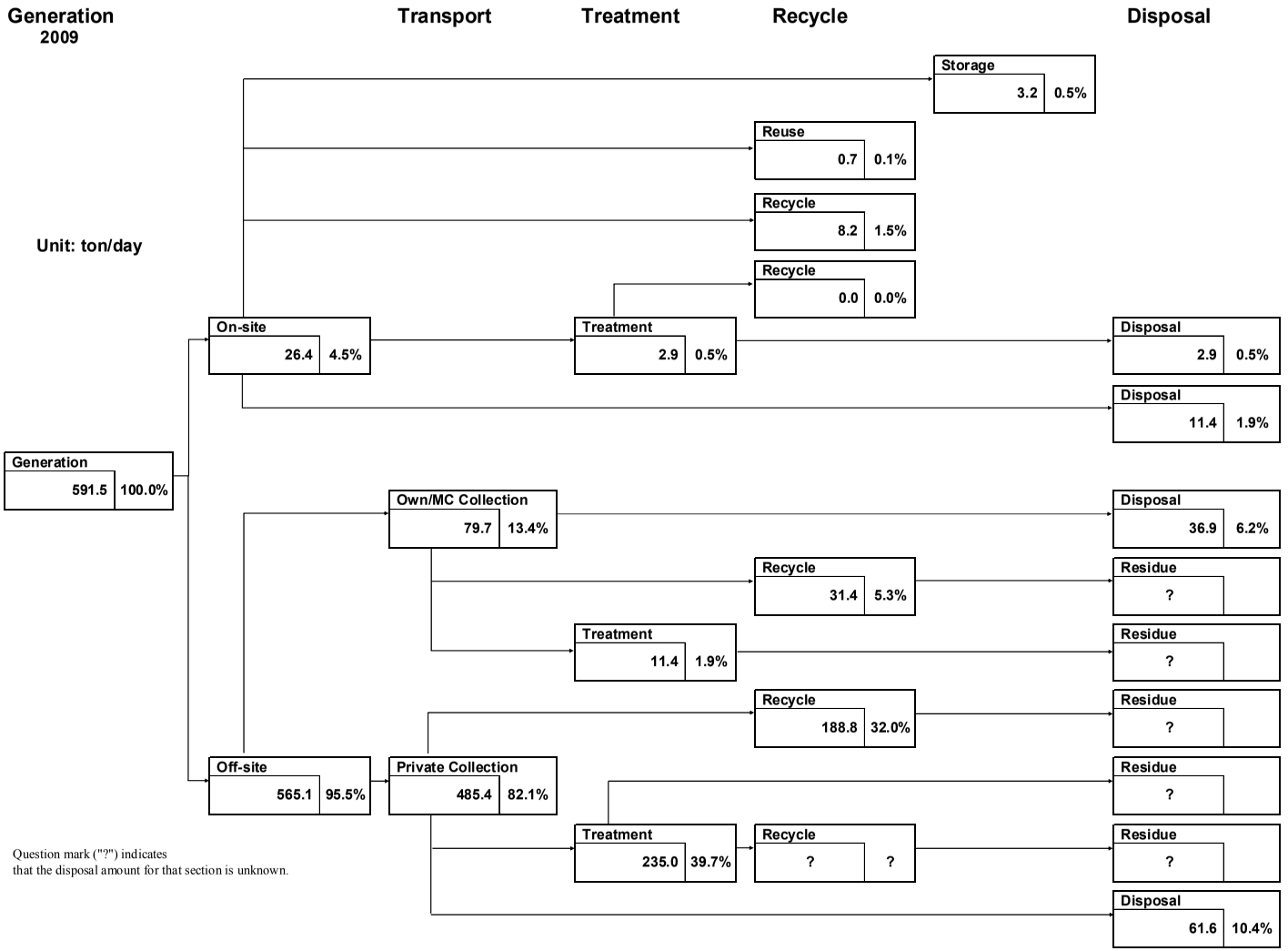


Figure 3-1: Waste Stream for all General industrial wastes generated from PIM

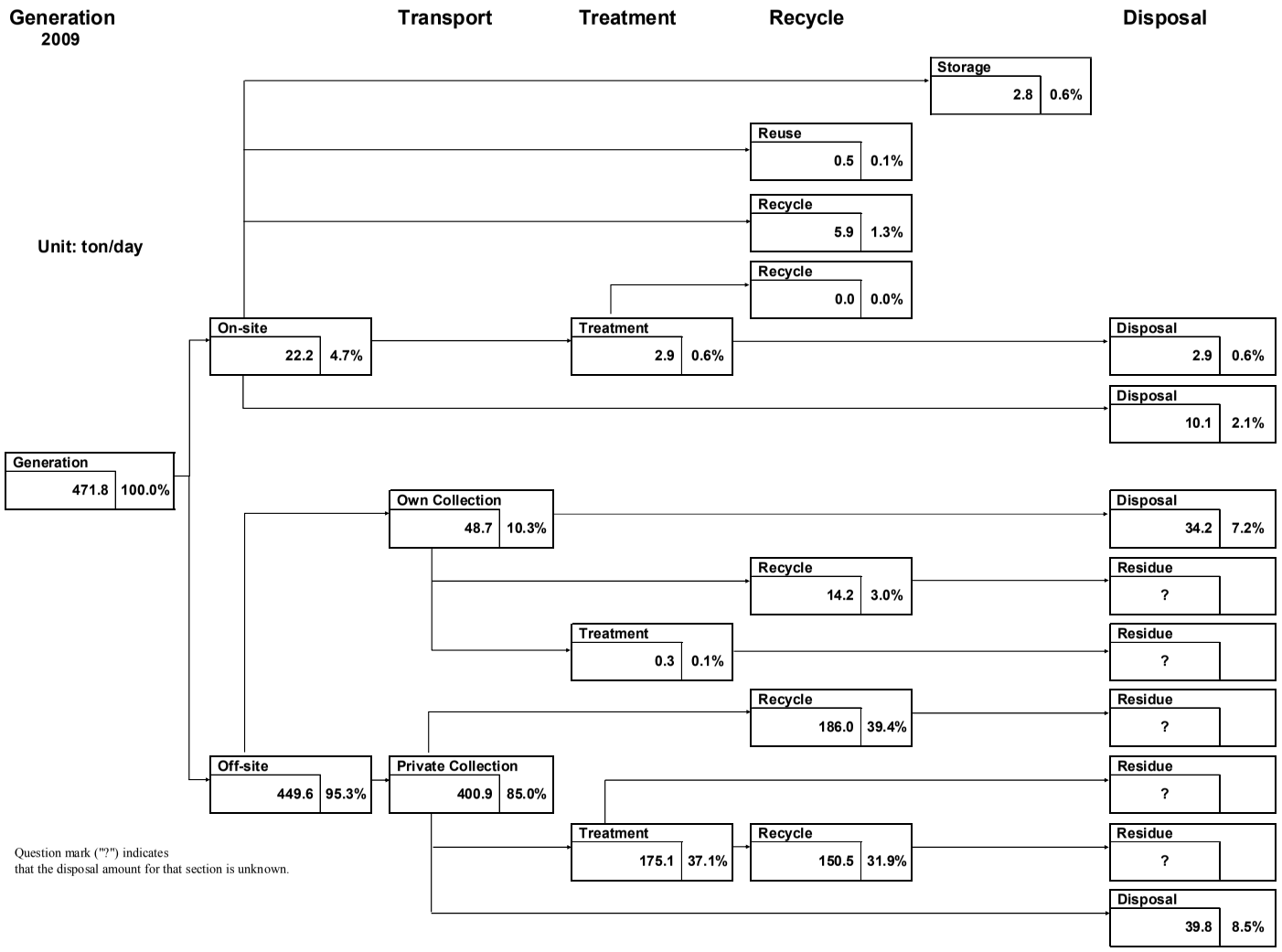


Figure 3-2: Waste Stream for General Non-HIW generated from PIM

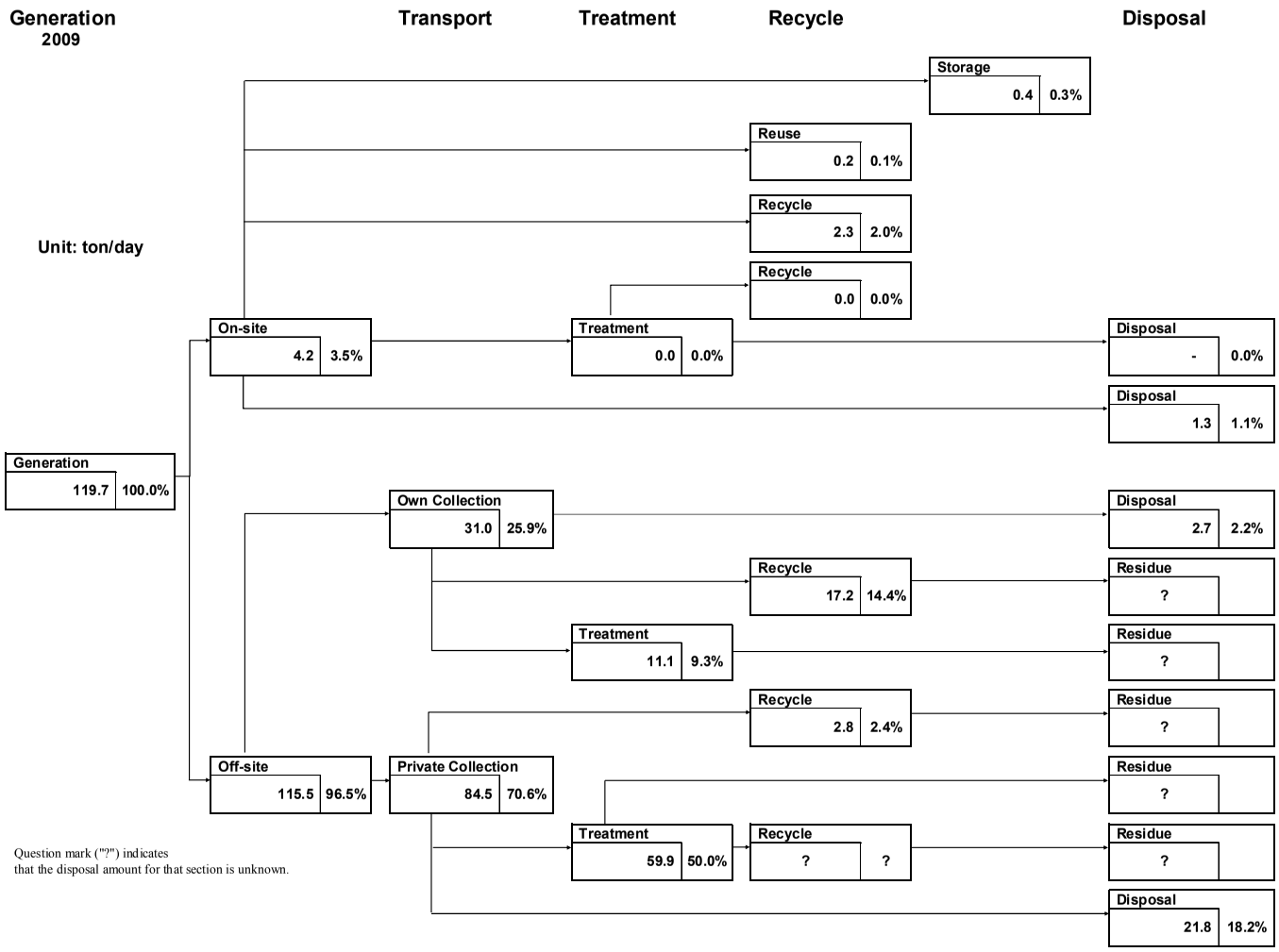


Figure 3-3: Waste Stream for General HIW generated from PIM

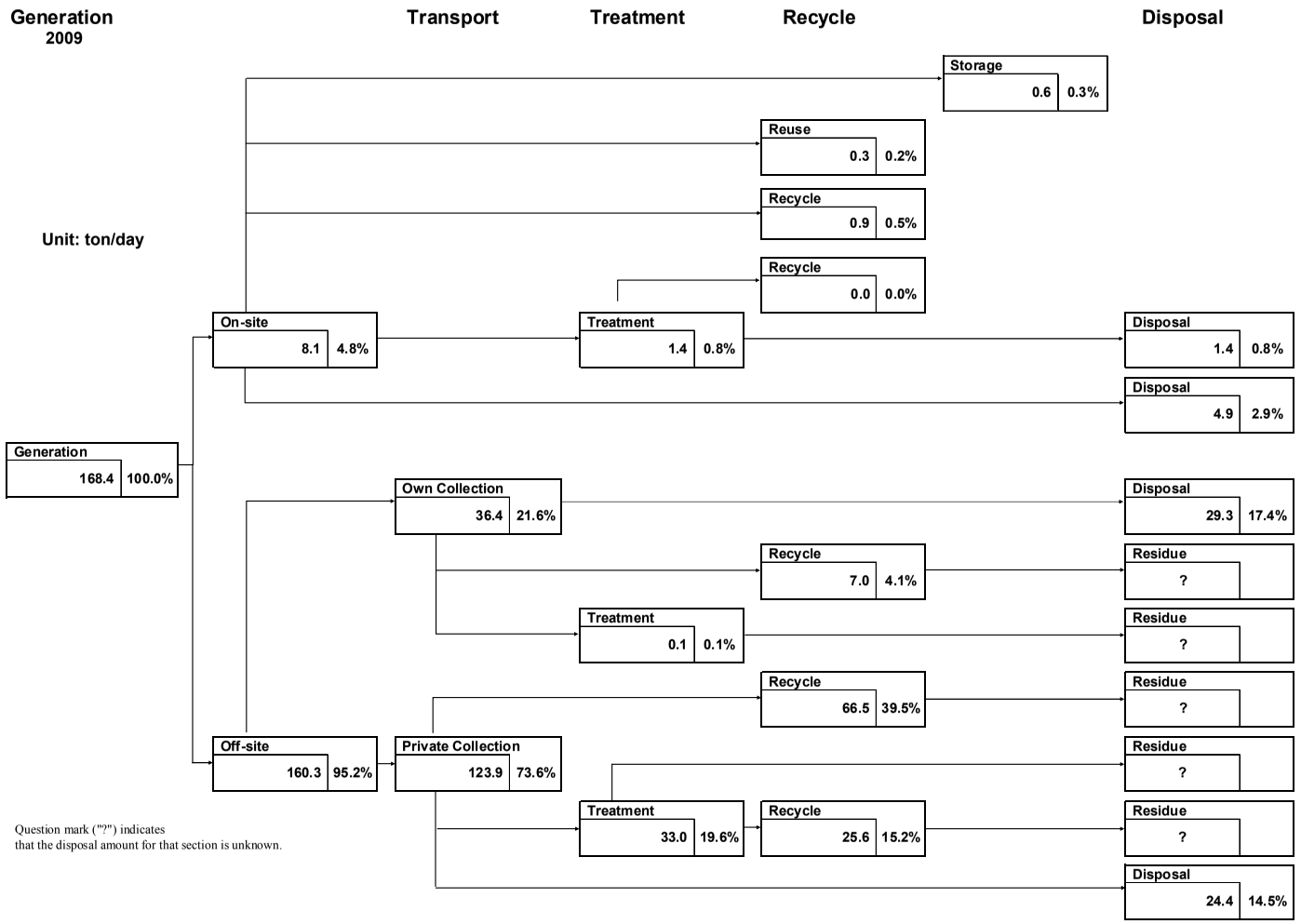


Figure 3-4: General industrial Waste Stream (Non production process – Non HIW)

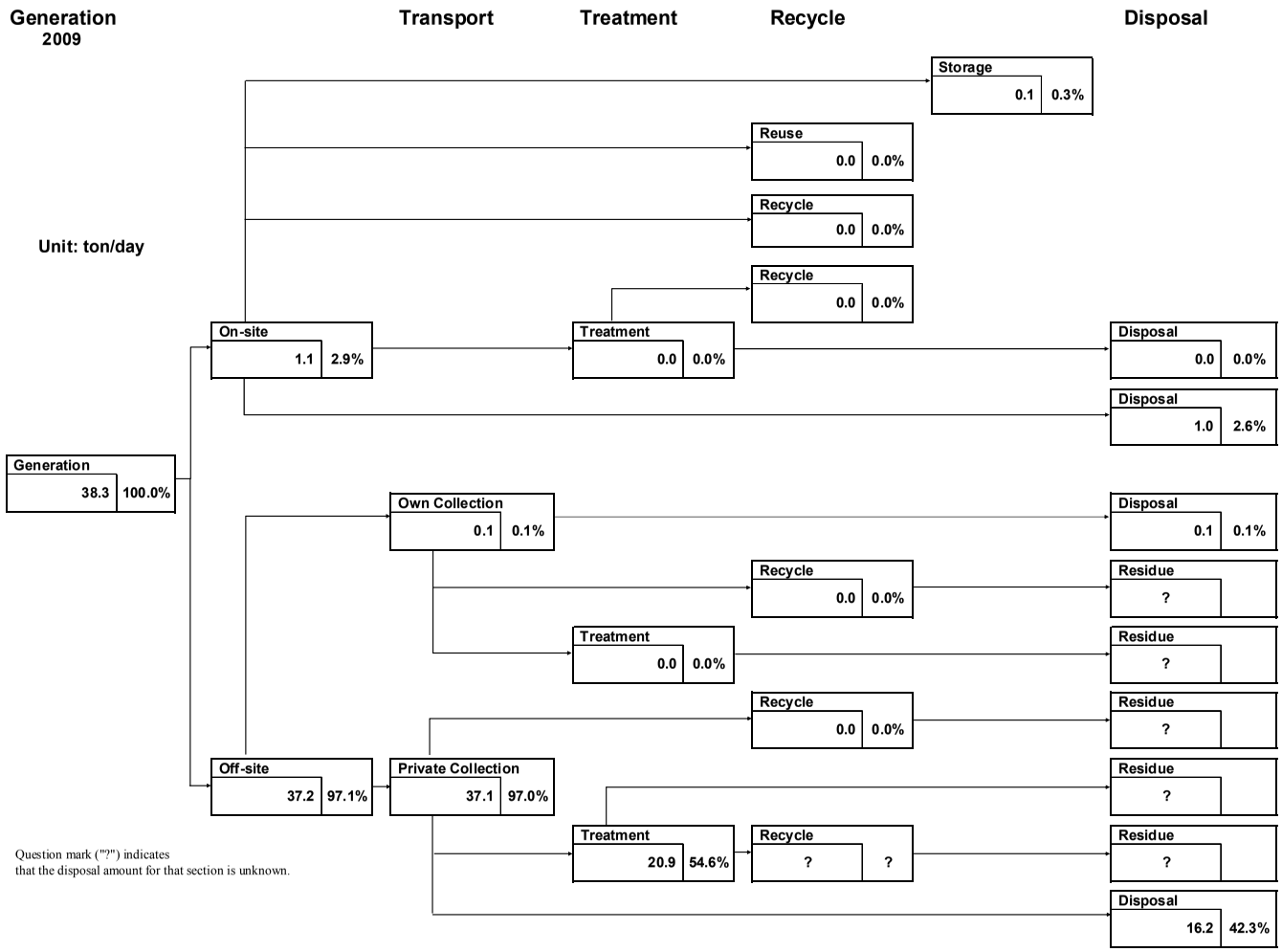


Figure 3-5: General Industrial Waste Stream (Non production process – HIW)

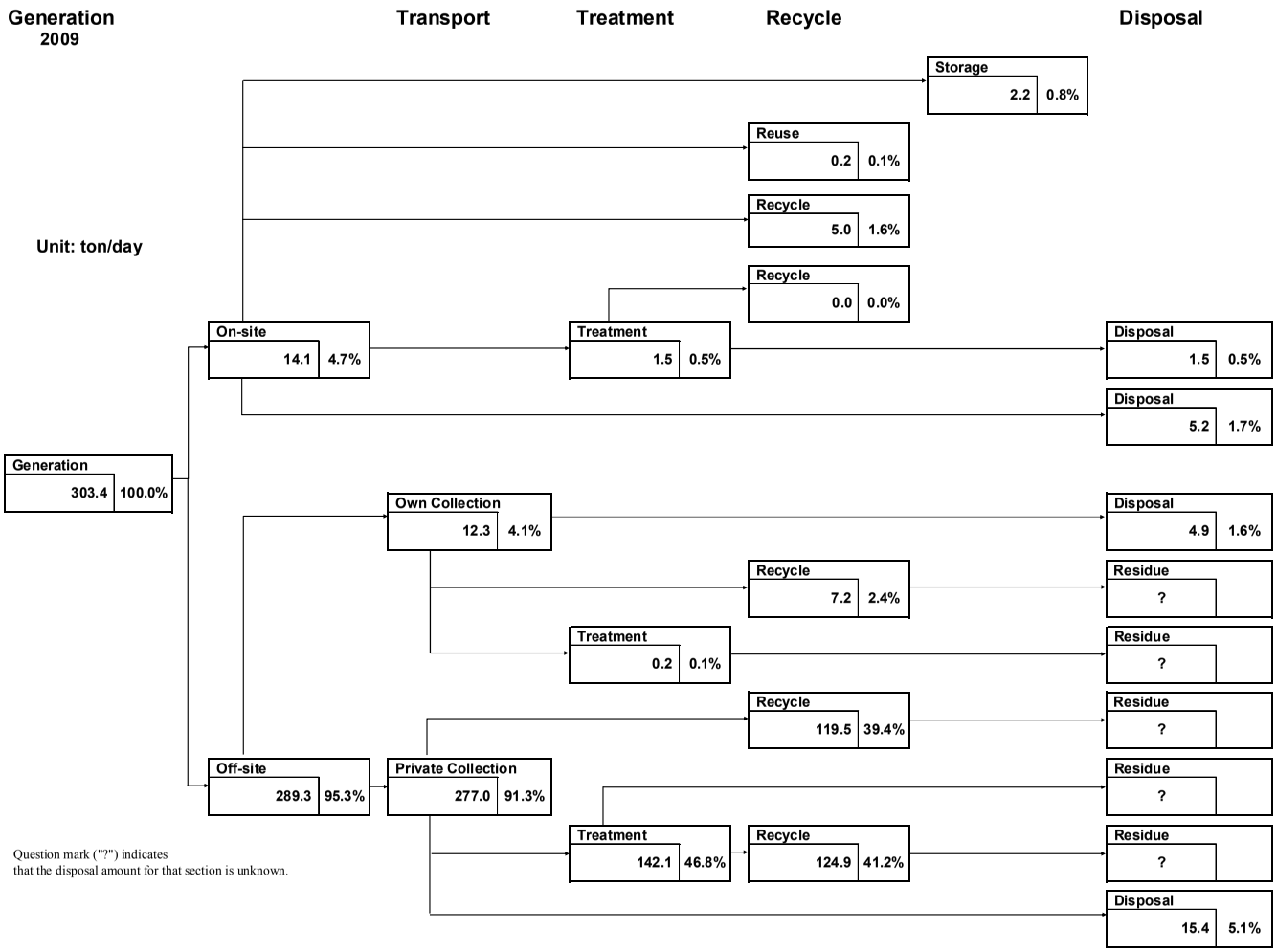


Figure 3-6: General Industrial Waste Stream (Production process – Non HIW)

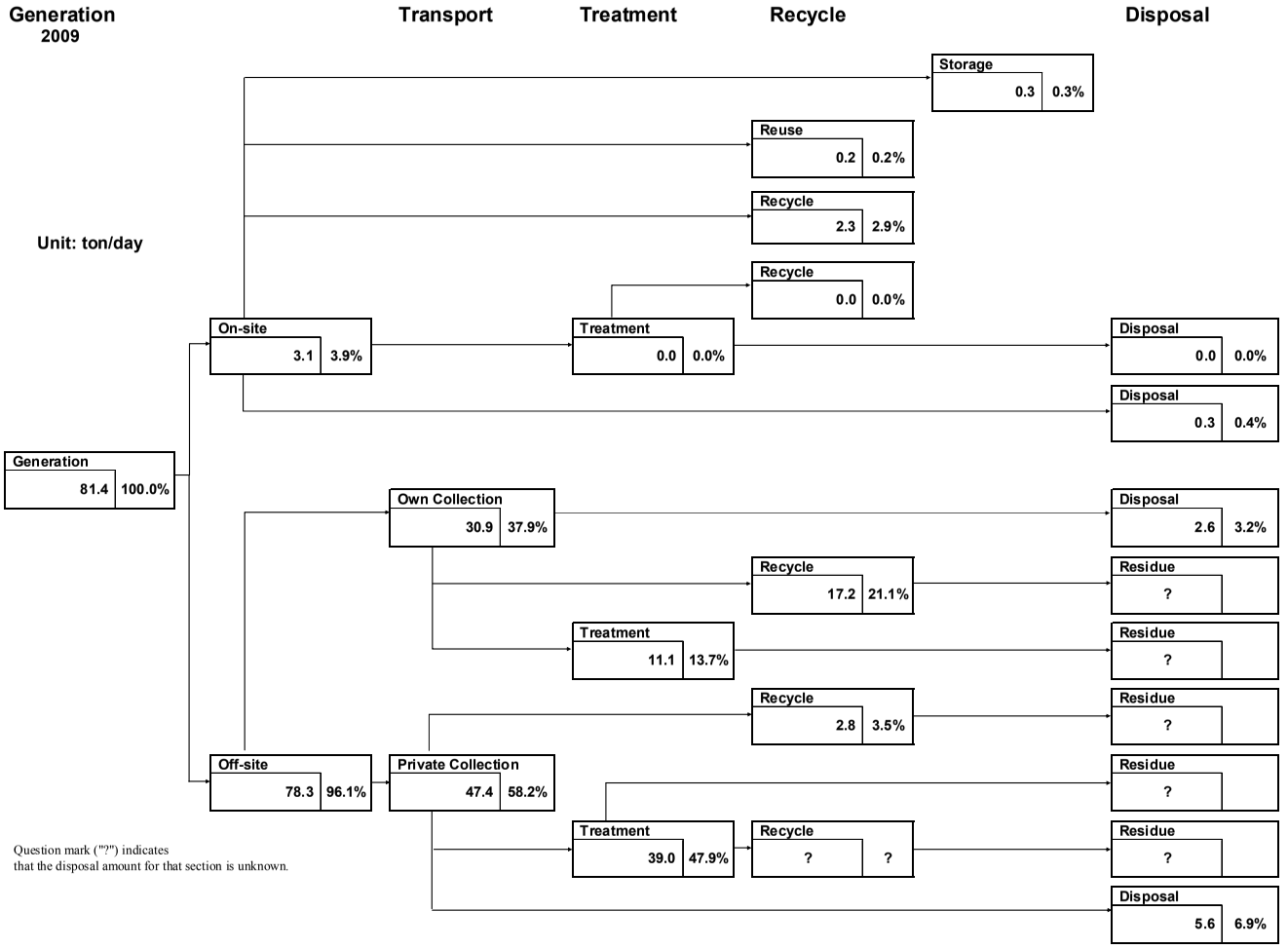


Figure 3-7: General Industrial Waste Stream (Production process – HIW)

3.2.2 Present Generation Amount of Health-care Waste

a. Medical Institutions in the Target Area

There are 475 factories in the factory list provided by SUFRAMA, and of those, 18 factories are located outside the target area, the MFZ. A total of 457 PIM factories in the MFZ area were contacted to confirm whether they had an attached clinic. The following results were found according to their responses.

- Factories that responded by telephone: 334
- Factories that have closed: 17
- Factories that refused to reply: 25
- Factories that could not be reached by telephone: 81

In this survey, it was revealed that 440 factories are PIM factories operating in the MFZ, including those which could not be reached by telephone (which was likely due to a changed phone number, etc.) and excluding the 17 which have closed.

It was found that at least 1/3 of the total (35.3%), or 124 factories, have an attached clinic. Of those 124, nine within the PIM were chosen for direct interview using the prepared survey questionnaire. A summary of these medical facilities, including one general hospital in the PIM, is given below.

Table 3-15: Summary of Medical Facilities

Type	No. Surveyed	No. of Employees*1	No. of Beds	Avg No. of Inpatients/Day	Avg No. of Outpatients/Day
General Hospital	1	439	70	48	900 (*3)
Attached factory clinic	9	4.1 (*2)	1.2 (*2)	No reply	19 *2

Notes: *1: Including part-time employees

*2: Average of 9 clinics

*3: Of this number, 22 were emergency room outpatients

b. Generation Amount of Health-care Waste

The generation amount of health-care waste for the 10 medical institutions is given below.

Table 3-16: Amount of Health-care Waste Generated by Target Medical Institutions

Unit: kg/day

Category of Health-care Waste	General Hospital	Clinics(*1)
Group A	**22.76**	**0.52**
A.1. Biologic	6.01	0.16
A.2. Animals	---	---
A.3 Body part	8.11	0.10
A.4 Patient care etc.	8.64	0.26
A.5 Prions	---	---
Group B: Chemical etc.	**1.67**	**0.27**
Group C: Radioactive	**---**	**---**

Group E: Piercing or Cutting	**3.40**	**0.44**
Total of Group A, B, C and E (Hazardous Waste)	**27.83**	**1.22**
Group D: Common waste	**94.00**	**1.17(*2)**
Total	**121.83**	**2.40**

Note: *1: Average number for 9 clinics

*2: This number is less than the amount of hazardous health-care waste generated. The reason being that it is discharged as non-process, non-hazardous waste from another place within the factory, and the clinic does not that this discharge into consideration. One clinic did not respond.

Based on the survey results given above, it is estimated that the following health-care waste is generated from PIM.

Table 3-17: Amount of Health-care Waste Generated

Category	Whole Factories in PIM (B x 440 /334) (kg/day)	General Hospital (kg/day)	Whole PIM (E = C + D) (kg/day)
Group A	84.8	22.7	107.5
Group B	44.0	1.7	45.7
Group C	0.0	0.0	0.00
Group E	71.7	3.4	75.1
Hazardous Health-care Waste Total	200.5	27.8	228.3
Class D	190.7	94.0	284.7
Health-care Waste Total	391.2	121.8	513.0

Health-care waste generation from factories in PIM excluding a general hospital is as follows:

- Hazardous Health-care waste: 200.5 kg/day
- Non-hazardous Health-care waste: 190.7 kg/day
- Total Health-care waste: 391.2 kg/day

Given the above information, the daily generation amount from the target area (PIM), including the one general hospital, of hazardous and non-hazardous health-care waste is estimated as follows:

- Hazardous Health-care waste: 228.3 kg/day
- Non-hazardous Health-care waste: 284.7 kg/day
- Total Health-care waste: 513.0 kg/day

c. Present Health-care Waste Management Flow

The present health-care waste management flow in PIM, according to the survey of medical institutions, is shown in the following figure.

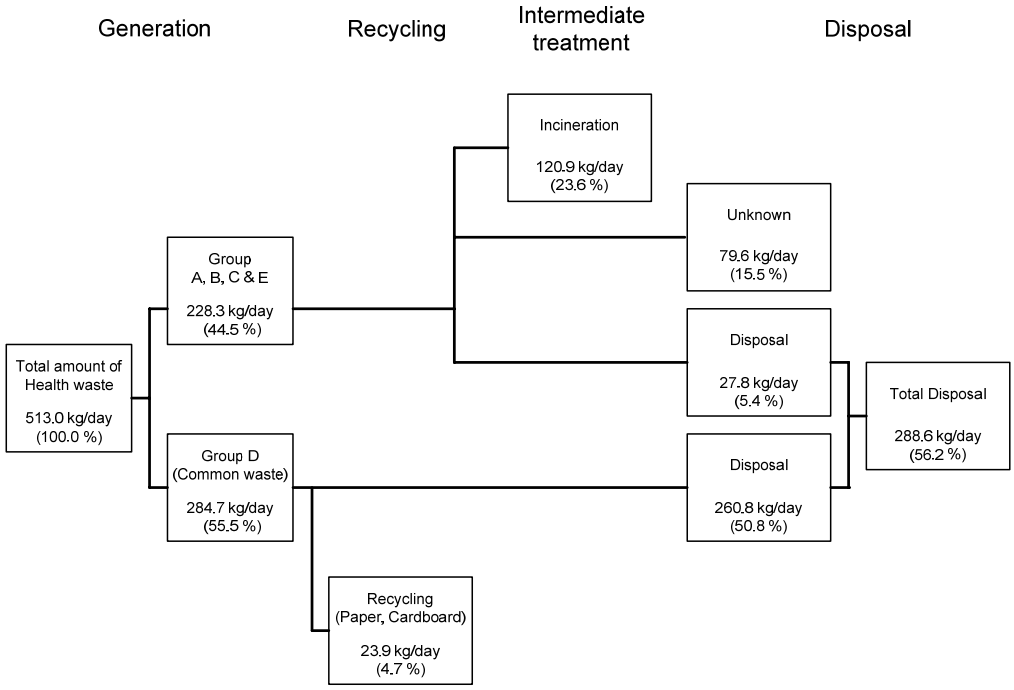


Figure 3-8: Health-care Waste Management Flow in PIM including General Hospital

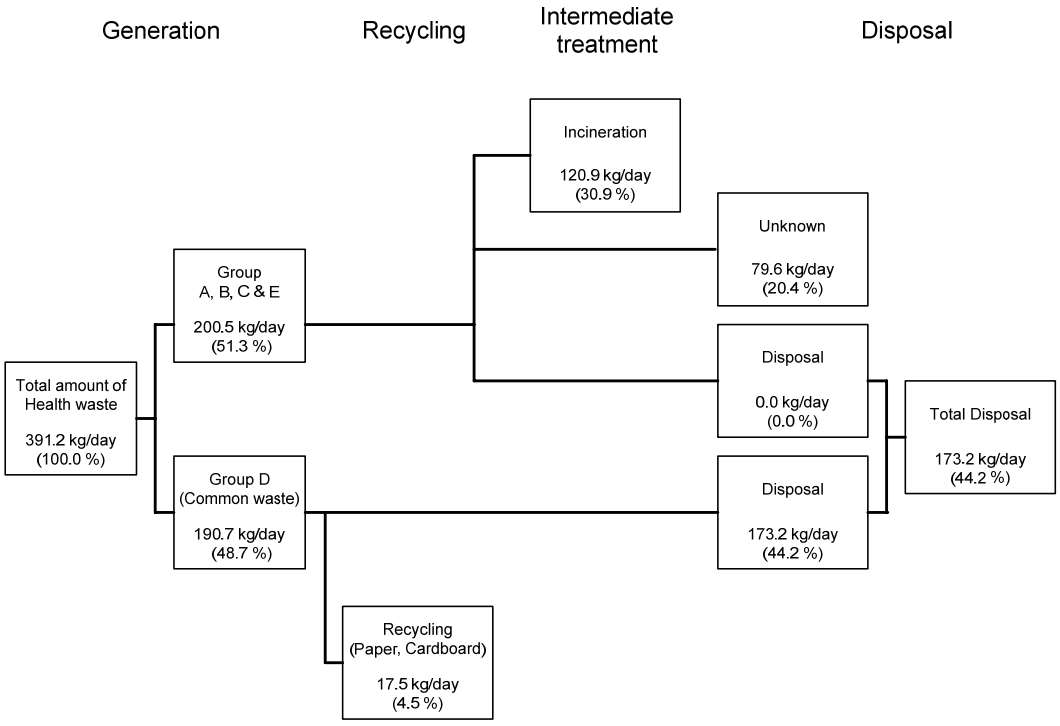


Figure 3-9: Health-care Waste Management Flow in PIM excluding General Hospital

3.2.3 Present Generation Amount of Construction Waste

a. Target Factories

The 457 factories located in the MFZ in the factory list provided by SUFRAMA, were contacted to confirm whether they had conducted any construction projects in the past year, from June 2008 to May 2009. The following results were found according to their responses.

- Factories that responded by telephone: 334
- Factories that have closed: 17
- Factories that refused to reply: 25
- Factories that could not be reached by telephone: 81

In this survey, it was revealed that 440 factories are PIM factories operating in the MFZ, including those which could not be reached by telephone (which was likely due to a changed phone number, etc.) and excluding the 17 which have closed.

It was found that, of the 334 factories, 123 factories, over one-third (36.8%), have conducted construction projects between June 2008 and May 2009. Ten of the 123 factories were chosen at random for direct interview using the prepared survey questionnaire. A summary of these factory construction projects is given below.

Table 3-18: Summary of Construction Projects

Type of Construction Project	No. of Respondents	Ratio (%)
1. New construction	2	20.0
2. Additional construction	0	0.0
3. Demolition	0	0.0
4. Renovation	6	60.0
5. Others *1	2	20.0
Total	10	100.0

Note: *1: In detail,
1. Installation of a waste water treatment facility (WWTF)
2. Construction of a retaining wall and drainage of the rain water.

b. Generation Amount of Construction Waste

In the year from June 2008 to May 2009, the amount of construction waste generated from construction projects at the 10 factories came to a total of 832.7 tons, as shown in column A in the following table. Moreover, the amount generated per day is shown in column B (B = A/365).

Table 3-19: Generation Amount of Construction Waste from Survey of 10 Factories

Waste No	Description of Waste	Total Number of Answer	**A.** Generation Amount (kg)	**B.** Generation Amount (kg/day)	Classification & Generation of Waste by CONAMA Resolution 307 (kg/day)			
					Class A	Class B	Class C	Class D
01	Excavated soil	5	32,985	90.4	90.4			
02	Concrete debris	7	53,830	147.5	147.5			
03	Asphalt debris	1	62,500	171.2	171.2			
04	Brick debris	5	3,015	8.3	8.3			
06	Tile and ceramic	1	10	0.0	0.0			
11	Plastic/vinyl sheet	1	430	1.2		1.2		
12	Iron-bar, steel materials	5	250	0.7	0.4	0.3		
13	Small metal waste	5	571	1.6	0.1	1.5		
17	Plaster boards	1	20	0.1	0.1			
20	Wood debris	3	1,335	3.7	2.8	0.8		
21	Timber form	1	200	0.6		0.6		
22	Scaffolding material	1	1,230	3.4		3.4		

23	Interior timber	3	1,150	3.2	2.9	0.3		
24	Packing (cardboard)	4	960	2.6	0.3	2.3		
29	Machine oil	1	74	0.2	0.2			
33	Ash	2	165	0.5	0.5			
44	Mixed construction waste*1	2	674,000	1,846.6	1,846.6			
	Total	48	832,725	2,281.4	2,271.2	10.3	0.0	0.0

Note: *1) Large-scale construction projects were confirmed at two factories which took place over the course of 6 months and 1 year produced a large amount of construction waste.

Based on the above survey results, the amount of construction waste generated from the PIM/MFZ was calculated. First, the generation rate (GR), which is the average amount of construction waste generated from 10 factories over the course of one year, from June 2008 to May 2009, was calculated. Referring to the above table, this can also be calculated: GR = B/10. Next, the total number of factories (TNF), which is the total number of factories that carried out construction projects in PIM/MFZ during the one year from June 2008 to May 2009. Here, TNF = 440 x 123/334. The total generation amount (TGA) of construction waste in PIM/MFZ is calculated: TGA = GR x TNF. The result of these calculations is as shown in the following table.

Table 3-20: Construction Waste Generation Amount

Unit: ton/day

Waste No	Description of Waste	GR (kg/day)	TGA (ton/day)	Portion (%)
1	Excavated soil	9.04	1.46	4.0
2	Concrete debris	14.75	2.39	6.5
3	Asphalt debris	17.12	2.77	7.5
4	Brick debris	0.83	0.13	0.4
6	Tile and ceramic	0.003	0.00	0.0
11	Plastic/vinyl sheet	0.12	0.02	0.1
12	Iron-bar, steel materials	0.07	0.01	0.0
13	Small metal waste	0.16	0.03	0.1
17	Plaster boards	0.01	0.00	0.0
20	Wood debris	0.37	0.06	0.2
21	Timber form	0.06	0.01	0.0
22	Scaffolding material	0.34	0.06	0.1
23	Interior timber	0.32	0.05	0.1
24	Packing (cardboard)	0.26	0.04	0.1
29	Machine oil	0.02	0.00	0.0
33	Ash	0.05	0.01	0.0
44	Mixed construction waste	184.66	29.92	80.9
	Total	228.18	36.96	100.0

From the above, it was estimated that the daily generation amount of construction waste in the target area (PIM/MFZ) is 37.0 ton/day. The categorization according to CONAMA Resolution 307 for construction waste which is generated is as follows. Note that there was no hazardous construction waste confirmed in this study.

- Class A (reusable or recyclable as aggregate): 36.8 ton/day

- Class B (recyclable as material other than aggregate): 0.2 ton/day
- Class C (not economically feasible for recycling): 0.0 ton/day
- Class D (hazardous): 0.0 ton/day

c. Present Construction Waste Management Flow

Based on the results of the construction waste survey, the flow of construction waste management in PIM was calculated as shown in the following figure.

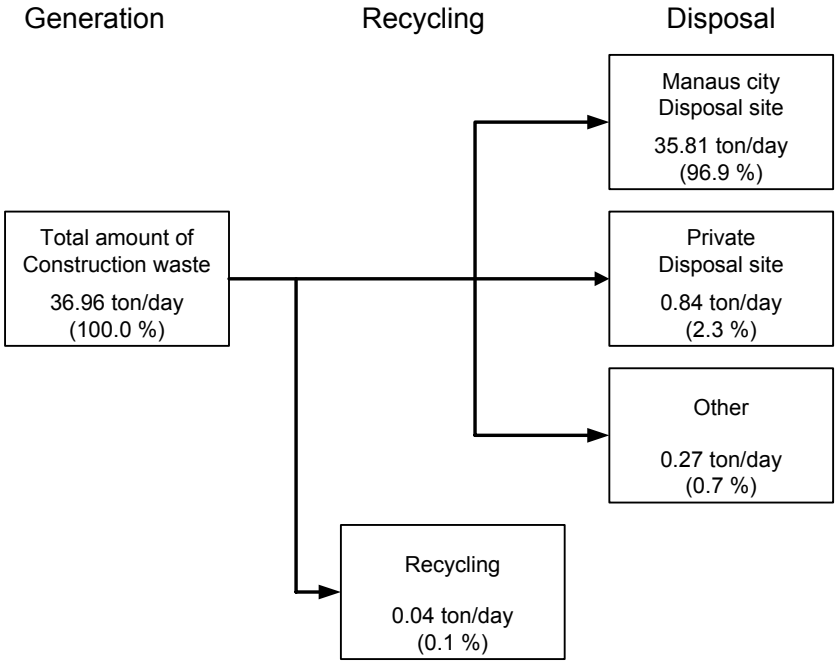


Figure 3-10: Flow of Construction Waste Disposal

4. IWM Master Plan

4 IWM Master Plan

4.1 Future Socio-Economic Framework

4.1.1 Population

IBGE (Brazilian Institute of Geography and Statistics) conducted a long-term population projection between 1980 and 2050 and revised the projected results periodically. Here, the latest revised population projection of IBGE in 2004 is applied for projection of the population in the city of Manaus. According to the latest population data in IBGE, the population in Manaus is 1,738,641 in 2009. Based on this latest population data, the future growth of population in Manaus is projected as follows:

Table 4-1: Population Projection in Manaus (2009-2030)

Unit: thousand

Year	2009	2010	2015	2020	2025	2030
Population (Brazil)	194,370	196,834	208,468	219,078	228,874	237,738
Population (Manaus)	1,739	1,761	1,865	1,960	2,047	2,127

The average annual population growth in the city of Manaus is estimated as 1.09% per year between 2009 and 2020 while it is 0.96% per year between 2009 and 2030.

4.1.2 Economy

According to the latest economic outlook available in the Central Bank of Brazil, the recent trend of GDP growth of Brazil and Manaus is as shown in the table below.

Table 4-2: Recent GDP growth in Brazil and Manaus

Year	2003	2004	2005	2006	2007	2008
Brazil GDP (billion Real)	2,376	2,512	2,591	2,694	2,858	3,005
Real Growth Rate (%)	1.1	5.7	3.2	4.0	6.1	5.1
Manaus GRDP (billion Real)	28.85	32.96	33.30	36.29	NA	NA
Real Growth Rate (%)	NA	14.2	1.0	9.0	NA	NA

According to the announcement of the Finance Minister of Brazil, the real growth rate of GDP in Brazil is estimated as 1.22% in 2009 while it is expected to increase up to 5.8% in 2010. Based on the past trend of economic growth in Brazil, the Study estimated the future economic growth with linear regressions model up until the year 2030. The result of estimation is shown in the next table.

Table 4-3: Estimated Economic Growth of Brazil

Year	2008	2010	2015	2020	2025	2030
Brazil GDP (billion Real)	3,005	3,218	3,794	4,386	4,978	5,570
Growth Rate (%/year)	-	3.5	3.3	2.9	2.6	2.3

On the other hand, the regional GDP of Manaus is only available between 2004 and 2006, by applying the linear regression model, the future economic growth of Manaus is estimated as shown in the table below.

Table 4-4: Estimated Economic Growth of Manaus

Year	2006	2010	2015	2020	2025	2030
Manaus GRDP (billion Real)	36.29	44.17	52.50	60.82	69.15	77.47
Growth Rate (%/year)	-	5.0	3.5	3.0	2.6	2.3

4.1.3 Industry

The framework of future industry growth is the basis of estimating the future industrial waste generation in PIM. The amount of industrial waste generation has the strongest correlation to industrial production although it is not linear considering the improvement of productivity in respective industries.

To estimate the future industrial growth in PIM, the Study utilizes the data of industrial output by types of industry during 2004-2008 available in SUFRAMA, as shown in the table below.

Table 4-5: Trend of Industrial Production Value during 2004-2008

Unit: million $US

Factory Code	Sector	2004	2005	2006	2007	2008
F01	Beverage	152	163	210	84	100
F16	Garment & Footwear	5	12	17	12	21
F03	Printing	35	32	34	36	39
F04	Electrical/Electronics	4,967	6,748	7,840	8,029	8,993
F05	Lumber	21	23	21	25	23
F06	Machinery (Mechanical)	333	475	524	654	788
F07	Metals	393	678	1,068	1,505	2,090
F08	Non-Ferrous Metals	35	51	68	94	151
F09	Furniture	10	15	18	20	27
F10	Paper & Packaging	87	132	158	172	188
F11	Rubber	1.4	1.0	0.5	0.2	1.7
F12	Food Product	59	65	69	52	63
F13	Chemical	1,253	1,584	2,016	2,640	2,987
F14	Plastics	729	1,101	1,279	1,422	1,669
F15	Textiles	5	6	7	7	8

F17	Transportation Equipment	2,353	3,153	4,185	5,948	7,668
F19	Others	3,752	4,676	5,236	4,995	5,359
Total		14,190	18,915	22,750	25,695	30,176

Source: SUFRAMA

With the past industrial output data above, the future industrial growth in Manaus Free Zone is estimated in accordance with the following steps:

STEP 1: Conversion of the industrial output into real output value at 2004 price in Real

The industrial output value during 2004-2008 is converted into real output value at 2004 price in Brazilian Real using deflators and the average currency exchange rate in respective years, as shown in the table below.

Table 4-6: Trend of Industrial Output Value during 2004-2008 at 2004 Price

Unit: million Real

Factory Code	Sector	2004	2005	2006	2007	2008
F01	Beverage	445	370	429	160	178
F16	Garment & Footwear	15	27	35	22	38
F03	Printing	104	72	70	68	70
F04	Electrical/Electronics	14,536	15,270	15,988	15,213	15,974
F05	Lumber	62	53	44	47	41
F06	Machinery (Mechanical)	976	1,075	1,069	1,240	1,399
F07	Metals	1,150	1,535	2,177	2,851	3,712
F08	Non-Ferrous Metals	103	116	139	178	269
F09	Furniture	31	34	37	38	48
F10	Paper & Packaging	255	299	322	327	333
F11	Rubber	4.0	2.3	1.0	0.4	3.0
F12	Food Product	172	146	141	98	111
F13	Chemical	3,667	3,584	4,111	5,001	5,305
F14	Plastics	2,134	2,492	2,607	2,695	3,138
F15	Textiles	15	13	14	13	14
F17	Transportation Equipment	6,886	7,135	8,534	11,270	13,620
F19	Others	10,972	10,578	10,675	9,465	9,347
Total		41,527	42,801	46,393	48,686	53,600

STEP 2: Estimation of the future industrial growth by approximate function analysis for each type of industries

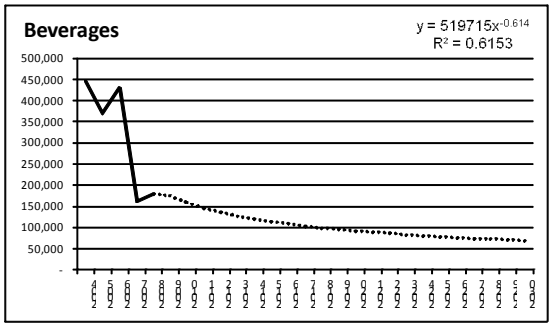
Based on the approximate function analysis of the past trend of industrial growth for each type of industries, the Study estimated the future industrial growth as shown in the table below up until the year 2030.

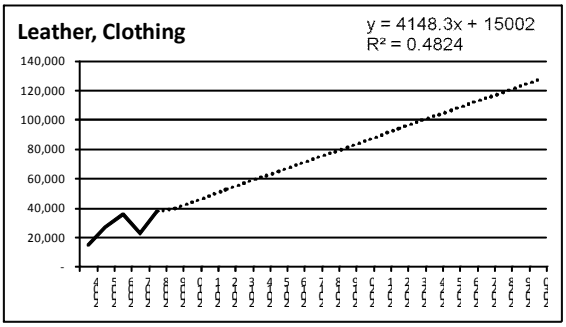
Table 4-7: Estimation of the Future Industrial Growth (2008-2030)

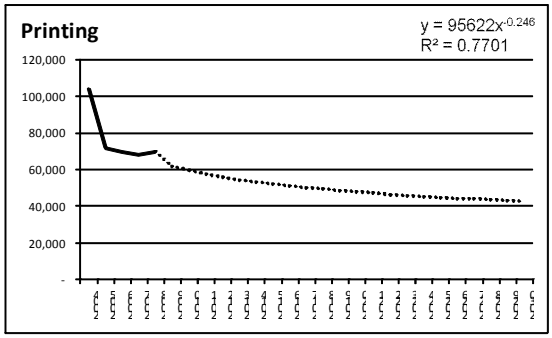
Unit: million Real

Factory Code	Sector	2008	2010	2015	2020	2025	2030
F01	Beverage	178	157	113	91	78	69
F16	Garment & Footwear	38	44	65	86	106	127
F03	Printing	70	59	52	48	45	43
F04	Electrical/Electronics	15,974	16,524	17,934	19,344	20,754	22,164
F05	Lumber	41	38	34	31	29	28
F06	Machinery (Mechanical)	1,399	1,556	2,062	2,568	3,074	3,580
F07	Metals	3,712	4,860	8,079	11,299	14,518	17,738
F08	Non-Ferrous Metals	269	318	515	712	908	1,105
F09	Furniture	48	53	72	92	111	131
F10	Paper & Packaging	333	381	473	565	658	750
F11	Rubber	3.0	0.8	0.5	0.4	0.3	0.3
F12	Food Product	111	96	81	73	67	63
F13	Chemical	5,305	6,211	8,558	10,905	13,251	15,598
F14	Plastics	3,138	3,325	4,257	5,190	6,123	7,055
F15	Textiles	14	13	11	10	8	6
F17	Transportation Equipment	13,620	16,531	25,334	34,136	42,939	51,742
F19	Others	9,347	8,636	6,625	4,612	2,603	590
Total		53,600	58,803	74,265	89,762	105,272	120,789

The Study has to keep in mind that the above estimation of the future industrial growth is made as a so-called 'Business as Usual' scenario in accordance with the statistical analysis of the past trend with the assumption that the past trend will be reflected to the future industrial growth. If SUFRAMA has some plans on future industrial location and/or development of Manaus Free Zone, it should be reflected to improve this estimation. The results of future industrial growth estimation for each type of industries are shown in the figures shown in the following pages.



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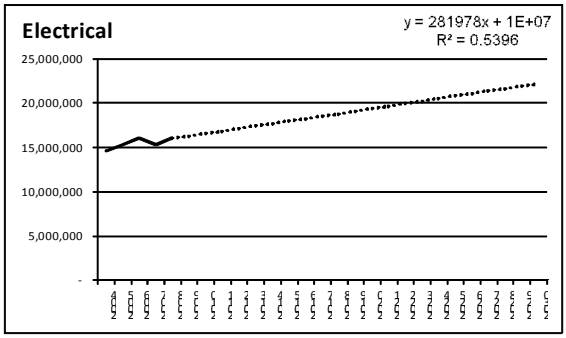
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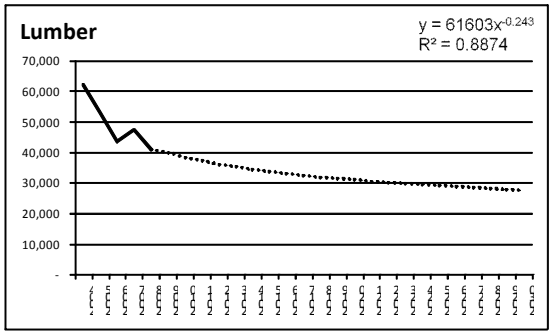
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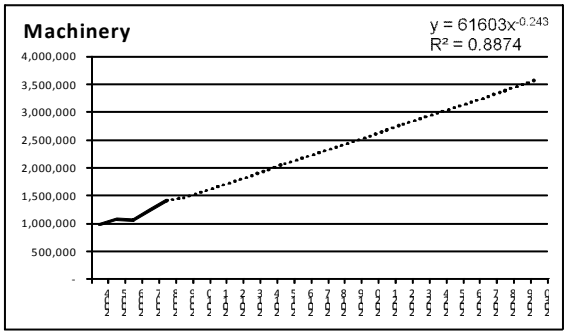
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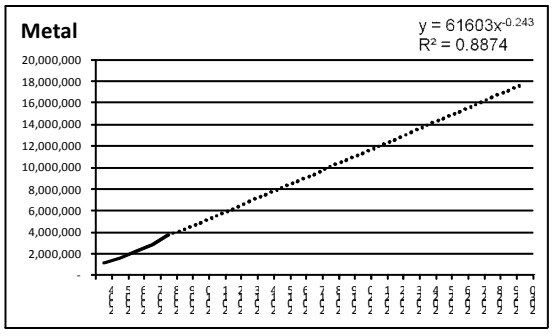
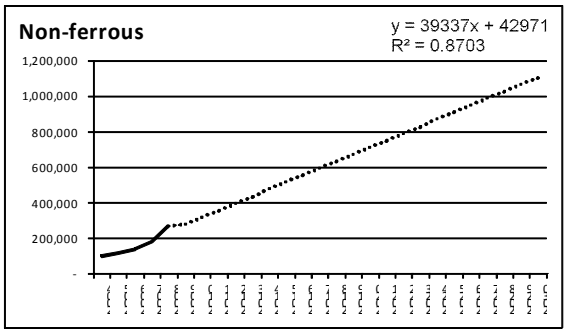
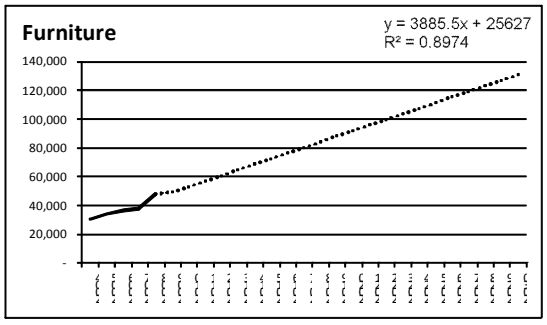
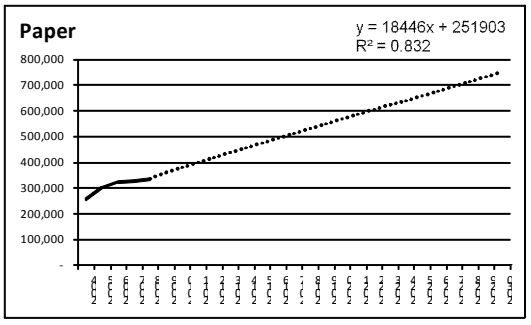
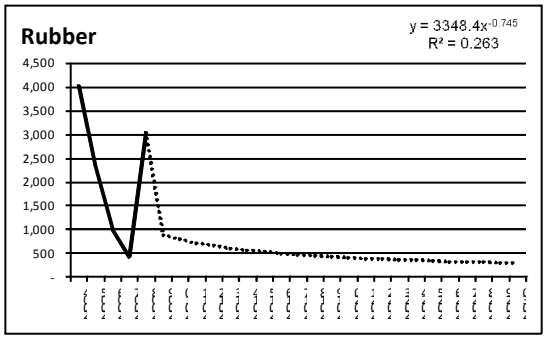
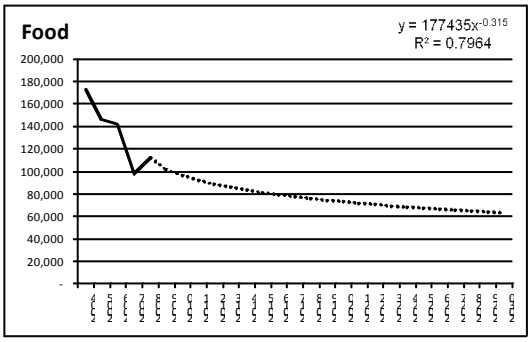

Metal
y = 61603x-0.243
R² = 0.8874

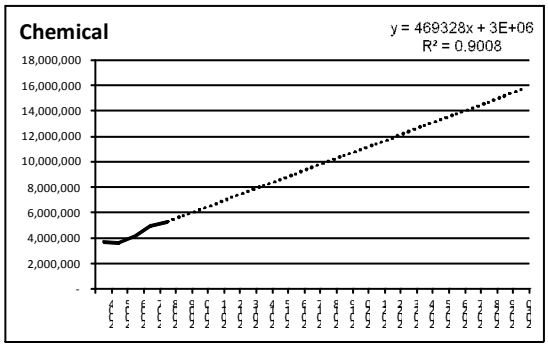

Non-ferrous
y = 39337x + 42971
R² = 0.8703

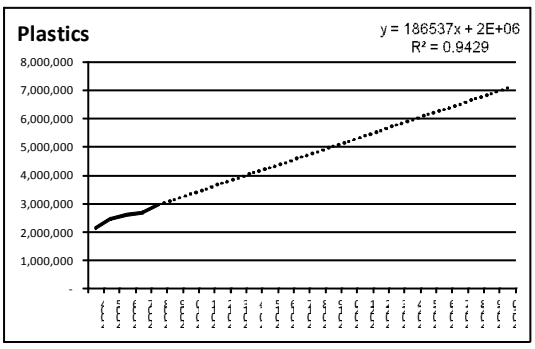

Furniture
y = 3885.5x + 25627
R² = 0.8974

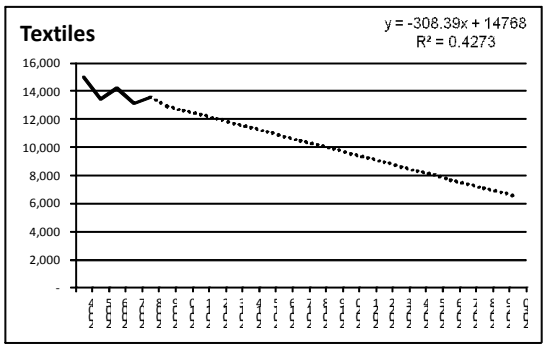

Paper
y = 18446x + 251903
R² = 0.832

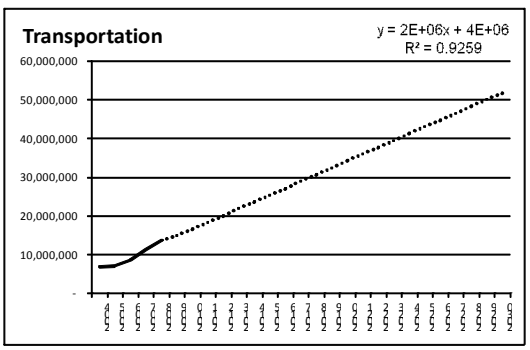

Rubber
y = 3348.4x-0.745
R² = 0.263

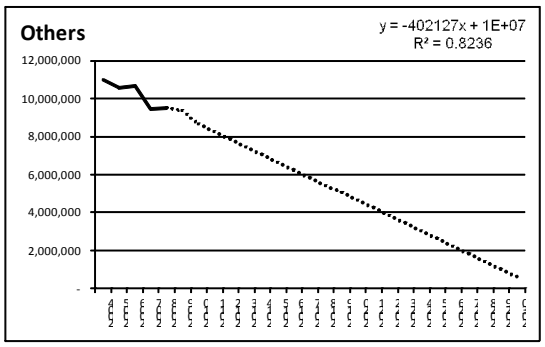

Food
y = 177435x-0.315
R² = 0.7964

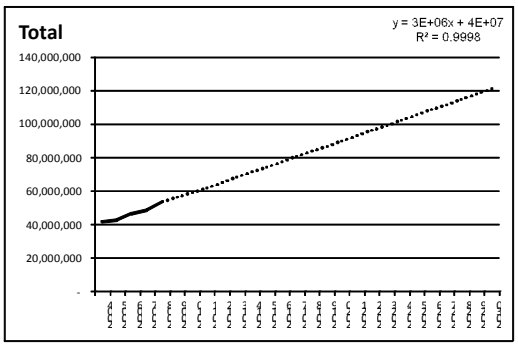

Chemical
y = 469328x + 3E+06
R² = 0.9008


Plastics
y = 186537x + 2E+06
R² = 0.9429


Textiles
y = -308.39x + 14768
R² = 0.4273


Transportation
y = 2E+06x + 4E+06
R² = 0.9259


Others
y = -402127x + 1E+07
R² = 0.8236


Total
y = 3E+06x + 4E+07
R² = 0.9998

4.2 Projection of Future IW Generation

4.2.1 Scope of Projection

a. Target Industry Types

In this report, the following 19 industry classifications used by SUFRAMA for PIM factories were used as the targets for the future estimate of IW generation[1]

Table 4-8: SUFRAMA's Factory Classification

Factory Code	Description of subsector
F01	Beverage (soft drink, alcoholic) and vinegars
F02	Leathers, skins and similar
F03	Printing and graphical company
F04	Electric, electronic and communication materials
	4.1 Components
	4.2 Products (except copy machines)
	4.3 Copy machines and similes
F05	Wood
F06	Mechanical
	6.1 Watch
	6.2 Other mechanical industries
F07	Metallurgy
F08	Non metallic minerals
F09	Furniture
F10	Paper, cardboard, cellulose
F11	Rubber
F12	Food products
F13	Chemical
F14	Plastic material products
F15	Textile
F16	Clothing, fabric and travel goods
F17	Transport material
	17.1 Two wheel
	17.2 Naval
	17.3 Other transport material industry
F18	Construction
F19	Others
	19.1 Optical
	19.2 Toys
	19.3 Devices, equipment, and fotogr. accessories
	19.4 Pens and disposable razors
	19.5 Other several industries

b. Targeted Industrial Waste

The industrial wastes targeted for generation estimates are those required by CONAMA Resolution 313 to be included in a waste inventory. For this report, the following three main categories were used to estimate generation amount.

- General Industrial Waste

[1] Industries (companies) established and producing in western Amazon with full projects approved by SUFRAMA (CGPRI & CGMER/COCAD SUFRAMA , up to 8/2008)

- Health Waste
- Construction Waste

c. Estimation Period for Generation Amount

The estimation period for the generation amount will be until the Master Plan target year 2015.

4.2.2 Methodology of Estimating Future IW Generation

a. Formula used to Estimate the Generation Amount

Estimation of future IW generation amount was made based on the following equation.

$$IWG = \sum_{i=1}^{n} \sum_{j=1}^{m} (Mi \cdot Gij)$$

Basically, the future IW generation amount is calculated using **the generation rate (G)** from each generation source, multiplied by **the number of basic units (M)** from each generation source. The number of basic units (M) can be the production amount, production value, etcetera, but in this study, number of employees was used for reasons given below.

The following table shows how each item of the above formula was established in terms of the previously mentioned 3 types of industrial waste.

Table 4-9: Explanation of Items of Estimation Formula for Future IW Generation Amount

Formula Items	General IW	Health Waste	Construction Waste
IWG	Generation Amount of General IW (ton/year)	Generation Amount of Health Waste (ton/year)	Generation Amount of Construction Waste (ton/year)
i	Factory type	Only one generation rate (GR) is used for all PIM factory	Only one generation rate (GR) is used for all PIM factory
j	Type of general IW	Type of health waste	Type of construction waste
M	Number of employees	Number of employees	Number of employees
G	Waste generation rate (ton/year/person)	Waste generation rate (ton/year/person)	Waste generation rate (ton/year/person)
n	Factory type number (19 types)	Factory type number (only one type)	Factory type number (only one type)
m	Waste type number (29 types)	Waste type number (5 types)	Waste type number (4 types)

b. Setting the Waste Generation Rate (GR)

The waste generation rate (GR) is given for each type of waste for all three types of industrial waste[1]. The GR used is ton per year per person (ton/year/person). The GR was established based on data that the study team gathered when carrying out three surveys: factories, medical institutions, and construction waste. Here, to estimate waste generation amount, it is assumed that until 2015 there is no change in the GR. The table below shows the industry type and generation amount of each type for general industrial waste.

b.1 General Industrial Waste

The tables below show the industry type and generation rate (GR) of each type for general industrial waste. However, Table 5-10 shows the Non-Hazardous and Hazardous industrial waste (Non-HIW and HIW, respectively) according to Non-Production and Production Process in each industry type, whereas Table 5-11 shows the waste generated from Non-Production and Production Process according to Non-HIW and HIW in each industry type. Namely, this is a selection of the generation rates found in the study; the GR of 29 waste types were calculated for each of the 19 types of industry, but the detailed results are given in the Databook.

Table 4-10: Generation Rate for General Industrial Waste by Industry Type

Unit : kg/person/year

Factory Code	Non-Production Process		Production Process	
	Non-HIW	HIW	Non-HIW	HIW
F01	1,349.6	19.0	111.8	21.1
F02*1	---	---	---	---
F03	84.2	6.4	1,686.2	899.1
F04		86.7	910.8	195.5
F05*2				
F06	557.2	228.3	1,699.5	242.9
F07	745.0	141.3	2,979.8	207.5
F08	184.1	1.7	841.4	3.1
F09			72.1	245.2
F10	11,481.4	69.9	5,006.7	448.2
F11*2				
F12	0.4		14,125.3	241.1
F13	133.1	0.9	1,089.2	100.0
F14	291.1	781.3	465.0	71.5
F15*2				
F16*2				
F17	137.3	13.8	471.4	363.6
F18*2				
F19	250.7	0.8	692.3	218.6
All Category	439.4	112.0	885.8	262.4

Note : *1: No factory corresponded to category F02 on the SUFRAMA factory list.
*2 : Listed on the SURAMA factory list and requested for the factory survey, but none of factory of this category was surveyed in this study.

[1] Given for 19 factory types for general IW.

Table 4-11: Generation Rate of General Industrial Waste by Waste Type

Unit : kg/person/year

Waste Code	Non- HIW		Waste Category	HIW	
	Non Process	Process		Non Process	Process
NH01	66.9	1.5	HW01	0.0	0.8
NH02	45.9	42.9	HW02	---*1	---*1
NH03	89.6	241.3	HW03	0.0	0.1
NH04	22.0	136.7	HW04	0.0	9.1
NH05	3.0	0.4	HW05	0.0	0.6
NH06	0.3	0.0	HW06	---*1	---*1
NH07	0.0	0.5	HW07	0.7	56.4
NH08	---*1	1.9	HW08	---*1	3.0
NH09	82.7	360.2	HW09	33.2	30.2
NH10	24.7	16.5	HW10	0.0	0.0
NH11	1.7	4.9	HW11	51.9	8.4
NH12	4.6	0.1	HW12	---*1	0.8
NH13	98.0	78.9	HW13	2.7	0.4
All Category	439.4	885.8	HW14	1.8	115.2
			HW15	14.5	26.5
			HW16	7.2	10.9
			All Category	112.0	262.4

Note: *1: Indicates that corresponding waste was not generated.

b.2 Health Waste

The generation amount of each group of health waste is given in the table below.

Table 4-12: Generation Rate of Health Waste

Waste Category			Clinics		General Hospital
			kg/clinic/day	g/employee/day*1	kg/hospital/day
Group A	A1	Biologic	0.16	0.22	6.01
	A2	Animals	0.00	0.00	0.00
	A3	Body part	0.10	0.14	8.11
	A4	Patient care etc.	0.26	0.36	8.64
	A5	Prions	---	---	---
Group B		Chemical etc.	0.27	0.38	1.7
Group C		Radioactive waste	0.00	0.00	0.0
Group E		Piercing or Cutting	0.44	0.62	3.4
Group D		Common waste	1.17	1.64	94.0
Total			2.40	3.36	121.8

Note: *1: In 2009, there were 116,192 employees.

b.3 Construction Waste

The generation rate was calculated for each class of construction waste, as listed in CONAMA Resolution 307.

Table 4-13: Generation Rate of CONAMA Resolution 307 Construction Wastes

Class	Class A	Class B	Class C	Class D	Total
Generation unit (kg/factory/day)	227.14	1.04	0.00	0.00	228.18

In the survey, the 4 classes of waste as shown in CONAMA Resolution 307 were subdivided into 44 types. The generation rate for each of these 44 types is given below. For those waste codes not listed indicates that generation of such waste was not reported.

Table 4-14: Generation Rate of Construction Waste

Waste No.	Name of Waste	kg/factory/day
01	Excavated soil	9.04
02	Concrete debris	14.75
03	Asphalt debris	17.12
04	Brick debris	0.83
06	Tile and ceramic	0.003
11	Plastic/vinyl sheet	0.12
12	Iron-bar, steel materials	0.07
13	Small metal waste	0.16
17	Plaster boards	0.01
20	Wood debris	0.37
21	Timber form	0.06
22	Scaffolding material	0.34
23	Interior timber	0.32
24	Packing (cardboard)	0.26
29	Machine oil	0.02
33	Ash	0.05
44	Mixed construction waste	184.66
Total		228.18

c. Future estimation for number of employees

The future estimation of number of employees is an important variable when estimating the waste generation amount. The variable for number of employees was selected, particularly, for the following reasons.

1. It is estimated that “the increase in waste generated from factories tends to be closer in relation to growth in number of workers rather than growth in production.”
2. Manufacturers and other industries will increase production according to a rise in demand to expand their profits, but they attempt to control production costs per item as much as possible through improved productivity. These efforts include improving worker productivity, economizing energy use and resources (raw materials).
3. Economizing on energy and resources is, in due course, tied to the reduction of waste generated through production activities. Therefore, assuming such efforts are made, the future amount of waste generated is estimated as a factor in improved productivity included in "growth in number of employees" rather than output growth.

However, the only data available is that for the total number of employees in PIM overall, as the corresponding data for the categories in each of the 19 types of industry does not exist. Accordingly, analysis of the correlation between total number of employees in PIM, 2004 ~ 2008, and estimated industrial growth resulted in an average annual growth in overall PIM production value of 6.6%, thus confirming that average annual growth of direct employment in the same period will remain at 5%.

Based on these results, the forecast for employees in each type of industry was estimated using the following method.

1. The correlation between the change in number of employees in PIM (annual average of 5.0% growth, 2004 ～2008) and change in production value (annual average of 6.6% growth, 2004 ～2008) was estimated, showing that PIM labor productivity will improve 1.5% annually on average.
2. Based on the assumption above, using the 2009 data for number of employees in each of the 19 industry types, and 2009 ~ 2015 estimated industry growth for each industry type, the number of employees in each sector was estimated for 2015 using the following formula:

   Number of Employees (2015) = Number of Employees (2009)× {2015 industrial growth/(2009 industrial growth × $1.015^{(2015-2009)}$)}
3. Results were similarly sought for each of the 19 types of industry.

The forecast for number of employees was estimated using the above conditions with the results as shown in the following table.

Table 4-15: Estimated Forecast for Number of Employees

Factory Code	2009			2015		
	Industrial growth	Number of Employee	Unit Industrial growth	Industrial growth	Number of Employee	Unit Industrial growth
	(mil. Real)	(employee)	(mil. Real /employee)	(mil. Real)	(employee)	(mil. Rea l/employee)
F01	173	2,975	0.058	113	1,794	0.063
F02	---	---	---	---	---	---
F03	62	843	0.074	52	642	0.081
F04	16,242	37,765	0.430	17,934	38,157	0.470
F05	40	348	0.115	34	270	0.126
F06	1,455	5,464	0.266	2,062	7,086	0.291
F07	4,217	6,003	0.702	8,080	10,521	0.768
F08	279	698	0.400	515	1,178	0.437
F09	49	445	0.110	72	600	0.120
F10	363	1,789	0.203	473	2,131	0.222
F11	0.9	133	0.007	0.5	63	0.008
F12	101	538	0.188	81	393	0.206
F13	5,742	1,355	4.238	8,558	1,847	4.634
F14	3,138	9,625	0.326	4,257	11,958	0.356
F15	13	20	0.650	11	15	0.711
F16	40	589	0.068	65	878	0.074

F17	14,771	43,937	0.336	25,334	69,030	0.367
F18	9,355*1	440	21.261	6,623*1	285	23.248
F19		3,225	2.901		2,088	3.172
Total	56,041	116,192	0.482	74,265	148,936	0.527

*1: Statistically, the type of industrial growth for F18 and F19 are the same. Here, in order to calculate the unit industrial growth for each industry, the same industrial growth trends were used.

The value and rate of both total industrial growth and total number of employees were estimated, as shown in the following graph.

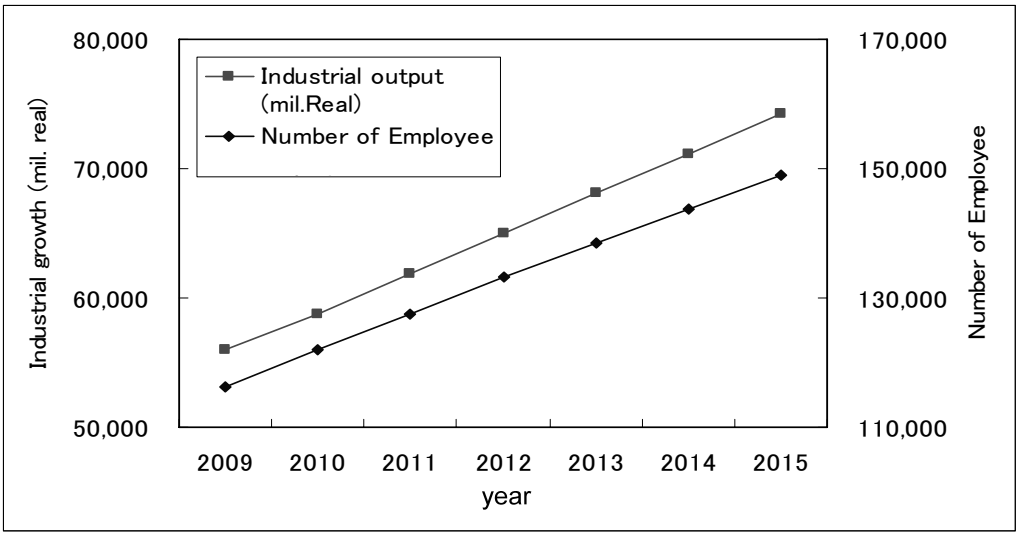


Figure 4-1: Estimated Results for Total Industrial Growth and Total Number of Employees (Forecast)

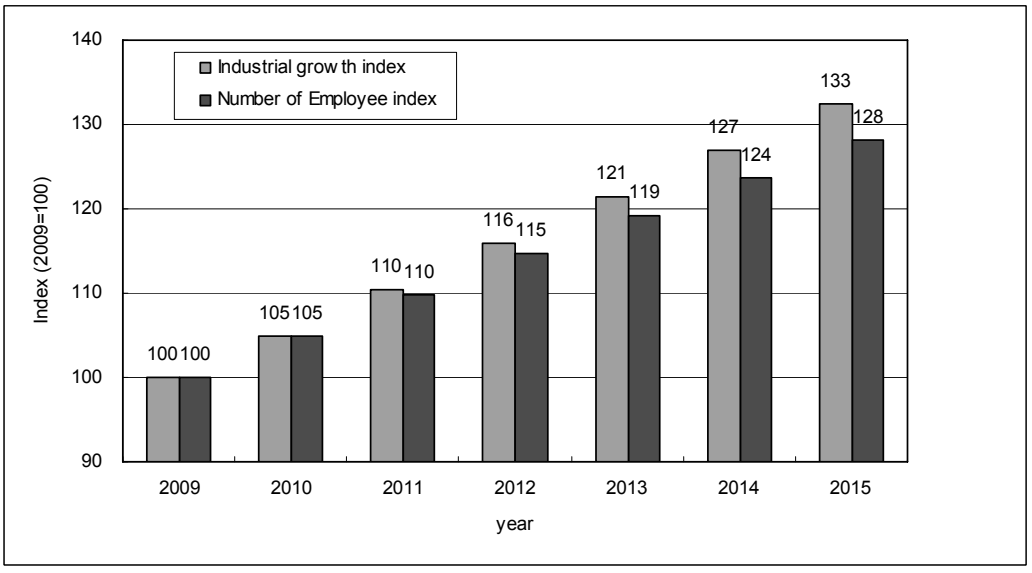


Figure 4-2: Estimated Results for Total Industrial Growth and Total Number of Employees (Rate)

4.2.3 Estimation of Future IW Generation Amount

Future IW generation rate is the product of the above-mentioned generation rate of industry/industrial waste by type (general IW, health waste, construction waste) and the number of employees by industry. The results are as follows.

a. General Industrial Waste Generation

The generation amount of general industrial waste in the entire target area of the study may be calculated by multiplying a GR of a general IW by the number of employees of each year. Below, Non-HIW and HIW generated from Non-Production and Production Processes was calculated for 2015.

The generation amount of general IW in 2009 was estimated at 591.5 ton/day. Further, the 2015 general industrial waste amount generated was estimated by multiplying each type of waste in each sector (Factory Category) by the future index 737.7 ton/day. It is estimated that in 2015 there will be about 1.3 times the present amount of general IW.

Table 4-16: Forecast Generation Amount of General IW by Factory Category (2015)

Factory Category		Non-Production		Production Process		All Process	
		Non-HIW	HIW	Non-HIW	HIW	2009	2015
F01	Beverages	6.6	0.1	0.5	0.1	12.2	7.3
F02	Leather	-	-	-	-	-	-
F03	Printing	0.1	-	3.0	1.6	6.2	4.7
F04	Electrical	51.3	9.1	95.2	20.4	174.1	176.0
F05	Lumber	0.3	0.1	0.7	0.2	1.7	1.3
F06	Machinery	10.8	4.4	33.0	4.7	40.9	52.9
F07	Metal	21.5	4.1	85.9	6.0	67.0	117.5
F08	Nonferrous Metal	0.6	-	2.7	-	2.0	3.3
F09	Furniture	0.7	0.2	0.1	0.4	1.0	1.4
F10	Paper	67.1	0.4	29.2	2.7	83.3	99.4
F11	Rubber	0.1	-	0.2	-	0.6	0.3
F12	Food	-	0.1	15.2	0.3	21.3	15.6
F13	Chemical	0.7	-	5.5	0.5	4.9	6.7
F14	Plastic	9.5	25.6	15.2	2.3	42.4	52.6
F15	Textiles	-	-	-	-	0.1	0.1
F16	Clothing	1.1	0.3	2.1	0.6	2.7	4.1
F17	Transportation	26.0	2.6	89.2	68.8	118.8	186.5
F18	Construction	0.3	0.1	0.7	0.2	2.1	1.3
F19	Other	1.4	-	4.0	1.3	10.2	6.7
Total		198.1	47.1	382.4	110.1	591.5	737.7

As shown in the table above, 93% of the total general IW will be generated in the following 6 factory's categories:

Factory Code	Type of Industry	Waste Generation in 2009 (ton/day)	Waste Generation in 2015 (ton/day)	Increase Rate (%)
F04	Electrical industry	174.1	176.0	1.1

F17	Transport Machinery	118.8	186.6	57.0
F10	Paper industry	83.3	99.4	19.3
F07	Metal industry	67.0	117.5	75.3
F14	Plastic Industry	42.4	52.6	24.1
F06	Machinery	40.9	52.9	29.3
Total		526.5	685.0	30.1

Among the 6 large generation sources the highest increase rate is F07: Metal Industry, 75.3%, followed by F17: Transport Machinery, 57.0%.

The following two tables show forecast of generation amount of general Non-HIW and HIW in 2015, respectively:

Table 4-17: Forecast Generation Amount of General Non-HIW by Type of Waste (2015)

Unit: ton/day

Waste Code	Description of Non-HIW	Generation Amount	
		2009	2015
NH01	Kitchen waste (include waste from animal such as bone, skin, hair)	26.0	32.8
NH02	Wood	29.2	34.0
NH03	Paper	120.0	137.2
NH04	Plastic or polymers and resins	54.5	62.8
NH05	Textile and fiber	1.0	1.1
NH06	Animal oil, Vegetable oil	0.1	0.1
NH07	Rubbers and Leather	0.2	0.2
NH08	Ash/dust from coal-fired power plants, etc.	0.7	0.7
NH09	Metals and metal alloys such as aluminum, copper, bronze	163.6	218.0
NH10	Ceramic & Glasses	13.4	14.8
NH11	Stone, sand or material that have composition of soil such as tile, brick, gypsum, cement	1.7	2.6
NH12	Mixed waste (This code shall be applied in case wastes are discharged without separation.)	1.5	1.1
NH13	Others	59.9	75.1
Total		**471.8**	**580.5**

Table 4-18: Forecast Generation Amount of General HIW by Type of Waste (2015)

Unit: ton/day

Waste Code	Description of Non-HIW	Generation Amount	
		2009	2015
HW01	Inorganic acid	0.2	0.3
HW02	Organic acid	-	-
HW03	Alkalis	-	-
HW04	Toxic Compounds	2.8	3.6
HW05	Inorganic Compounds	0.2	0.3
HW06	Other Inorganic	-	-
HW07	Organic Compounds	18.9	22.5
HW08	Polymeric Materials	1.0	1.4

HW09	Fuel, Oil and Grease	20.0	27.0
HW10	Fine Chemicals and Biocides	-	-
HW11	Treatment Sludge	20.6	24.9
HW12	Ash from incinerator	0.2	0.3
HW13	Dust and Air pollution control (APC) products	1.0	1.8
HW14	Other Hazardous substance (besides HW01-HW13)	34.4	50.7
HW15	Mixed Waste	14.7	16.9
HW16	Hazardous materials from Non-production process	5.7	7.5
Total		**119.7**	**157.2**

As shown in the Table 4-17, 72% of the general Non-HIW will be main 3 types of waste, i.e. NH09: Metal Scrap, NH03: Waste Papers and NH04: Waste Plastics. Among the 3 main types of general Non-HIW the highest increase rate is NH09: Metal Scrap, 33.3%, followed by NH04: Waste Plastics, 15.2%.

Factory Code	Type of Industry	Waste Generation in 2009 (ton/day)	Waste Generation in 2015 (ton/day)	Increase Rate (%)
NH09	Metal Scrap	163.6	218.0	33.3
NH03	Waste Papers	120.0	137.2	14.3
NH04	Waste Plastics	54.5	62.8	15.2
	Other than the above 3 Types of Waste	133.7	162.5	21.5
	Total	471.8	580.5	23.1

As shown in the Table 4-18, 47.3% of the general HIW will be main 3 types of waste, i.e. HW09: Fuel, Oil and Grease, HW11: Treatment Sludge and HW07: Organic Compounds. Among the 3 main types of general HIW the highest increase rate is HW09: Fuel, Oil and Grease, 353%, followed by HW11: Treatment Sludge, 20.9%.

Factory Code	Type of Industry	Waste Generation in 2009 (ton/day)	Waste Generation in 2015 (ton/day)	Increase Rate (%)
HW09	Fuel, Oil and Grease	20.0	27.0	35.0
HW11	Treatment Sludge	20.6	24.9	20.9
HW07	Organic Compounds	18.9	22.5	19.0
	Other than the above 3 Types of Waste	60.2	82.8	37.5
	Total	119.7	157.2	31.3

b. Health Waste

The generation amount of health waste in the entire target study area is calculated by multiplying the generation rate per employee by the number of employees in each year. The results for each type of waste are shown below.

The generation amount of health waste in 2009 and 2015 is estimated at 391.2 kg/day and 500.5 kg/day, respectively. Health waste in 2015 will be generated at 1.3 times the current amount.

Table 4-19: Forecast Amount of Health Waste

Waste Category		Generation Rate	Generation amount	
		g/employee/day	2009	2015
			kg/day	kg/day
Group A	A.1	0.22	26.1	32.8
	A.2	0.00	0.0	0.0
	A.3	0.14	16.3	20.9
	A.4	0.36	42.4	53.6
	A.5	---	---	0.0
Group B		0.38	44.0	56.6
Group C		0.00	0.0	0.0
Group E		0.62	71.7	92.3
Group D		1.64	190.7	244.3
Total		3.36	391.2	500.5

c. Construction Waste

The amount of construction waste generated according to each class as shown in CONAMA Resolution 307 is calculated by multiplying the generation rate per employee for each waste by the number of employees each year. The results estimated for each type of waste are shown below.

The amount of construction waste generated in 2009 and 2015 is estimated at 36.96 ton/day and 47.54 ton/day, respectively. The amount of construction waste generated in 2015 is estimated to be about 1.3 times the current amount.

Table 4-20: Generation Amount of Construction Waste according to CONAMA Resolution 307

Class	Class A	Class B	Class C	Class D	Total
Construction Waste Generation in 2009	36.79	0.17	0.00	0.00	36.96
Construction Waste Generation in 2015	47.28	0.26	0.00	0.00	47.54

The study surveyed 44 types of waste according to the 4 classes as shown in CONAMA Resolution 307. The generation rate of these 44 types of wastes is shown below. For those waste codes not listed indicates that generation of such waste was not reported.

Table 4-21: Forecast Amount of Construction Waste

Waste No.	Name of Waste	Generation Rate	Generation amount	
			2009	2015
		kg/employee/day	ton/day	ton/day
01	Excavated soil	0.013	1.46	1.94
02	Concrete debris	0.021	2.39	3.13
03	Asphalt debris	0.024	2.77	3.57

04	Brick debris	0.001	0.13	0.15
06	Tile and ceramic	0.000	0.00	0.00
11	Plastic/vinyl sheet	0.000	0.02	0.02
12	Iron-bar, steel materials	0.000	0.01	0.01
13	Small metal waste	0.000	0.03	0.03
17	Plaster boards	0.000	0.00	0.00
20	Wood debris	0.001	0.06	0.16
21	Timber form	0.000	0.01	0.01
22	Scaffolding material	0.001	0.06	0.15
23	Interior timber	0.000	0.05	0.04
24	Packing (cardboard)	0.000	0.04	0.04
29	Machine oil	0.000	0.00	0.00
33	Ash	0.000	0.01	0.01
44	Mixed construction waste	0.257	29.92	38.28
Total		0.318	36.96	47.54

d. Total Amount of Industrial Waste Generated and IWM Flow in 2015

From the above results, it is estimated that the total generation amount for industrial waste in PIM in 2015 will be 785.7 ton/day.

If current IWM is continued in 2015, IWM flow chart will be shown in the following figure.

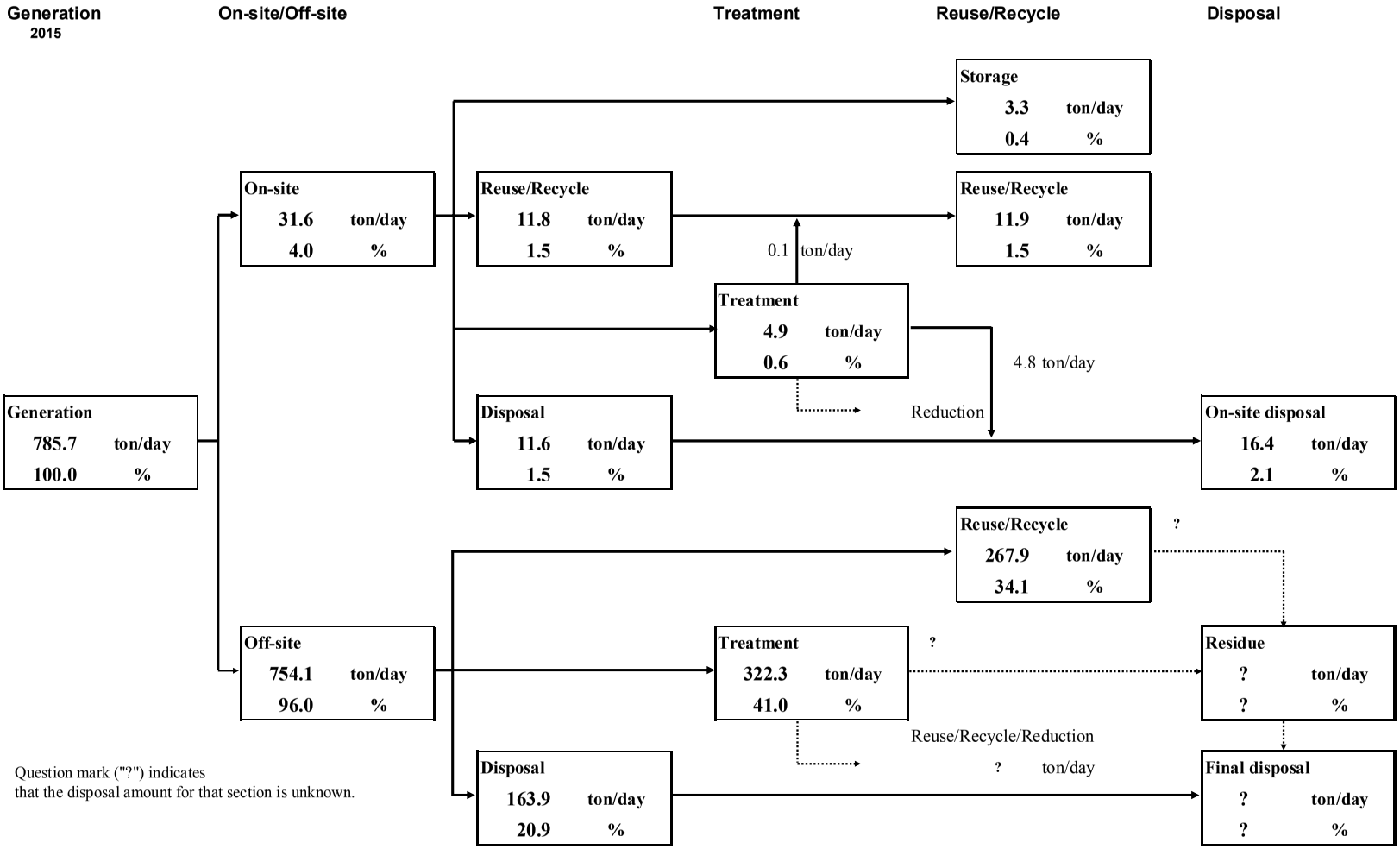


Figure 4-3: Industrial Waste Treatment and Disposal Flow in 2015

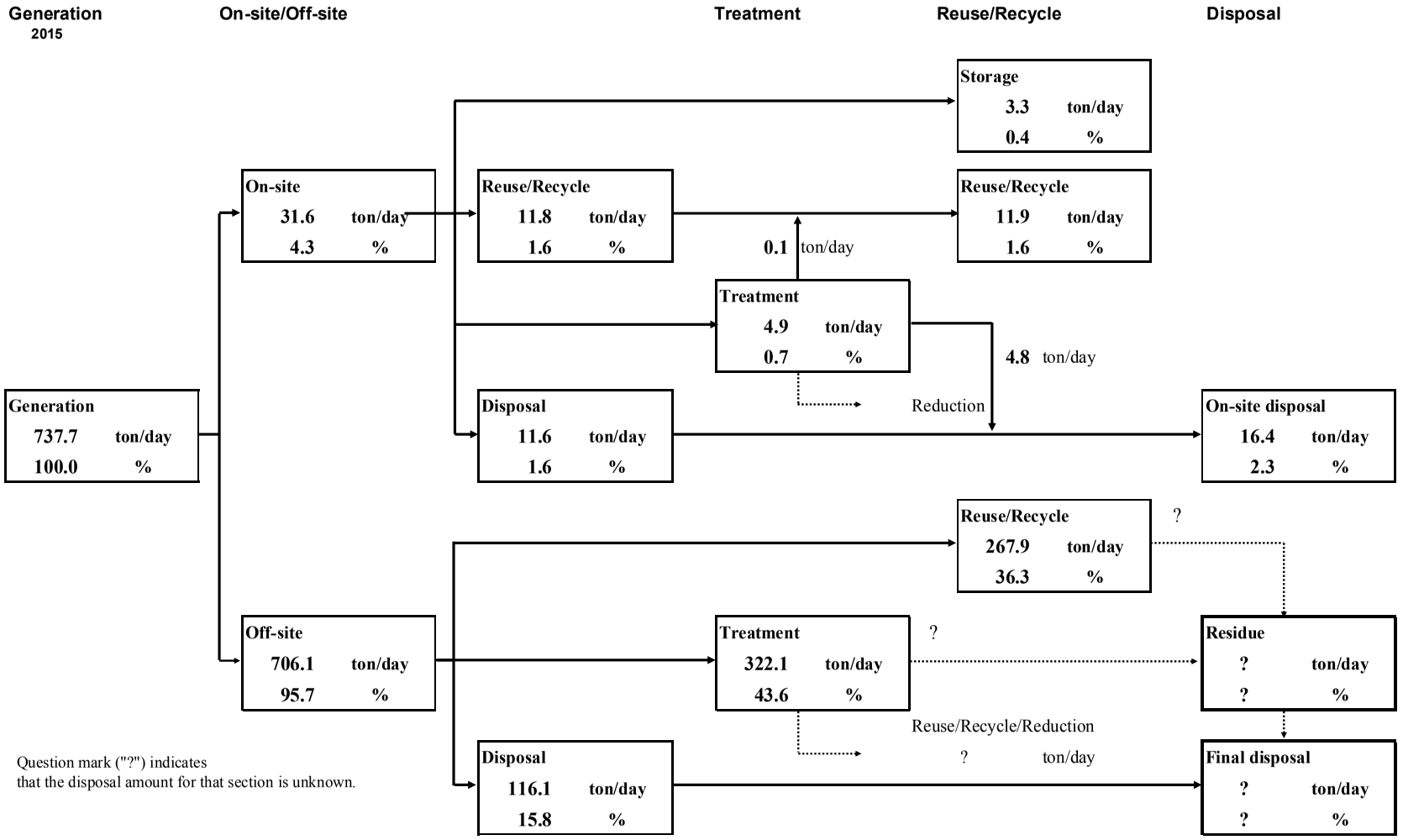


Figure 4-4: Waste Flow for all General industrial wastes generated from PIM in 2015

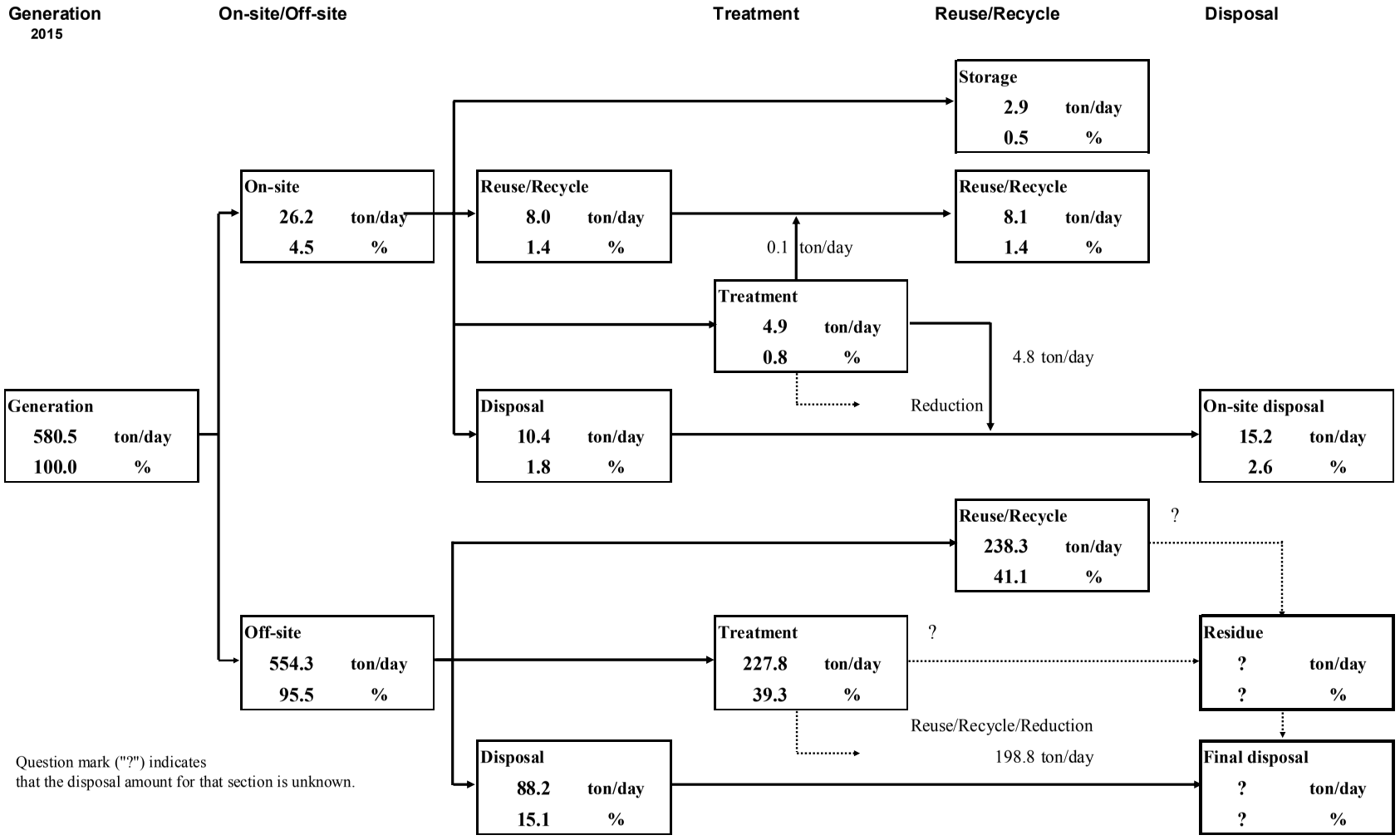


Figure 4-5: Waste Flow for General Non-HIW generated from PIM in 2015

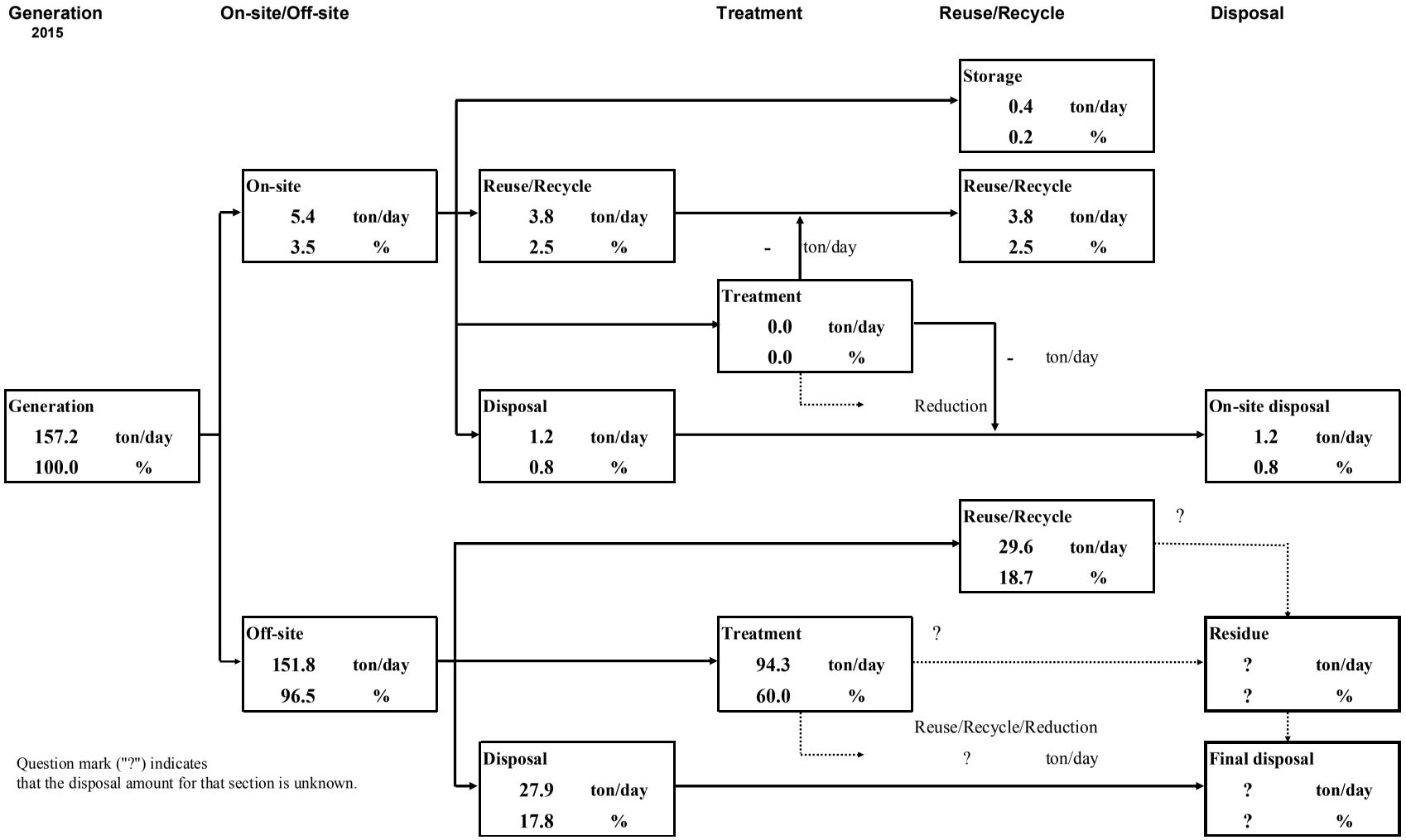


Figure 4-6: Waste Flow for General HIW generated from PIM in 2015

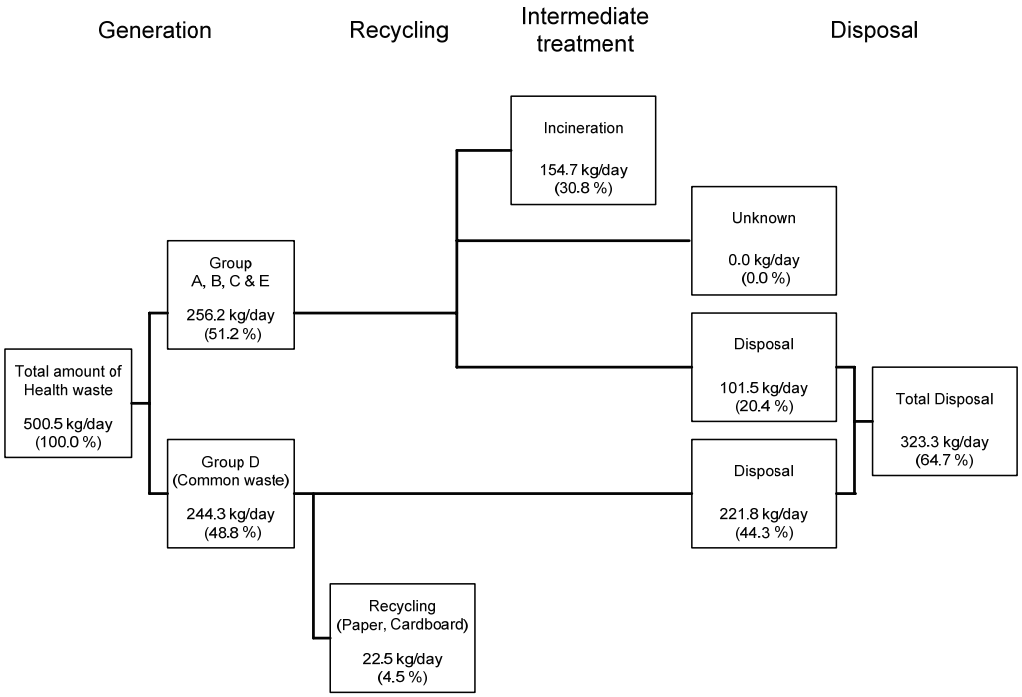


Figure 4-7: Health Waste Management Flow in PIM excluding General Hospital in 2015

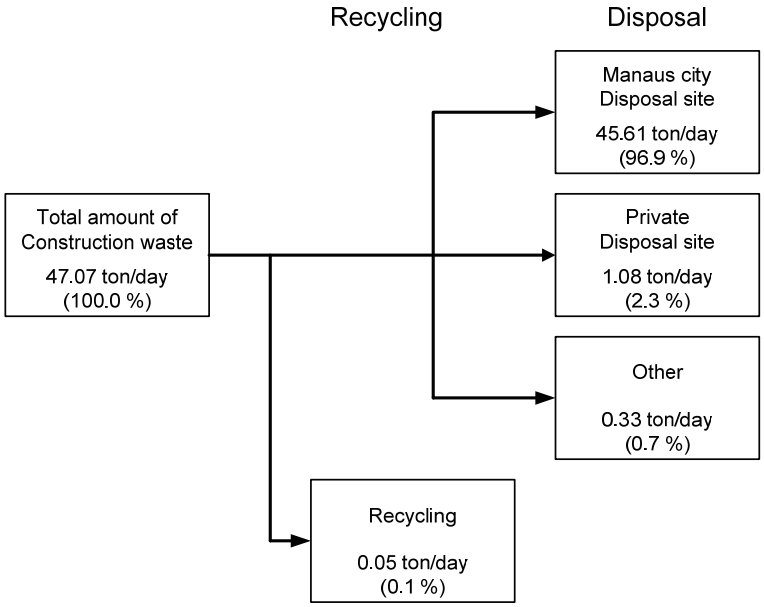


Figure 4-8: Construction Management Flow in PIM in 2015

5. Guidelines to Improve Industrial Waste Management in PIM

5 Guidelines to Improve Industrial Waste Management in PIM

5.1 Guideline Objectives and Composition

5.1.1 Guideline Objectives

The aim of the guidelines is to support the Master Plan objective to "establish an appropriate industrial waste management system in the Industrial Pole of Manaus (PIM)". To achieve this objective, the 3 entities of Generators, Receptors and Administrators shall achieve the following requirements:

1. Establish a management system for industrial waste Generators: Establish an appropriate management system at generation sources (such as factories) for dischargers of industrial waste.
2. Establish a management system for industrial waste service companies, i.e. Receptors: Establish an appropriate management system for industrial waste that has been discharged for waste service companies.
3. Establish a management system for industrial waste Administrators: Establish the administrative system for industrial waste management to promote, guide, monitor and regulate proper management for dischargers of industrial waste and waste service companies.

5.1.2 Composition of the Guidelines

The management system for industrial wastes is composed largely of three actors: the waste generators, waste service companies and administrators. In order to establish this system, administrators, taking the central position, require the tools to properly manage it. Thus, to succeed in "establishing an appropriate industrial waste management system in the Industrial Pole of Manaus (PIM), the 3 tools included in the Master Plan must be applied to their maximum utility.

Tool 1. Waste Inventory Database System (WI_DB System)

Tool 2. Waste Service Company Database System (WSC_DB System)

Tool 3. Waste Manifest System (WM System)

The following figure shows the relationship of the three actors and these three tools, with Administrators at the center.

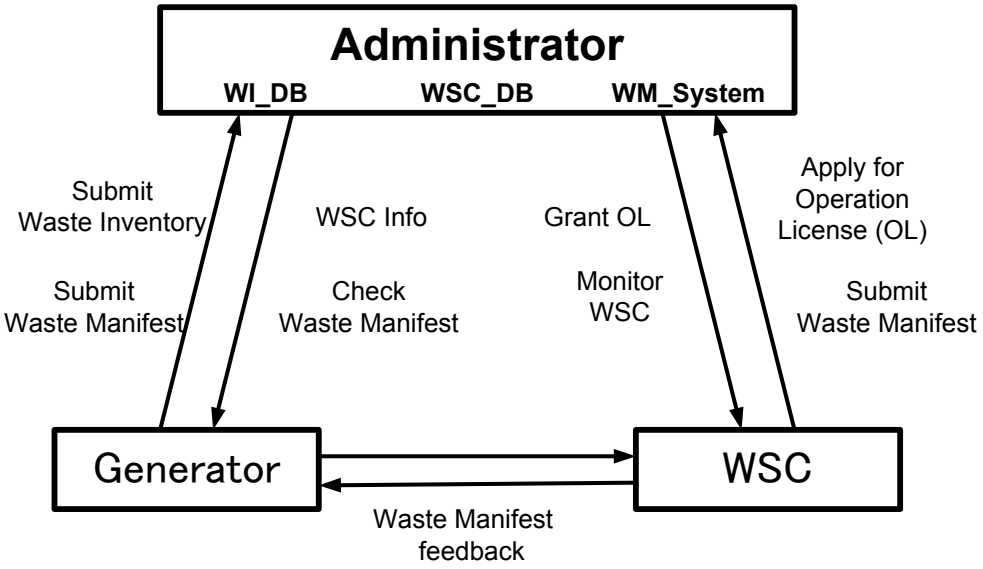


Figure 5-1: Interaction between Administrators, Generators and Receptors to implement industrial waste management

Of the three tools given above, the WI_DB System and WSC_DB System were developed during the study by the Japanese Experts in cooperation with counterparts at IPAAM and SUFRAMA, whereas IPAAM is currently working on developing the Waste Manifest System.

These guidelines are meant to promote the improvement of industrial waste management through the effective use of these tools by waste dischargers, waste service companies (WSC) and administration. The guidelines are composed as shown below:

1. The management of industrial waste by the three parties (Generators, Waste Service Companies and Administrators), as well as items common to the three tools
2. Guidelines for waste dischargers
3. Guidelines for WSCs
4. Guidelines for administrative entities

These guidelines were formulated for the PIM factories that discharge industrial waste in the target study area, the waste service companies (WSCs) which handle the discharged waste, and the administration that handles overall industrial waste management. However, they were created as much as possible so that they may serve as reference material for other industrial complexes or areas where factories are concentrated. Accordingly, stakeholder organizations such as SUFRAMA or the Ministry of Environment, are expected to share these results with related organizations, such as industrial groups and so forth, nationwide.

5.2 Common Items

The first important step to establish an industrial waste system is to define the terms used in conjunction with the system so that all three parties (Generators, WSCs, and Administrators) have the same understanding. Once that is achieved, it is important that the three systems – the WI_DB System, WSC_DB System and Waste Manifest System – are used effectively.

The most important thing to ensure that is for each system to use the same waste codes and units of measurement. This section will not only attempt to define the industrial waste-related terms, but also cover issues dealing with joining these three systems.

5.2.1 Understanding the Industrial Waste Categories and Amount Generated

a. Industrial Waste Categories

All wastes generated in factories should be reported, according to CONAMA Resolution 313. In the case of medical clinics attached to factories, the health-care waste generated is considered as industrial waste. Also, any waste produced from construction undertaken in the factory will be included in the waste regularly generated in the operation of the factory. Furthermore, these two types of wastes are not clearly separated from other types of wastes. The generation source, and properties of health-care and construction waste are very different, and the segregation of these wastes is included in a separate Resolution. As such, these guidelines have divided the industrial wastes covered in CONAMA Resolution 313 into three main categories, as follows:

1. General industrial waste (GIW): Waste generated from factories, except for health-care waste and construction waste.
2. Health-care waste: Waste generated from factory medical clinics
3. Construction waste: Waste generated from factory renovation or expansion.

In principle, if a factory has an attached medical clinic, or if there are plans to perform construction in the year targeted for the waste inventory, it is necessary to report these. However, if there is no clinic and no plans for construction, then naturally there is no need to report these types of waste.

The division of industrial wastes using this 3-type system is shown in the following table. It is divided as follows:

1. The Category column shows the three types of waste mentioned above.
2. The Type column sub-divides each category: (1) General industrial waste (GIW) is sub-divided into Non-HGIW and HGIW, in accordance with CONAMA Resolution 313; (2) Health-care waste is sub-divided into 5 groups according to RDC 36/2004-ANVISA; and (3) Construction waste is sub-divided into 4 classes according to CONAMA Resolution 307.
3. Each type is further divided into individual Waste Codes: 77 codes for GIW, 9 codes for Health-care waste, and 6 codes under Construction waste.
4. In total, there are 92 waste codes for industrial waste.

To manage industrial waste, the three parties – Generators, WSCs and Administrators – will have to produce the proper documents and data according to these categories.

Table 5-1: Industrial Waste Definitions and Categories

Category	Type	Waste Code	Description	No
1. General Industrial Waste (GIW)	Non-Hazardous General Industrial Waste (Non-HGIW)	A001	Residues of restaurant (food remaining portions)	1
		A002	Generated residues outside of the industrial process (office, packings, etc.)	1
		A003	Residues of varrição of plant	1
		A004	Ferrous metal scrap iron	1

Category	Type	Waste Code	Description	No
		A005	Not ferrous metal scrap iron (brass, etc.)	1
		A006	Residues of paper and cardboard	1
		A007	Polymerized plastic residues of process	1
		A008	Rubber residues	1
		A009	Residues wooden I contend not toxic substances	1
		A010	Residues of têxteis materials	1
		A011	Not metallic mineral residues	1
		A012	Slag of aluminum casting	1
		A013	Slag of iron production and steel	1
		A014	Slag of brass casting	1
		A015	Slag of zinc casting	1
		A016	Sand of casting	1
		A017	Refractory ceramic residues and material	1
		A018	Solid residues not toxic metal composites	1
		A019	Solid residues of stations of treatment of effluent I contend material biological not toxic	1
		A021	Solid residues of stations of treatment of effluent I contend not toxic substances	1
		A022	Pastosos residues of stations of treatment of effluent I contend not toxic substances	1
		A023	Pastosos residues I contend limy	1
		A024	Bagasse of sugar cane	1
		A025	Fibre glass	1
		A026	Slag of jateamento I contend not toxic substances	1
		A027	Used catalysers I contend not toxic substances	1
		A028	Residues of system of control of not toxic gaseous emission I contend substance (sleeve precipitadores, filters, among others)	1
		A029	Products are of the specification or are of the validity stated period contend not dangerous substances	1
		A099	Salty shavings	1
		A104	Metallic packings (empty cans)	1
		A105	Not ferrous metal packings (empty cans)	1
		A107	Bombonas of plastic not contaminated	1
		A108	Etil acetate residues vinila (EVA)	1
		A111	Leached ashes of boiler	1
		A117	Glass residues	1
		A199	Foam	1
		A204	Tambores metallic	1
		A207	Plastic films and small packings	1
		A208	Polyurethane residues (PU)	1
		A299	Caleadas shavings of skins	1
		A308	Silt of the caleiro	1
		A399	Atanado leather shavings, remnants	1
		A499	Carnaça	1
		A599	Residues organic of process (tallow, serum, bones, blood, others of the nourishing industry, etc)	1

Category	Type	Waste Code	Description	No
		A699	Rind of rice	1
		A799	Atanado leather Serragem, bran and dust	1
		A899	Generated residues outside of the industrial process (office, packings, etc.)	1
		A999	Residues of fruits (bagasse, must, rind, etc.)	1
	Hazardous General Industrial Waste (HGIW)	C001_C009	Listing 10 - dangerous residues for containing volatile components, in which do not apply solubilização and/or leaching tests, presenting superior concentrations to the indicated ones in listing 10 of Norm NBR 10004	1
		D001	Dangerous residues for presenting inflammability	1
		D002	Dangerous residues for presenting corrosively	1
		D003	Dangerous residues for presenting reactivity	1
		D004	Dangerous residues for presenting pathogenicity	1
		D005_D029	Listing 7 of Norm NBR 10004: dangerous residues characterized by the leaching test	1
		D099	Other dangerous residues - to specify Outros resíduos perigosos - especificar	1
		F001_F0301	Listing 1 of Norm NBR 10004- admittedly dangerous residues - Classroom 1, of not-specific sources	1
		F100	Bifenilas Policloradas - PCB`s. Packings contaminated with PCBs also transforming and capacitors	1
		F102	Residue of catalysers not specified in Norm NBR 10.004	1
		F103	Deriving residue of industrial laboratories (chemical products) not specified in Norm NBR 10.004	1
		F104	Not specified contaminated empty packings in Norm NBR 10.004	1
		F105	Solvent contaminated (to specify solvent and the main contaminante)	1
		F130	for used lubricative Oil	1
		F230	for hydraulical Fluid	1
		F330	for Oil of cut and usinagem	1
		F430	for contaminated used Oil in insulation or the refrigeration	1
		F530	for oily Residues of the separating system of water and oil	1
		K001_K209	Listing 2 of Norm NBR 10004- admittedly dangerous residues of specific sources	1
		K053	Remaining portions and you splodge of inks and pigments	1
		K078	Residue of cleanness with solvent in the manufacture of inks	1
		K081	Silt of ETE of the production of inks	1
		K193	Shavings of leather tanned to chromium	1
		K194	Leather Serragem and dust I contend chromium	1
		K195	Silt of stations of treatment of effluent of tanning to chromium	1
		K203	Residues of laboratories of research of illnesses	1
		K207	It splodges of the used oil re-refining (it splodges	1

Category	Type	Waste Code	Description	No
			acid)	
		P001_P123	Listing 5 of Norm NBR 10004 - dangerous residues for containing toxic substances acutely (remaining portions of packings contaminated with substances of listing 5; contaminated residues of spilling or ground, and products are of specification or products of commercialization forbidden of any constant substance in listing 5 of Norm NBR 10.004	1
		U001_U246	Listing 6 of Norm NBR 10004- dangerous residues for containing toxic substances (contaminated residues of spilling or ground; products are of specification or products of commercialization forbidden of any constant substance in listing 6 of Norm NBR 10.004	1
1. Sub-total				77
2. Health-care Waste	Group_A	RMA1	Group A.1 Biologic	1
		RMA2	Group A.2 Animals	1
		RMA3	Group A.3 Body part	1
		RMA4	Group A.4 Patient care etc.	1
		RMA5	Group A.5 Prions	1
	Group_B	RMB1	Chemical etc.	1
	Group_C	RMC1	Radioactive waste	1
	Group_D	RMD1	Common waste	1
	Group_E	RME1	Piercing or Cutting	1
2. Sub-total				9
3. Construction waste	Class_A	RCA1	from construction, demolition, refitting and repair of pavement	1
		RCA2	from the construction, demolition refitting and repair of edifications: ceramic components	1
		RCA3	from manufacturing and/or demolition process of concrete pre-modulated pieces	1
	Class_B	RCB1	The recyclable waste for other purposes	1
	Class_C	RCC1	Waste which has no economically feasible technology or applications which may allow it to be recycled	1
	Class_D	RCD1	Hazardous waste arisen from construction process, such as paints, solvents, oils and so forth	1
3. Sub-total				6
Ground Total				92

Below, general industrial waste, health-care waste and construction waste, as shown in the proceeding table, are explained individually.

a.1 General Industrial Waste (GIW)

The categorization of general industrial waste is in accordance with CONAMA Resolution 313, which regulates the submission of industrial waste inventories. CONAMA Resolution 313 categorizes industrial waste in great detail, even beyond the categories of health-care and construction waste; the categories in the Resolution are based on chemical and physical

properties, which results in a very complex and differentiated list of wastes. In particular, there are many types of hazardous wastes that must be analyzed to identify them; in fact, there are a total of 708 waste types: 48 Class II (A&B) non-hazardous, general industrial wastes and 660 Class I hazardous, general industrial wastes. As a result, the work required in making a waste inventory and aggregating the data can be overwhelming. Therefore, the waste categorization in these guidelines and the three systems has put a portion of the various hazardous wastes under a single code (e.g. U001_U246). By doing so, it was possible to arrange the wastes into 77 types, with 48 types of non-hazardous GIW and 29 types of hazardous GIW.[1]

a.2 Health-care Waste

This is waste generated from a medical facility within a factory (i.e. a clinic), and is in accordance with health-care waste as regulated in RDC 306/2004-ANVISA. If there is no clinic in a factory, then there is no need to report on health-care waste generated or how it is disposed.

There are a total of 9 types of health-care waste: 8 hazardous (Class I) wastes and one (Group D) non-hazardous (Class II) waste.

a.3 Construction Waste

The amount of construction waste generated and how it was disposed must be reported if there was construction within the factory premises during the year targeted for the waste inventory. Construction waste is in accordance with CONAMA Resolution 307, which regulates the category for construction waste.

There are a total of 6 types of construction waste: 5 non-hazardous (Class II) wastes and one is a hazardous (Class D) waste.

b. **Understanding the Generation Amount of Industrial Wastes**

Fundamentally, if the necessary data is entered into the WI_DB System, then it is possible to know the amount of all industrial waste generated in total, or separately for general industrial wastes, health-care waste and construction waste. Moreover, the sub-categories of each of these wastes can be aggregated as necessary. The method to aggregate each type of waste is outlined below.

b.1 Understanding the Generation Amount for Each Waste Code (92 waste types)

The WI_DB System allows industrial wastes generated from factories to be entered under 92 Waste Codes, as shown in Table 5-1: Industrial Waste Definitions and Categories. The database system will then contain the amount of industrial waste generated for each of the 92 Waste Codes. Using these 92 Waste Codes, it is possible to aggregate the generation amount for each type of industrial waste.

b.2 Understanding the Generation Amount for each Type

The generation amount for a particular type of waste can be extracted by aggregating the generation amount of all its related waste codes. For example, general industrial waste is sub-divided into two types, which are hazardous general industrial (Class 1) waste and

[1] The factory survey conducted by JICA divided general industrial waste into 13 categories for non-hazardous GIW and 16 for hazardous GIW, for a total of 29. The waste streams for these 29 wastes were then clarified and the results saved in SUFRAMA's WI_DB. Following these guidelines, it is possible to use the code sheet in the JICA Report to compare the JICA factory study results with the general industrial waste data by using the categories in CONAMA Resolution 313.

non-hazardous general industrial (Class II) waste. To know the generation amount for non-hazardous general industrial (Class II) waste, the generation amounts for each related waste code under that type would be aggregated.

b.3 Understanding the Generation Amount for each Category

The generation amount for a particular category (i.e. GIW, Health-care Waste, or Construction Waste) can be found by aggregating the generation amount of all waste codes belonging to that category. For example, to know the generation amount for GIW, aggregate the generation amounts for all waste codes in that category. Similarly, health-care waste can be found by aggregating the generation amount for all waste codes related to its category.

b.4 Understanding the Generation Amount for all Industrial Waste

To know the overall generation amount for all categories of industrial waste generated at factories (i.e. GIW, Health-care Waste, Construction Waste), the amounts of all of those categories are aggregated. This generation amount is the total amount of all 92 types of industrial wastes shown in Table 1: Industrial Waste Definitions and Categories.

b.5 Understanding the Generation Amount for Hazardous Industrial (Class I) Waste, and Non-hazardous Industrial (Class II) Waste

To find the generation amount for hazardous industrial (Class I) waste, the generation amount for all the waste codes in each category belonging to the hazardous waste type would be aggregated. The hazardous waste types in each category are as follows:

1. General industrial waste: HGIW
2. Health-care waste: Group A, B, C & E
3. Construction waste: Class D

The generation amount of non-hazardous industrial (Class II) waste can be found by aggregating the waste codes excluding those mentioned above for hazardous waste types.

5.2.2 Waste Stream for Industrial Waste Management

a. **Waste Stream**

In order to establish appropriate industrial waste management, it is necessary to grasp the actual conditions regarding industrial waste disposal. To do so effectively, the flow of industrial waste disposal must be clarified. This “waste stream” is made up of on-site (i.e. at the factory) industrial waste management (IWM) and off-site IWM. The figure below shows the concept of the waste stream, which shows the disposal methods (i.e. treatment, recycling, etc) of the various wastes.

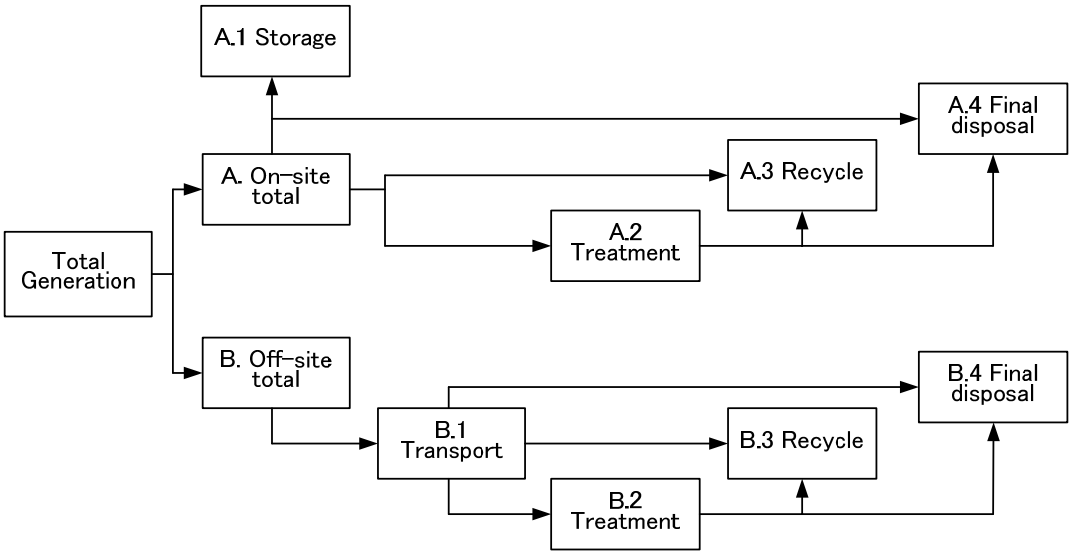


Figure 5-2: Waste Stream for Industrial Waste Disposal

b. **How to Make the Waste Stream**

By entering the data about generation of each type of industrial waste mentioned above into the WI_DB System, as well as disposal data (as shown in the following section), it is then possible to know the waste stream for general industrial waste, health-care waste and construction waste, or all of the industrial wastes together. Furthermore, one can produce the waste stream for each detailed type of waste, as necessary. The following section is how to make a waste stream for each type of waste.

b.1 Making the Waste Stream for each Waste Code (92 types of waste)

The WI_DB System allows the data for on-site and off-site disposal methods to be entered according to the 92 waste codes. The disposal method according to each waste code can be entered as shown in Figure 5-2: Waste Stream for Industrial Waste Disposal. This can then be used to make the waste stream for each of the 92 types of waste. The disposal methods are explained in more detail below.

b.2 Making the Waste Stream for each Type

The waste stream for a particular type of waste can be made by aggregating the disposal methods of all waste codes for that type. For example, general industrial waste is divided into hazardous general industrial (Class I) waste and non-hazardous general industrial (Class II) waste, so the disposal methods for the waste codes related to those types are aggregated to make the waste stream. Similarly, for health-care waste, the waste stream for each group can be made by aggregating the disposal method for all waste codes belonging to the relevant group.

b.3 Making the Waste Stream for each Category

The waste stream for a particular category (GIW, Health-care Waste, Construction Waste) is made by aggregating the disposal methods for all waste codes which belong to that category. For example, the waste stream for general industrial waste would be the disposal methods for all of the waste codes in the GIW category. Similarly, the waste stream for health-care waste is made by aggregating the disposal methods for all the waste codes belonging to that category.

b.4 Making the Waste Stream for All Industrial Wastes

The waste stream for all industrial wastes (i.e. GIW, health-care waste and construction waste) can be made by aggregating all disposal methods for all of the categories.

b.5 Making the Waste Stream for hazardous industrial (Class I) waste or non-hazardous industrial (Class II) waste

To make the waste stream for hazardous industrial (Class I) waste, the disposal method for all waste codes that belong to hazardous wastes in each category are aggregated. The hazardous waste types in each category are as follows:

1. General industrial waste: HGIW
2. Health-care waste: Group A, B, C & E
3. Construction waste: Class D

The generation amount of non-hazardous industrial (Class II) waste can be found by aggregating the waste codes excluding those mentioned above for hazardous waste types.

5.2.3 Industrial Waste Disposal

When making the waste inventory, the first step is to select whether the waste code is for on-site or off-site disposal, and then select each disposal method that was used. CONAMA Resolution 313 regulates the disposal methods for all waste generated from factories as follows.

a. **Storage**

Storage is the amount shown in Figure 5-2: Waste Stream for Industrial Waste Disposal in the section A.1 Storage, in regards to factory on-site storage of industrial waste. There are two main choices for on-site storage methods:

1. "S" for wastes generated in the past one year, and
2. "Z" for wastes stored more than one year.

Both of these are further divided into particular storage methods.

Table 5-2: Storage methods

"S" for wastes generated in the past one year	"Z" for wastes stored more than one year residues more	Description
S01	Z01	Barrel in waterproofing floor, protected area
S11	Z11	Barrel in waterproofing floor, unprotected area
S21	Z21	Barrel on the ground, protected area
S31	Z31	Barrel on the ground, unprotected area
S02	Z02	In bulk on waterproofing floor, protected area
S12	Z12	In bulk on waterproofing floor, unprotected area
S22	Z22	In bulk on the ground, protected area
S32	Z32	In bulk on the ground, unprotected area
S03	Z03	Covered dumper truck
S13	Z13	Uncovered dumper truck

S04	Z04	Tank with contention tray
S14	Z14	Tank without contention tray
S05	Z05	Bottle on waterproofing floor, protected area
S15	Z15	Bottle on waterproofing floor, unprotected area
S25	Z25	Bottle on the ground, protected area
S35	Z35	Bottle on the ground, unprotected area
S09	Z09	Lagoon with waterproofing
S19	Z19	Lagoon without waterproofing
S08	Z08	Other systems

b. **Intermediate Treatment**

Intermediate treatment is the amount of industrial waste shown in Figure 5-2: Waste Stream for Industrial Waste Disposal in the on-site section A.2 Treatment, and off-site section B.2 Treatment. Intermediate Treatment is further divided according to the choices shown in the following table.

Table 5-3: Intermediate Treatment Method

Code	Description
T01	Incinerator
T02	Incinerator with chamber
T05	Outdoor burning
T06	Detonation
T07	Oxidation of cyanides
T08	Chemical encapsulation/fixture or solidification
T09	Chemical oxidation
T10	Precipitation
T11	Detoxification
T12	Neutralization
T13	Adsorption
T15	Biologic treatment
T16	Composting
T17	Drying
T18	Land farming
T19	Thermal plasma
T34	Other treatments

c. **Recycle**

Recycle is the amount of industrial waste shown in Figure 5-2: Waste Stream for Industrial Waste Disposal for on-site in the section A.3 Recycle, and off-site in section B. 3 Recycle. Recycle is further divided according to the choices shown in the following table.

Table 5-4: Recycle Method

Code	Description
R01	Use in industrial oven (except in heating ovens)
R02	Use in boiler
R03	Co-processing in cement ovens

R04	Blending of wastes
R05	Formulation of micronutrients
R06	Incorporation in agricultural soil
R07	Fertilization and irrigation
R08	Animal reaction
R09	Reprocessing of solvents
R10	Re-refining of oil
R11	Reprocessing of oil
R12	Scrap iron collector
R13	On-site reuse/recycling/recovery
R99	Other forms of reuse/recycling/recovery

d. **Final Disposal**

Final disposal is the amount shown in Figure 5-2: Waste Stream for Industrial Waste Disposal for on-site in section A.4 Final Disposal and off-site in section B. 4 Final Disposal. Final disposal is further divided according to the choices shown in the following table.

Table 5-5: Final Disposal Method

Code	Description
B01	Infiltration in the soil
B02	Municipal Landfill
B03	Own Industrial Landfill
B04	Third-parties Industrial Landfill
B05	Municipal Dumping Site
B06	Private Dumping Site
B20	Sewer
B30	Other

5.2.4 Non-IW Common Items

a. **Factory Categorization Code**

The factory categories utilize the categorization SUFRAMA uses for registered factories.

SUFRAMA uses 19 factory codes, and further subdivides 4 of the factory codes for a total of 28. However, only the large factories included in Part 1 of the SUFRAMA factory list use the sub-categories, so only the 19 primary categories are used for industrial waste management, such as when creating the waste flowcharts.

The factory codes and categories are shown in the following table.

Table 5-6: SUFRAMA Factory Categories

Factory Code	Sector	
	Main Category	Sub-category
F01	Beverages	
F02	Leather	
F03	Printing	
F04	Electrical	
	4-1	Parts

		4-2	Products (except copy machines)
		4-3	Copy machines
F05	Lumber		
F06	Machinery		
		6-1	Clock/watch
		6-2	Other machinery industry
F07	Metal		
F08	Nonferrous		
F09	Furniture		
F10	Paper		
F11	Rubber		
F12	Food		
F13	Chemical		
F14	Plastic		
F15	Textiles		
F16	Clothing		
F17	Transportation		
		17-1	Two-wheelers
		17-2	Ships
		17-3	Other transportation
F18	Construction		
F19	Other		
		19-1	Optics
		19-2	Toys
		19-3	Small instruments
		19-4	Writing utensils, razor blades
		19-5	Other

b. **Waste Service Company Categorization Code**

IPAAM plans to use a new environmental license code dedicated only for waste service companies (WSC). There are two main categories depending on the type of waste the WSC handles: "Municipal Waste (code 33＊＊)" and "Industrial Waste (code 34＊＊)", which are then subdivided into categories for collection/transportation, intermediate treatment, reuse/recycling, and final disposal. These codes are given in the table below.

If a company conducts more than one type of service, it must be licensed and registered under all of the appropriate codes. For example, if a company collects and transports industrial waste and also recycles it, then it will have to be registered under both code 3401 and 3403.

Table 5-7: Waste Service Company Classification and Code (Draft)

Code	Major Classification	Code	Sub-Classification	Class [Types of Waste Handled]
33	Municipal Waste Management	3301	Collection and Transportation	Class I (HW), Class II-A(Non-HW & Non-Inert), Class II-B (Non-HW & Inert)
		3302	Intermediate Treatment	Class I (HW), Class II-A(Non-HW & Non-Inert), Class II-B (Non-HW & Inert)
		3303	Recycling	Class II-A (Non-HW & Non-Inert), Class II-B (Non-HW & Inert)
		3304	Final Disposal	Class II-A (Non-HW & Non-Inert), Class II-B (Non-HW & Inert)
34	Industrial Waste Management	3401	Collection and Transportation	Class I (HW), Class II-A(Non-HW & Non-Inert), Class II-B (Non-HW & Inert)
		3402	Intermediate Treatment	Class I (HW), Class II-A(Non-HW & Non-Inert),

				Class II-B (Non-HW & Inert)
		3403	Recycling	Class II-A (Non-HW & Non-Inert), Class II-B (Non-HW & Inert)
		3404	Final Disposal	Class II-A (Non-HW & Non-Inert), Class II-B (Non-HW & Inert)

c. **Units of Measurement**

The amount of general industrial waste, health-care waste and construction waste generated in PIM is indicated in weight (tons) as a unit of measurement, which also served to create the PIM waste flow. Waste generated by volume or individually is to be converted to indicate weight before being entered. Also, in cases where the generation amount is extremely small, such as for health-care waste, it can be indicated in kilograms (kg) instead of tons.

(Note: measure by apparent density as a simple conversion method from volume (m^3) to weight (ton))

(1) Things to prepare

- Sample (when weight is unknown)
- Plastic bucket (about 20 litres)
- Scale (max. approx. 50 kg)

(2) Measure the weight of the plastic bucket (Basket weight (Bw): kg)

(3) Measure the weight of the plastic bucket with 10 liters of water (the water ratio is 1.0 so this is 10 kg).

(4) Mark the water line of 10 liters of water in the bucket.

(5) Pour out the water and pack the sample into the bucket up to the line. (Gwb (kg) = Bw + Weight of 10 liter sample)

(6) The sample's apparent density AM (ton/m^3) is calculated with the following formula.

$$AM\ (ton\ /\ m3) = \frac{(Gwb\ -\ Bw)}{10}$$

(7) Sample weight conversion: Multiply the known volume of the sample by AM and calculate the weight.

d. **Other**

The databases for the waste inventory management system (WI_DB), waste service company licensing and registry management system (WSC_DB), and waste manifest system (WMS) are all managed using the National Corporate Tax Payer registration number (CNPJ) as their "Primary key" so that all the databases can be linked. Consequently, the format of the CNPJ to be entered will be the officially registered CNPJ. If this is done online, a program will confirm the number entered according to the following format.

CNPJ Format: XX.XXX.XXX/0001-1

5.3 Industrial Waste Management Improvement Guidelines for the Generator (Factory)

5.3.1 Responsibility of the Generator (Factory) in relation to Industrial Waste Management

a. Responsibility of the Generator (Factory) in relation to Industrial Waste Management

The generator holds primary responsibility for the appropriate disposal of industrial waste, whereas the transporter/receptor and other waste service companies (WSC) has only joint responsibility. The generator must be sufficiently aware of this point and needs to establish an industrial waste management system for the factory. In order to do so, the generator must carry out the following:

- Assign an officer in charge of industrial waste management
- Make a waste inventory (WI)
- Make a waste manifest (WM)
- Obtain the services of a waste service company, such as the transporter, disposal company, etc., that has the appropriate operation license (OL)
- Promote improvement of industrial waste management and 3R at the factory

b. Assignment of an Industrial Waste Management Officer

In order to establish an industrial waste management system in the factory, it is necessary to assign a technician to be in charge of industrial waste management (i.e. an IWM officer). This IWM officer would be in charge of overall IWM in the factory, and be the first one responsible for the appropriate management of industrial wastes generated at the factory. Accordingly, this officer would receive notices and guidance concerning IWM from IPAAM and carry out the appropriate action. The officer would also receive guidance from IPAAM and, according to regulation, make a summary of the waste inventory (WI) and waste manifest (WM). Furthermore, through making the WI, the officer would be conscious of any issues concerning IWM in the factory. To make improvements as needed, the officer would receive instruction from IPAAM and formulate an industrial waste management plan.

5.3.2 Production and Use of the Waste Inventory (WI)

The first step to establishing appropriate industrial waste management in a factory is to properly produce the waste inventory (WI) as required by CONAMA Resolution 313. Namely, the WI exhibits the proper understanding of how industrial waste is being managed in the factory. Then, using the WI, an IWM improvement plan will be formulated and carried out. The following points are to be kept in mind when producing and making use of the WI.

a. Summary of the Waste Inventory Database

A summary of the waste inventory database is shown in the figure below.

The database inventory seeks to report off-site disposal. The generator (factory) obtains information from a waste service company database (WSC_DB) on WSCs that have obtained the proper operation license. Then, making use of both the WI_DB and WSC_DB, it is possible to produce a highly accurate account of off-site disposal.

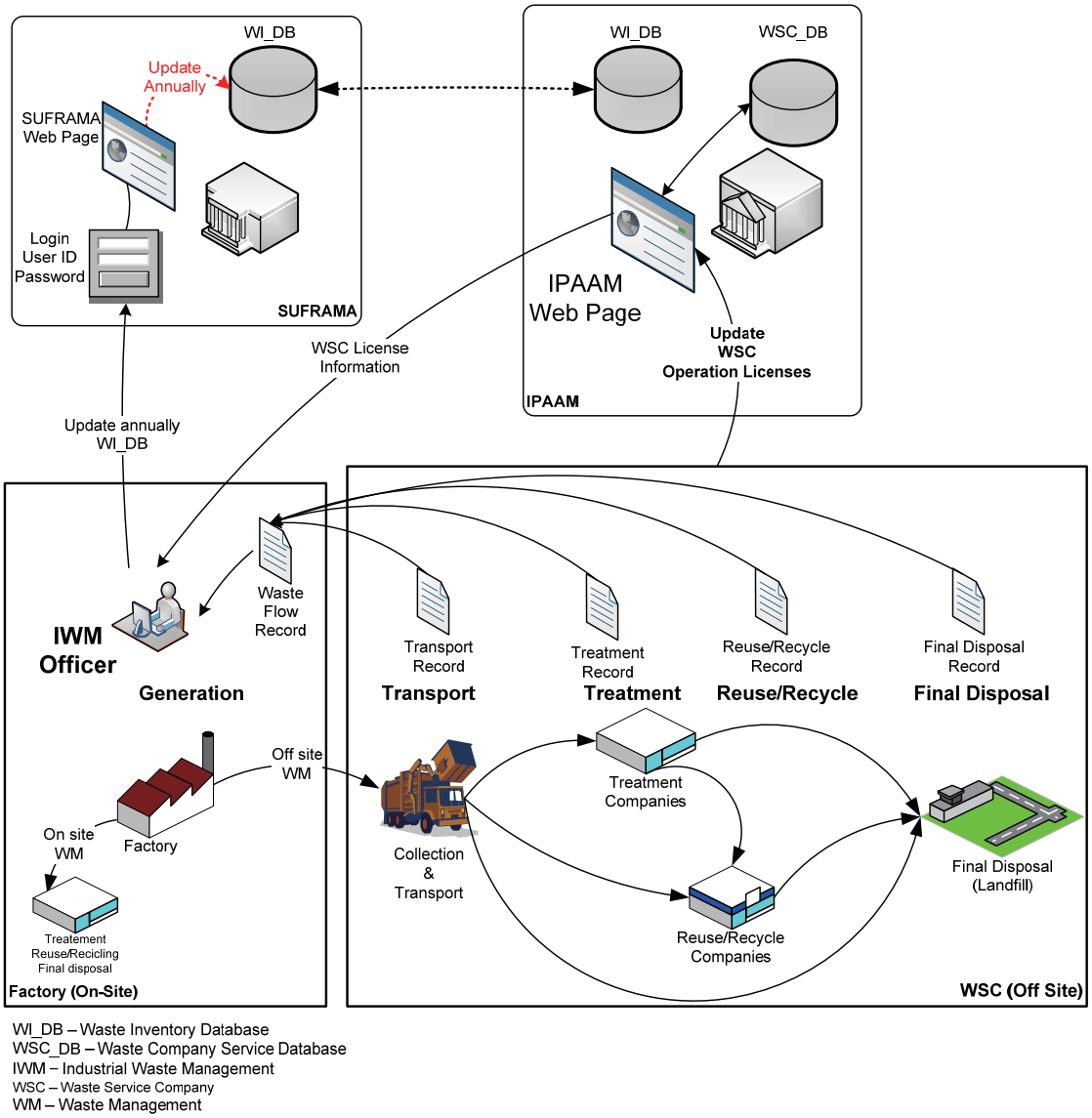


Figure 5-3: Summary of the Waste Inventory Database

b. Using the Waste Inventory Database (WI_DB) System File

Each factory uses the system file made for the WI_DB system developed in this study to enter accurate data about their waste management situation (i.e. the waste inventory). Then, using these waste inventories, it is possible to know the conditions of each factory's waste management. Accordingly, the IWM officer at each factory will need to receive this system file from IPAAM, along with instruction on how to use it, and make a proper waste inventory.

c. Using the WI_DB User Guide

In order to produce a proper waste inventory using the WI_DB system file, it is necessary to pay close attention to the WI_DB User Guide. The WI_DB User Guide primarily provides instruction on how to enter data into the database. However, it assumes that the user already has a good understanding of the common items introduced earlier in these guidelines. Accordingly, with an understanding of the common items mentioned above, the officer will use the WI_DB User Guide and the WI_DB system file to enter the necessary data. In doing

so, the officer can direct any technical questions about entry methods toward IPAAM, the owner of the WI_DB, or the appropriate officer at SUFRAMA.

d. **Using the WI**

By using the WI_DB system file to produce a proper waste inventory, a factory IWM officer is able to obtain the invaluable data to carry out industrial waste management.

- As shown in the common items, it is possible to clarify the generation amount for any of the 92 waste codes, or by type (such as non-hazardous general industrial waste, and hazardous general industrial waste), or for any of the three categories, (general industrial waste, health-care waste, construction waste).
- Moreover, if each waste disposal method is properly entered, as shown in the common items, then it is possible to produce each waste stream diagram for any of the 92 waste codes, or by type (such as non-hazardous general industrial waste, and hazardous general industrial waste), or for any of the three categories, (general industrial waste, health-care waste, construction waste).
- Using this waste stream, it is possible to understand how and where each type of waste generated is being disposed. This also serves as reference data concerning disposal costs of each waste, so factories can identify IWM issues at their factories.
- Also, for wastes that are disposed of off-site by WSCs, this makes it possible to identify any potential problems or unreliable companies, the disposal methods and processes, and take necessary measures.

5.3.3 Production of the Waste Manifest (WM)

The waste manifest system differs from the "waste inventory database system" (WI_DB System) and the "waste service company database system" (WSC_DB System) in that it was not developed during the study period. Based on the proposed M/P, IPAAM plans to formulate a waste manifest form and system for Amazonas State. Moreover, they plan to develop an online waste manifest system in the year 2011.

The methods to produce a waste manifest (WM) here, then, is entirely based on what was suggested in the M/P, and it will be necessary to make the appropriate revisions based on the Amazonas State waste manifest formulated by IPAAM.

The waste manifest (WM), as shown in the image below, is produced by the waste generator, and a copy of it is given to the collection/transport company (transporter) that hauls away the waste from the factory. The WM is made separately for according to each waste code when the waste is discharged. The transporter will fill in the necessary sections of the WM copy, and then give a copy (copy 3) to the treatment or disposal company. Likewise, the receptor of the waste will again fill in the necessary sections of the WM copy, and pass a copy on to the place of final destination. The company in charge of final destination, such as a landfill, will fill in any necessary items and then give a copy back to the generator, i.e. the original factory. Once this final copy is received by the factory, as the waste generator, they have a complete and accurate picture of the off-site disposal process. As a result, with the final copy from the waste receptor, the generator/factory will then have all of the essential information about waste disposal to produce a waste stream diagram.

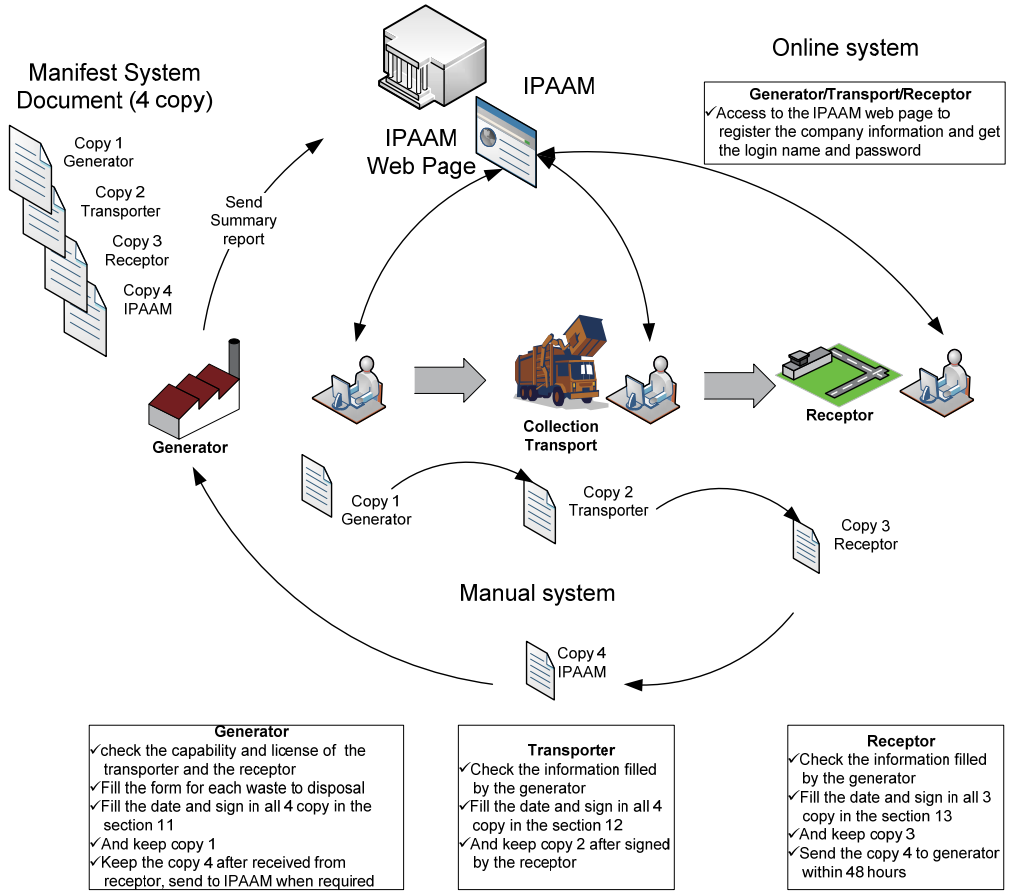


Figure 5-4: The Proposed Waste Manifest System

5.3.4 Entrusting Collection and Treatment/Disposal to a Licensed (OL) Waste Service Company

The generator must take responsibility for any inappropriate disposal of discharged industrial wastes. There are cases where the cost to rectify the environmental damage due to inappropriate disposal is extremely high. In order for the generator to avoid that risk, they must entrust off-site waste disposal to a waste service company that possesses the appropriate operation license (OL).

There are many kinds of waste service companies, and many kinds of industrial waste disposal, as mentioned in these guidelines, Section 5.2.3 Industrial Waste Disposal. Therefore, in order to select an appropriate waste service company, waste generators must have information concerning those that have an operation license (OL). The WSC_DB is used to manage this information, and as shown in Figure 5-3: Summary of Waste Inventory Database, IPAAM plans to make information concerning waste service companies available on a related part of their website[1]. Generators will have to make sufficient use of the website and select the appropriate waste service company for collection/transport and treatment/disposal.

[1] As of August 2010, the environmental licensing system for waste service companies as suggested in the M/P has not been established, and this part of the website does not yet exist. These guidelines were written assuming that this system will be put into place and waste service companies will apply and be approved for the new operation license.

5.3.5 Methods to Promote Industrial Waste Management Improvement and 3R at Factories

The promotion of appropriate disposal of industrial waste and 3R was emphasized in the Substitute of Draft Bill No. 203 National Policy on Solid Waste, which was approved by the National Congress in March 2010. The need for such measures has become obvious in the current age, and from a global perspective, the demand for appropriate disposal and 3R are increasing particularly for factories located in the Amazon region, where attention is focused on environmental conservation.

Based on this situation, the IWM officer at each factory must play a central role in formulating a plan for industrial waste improvements that promote appropriate disposal and 3R. It is recommended that the industrial waste improvement plan be formulated using the WI to maximum effect, as follows:

Step 1. Construct a Factory WI_DB

Using the WI_DB system file to make the factory WI, each factory constructs a WI_DB.

Step 2. Know the Conditions of Factory Industrial Waste Management

Using the WI_DB constructed in Step 1, make a waste stream diagram showing the generation amount and discharge amount for each type of industrial waste generated at the factory in accordance with how it is being managed, separately for On-site Management and Off-site Management.

Step 3. Analyze Conditions of Factory Industrial Waste Management

Analyze the waste disposal flow for On-site Management and Off-site Management made in Step 2, and identify issues concerning industrial waste management for each. It is necessary to utilize data that is not in the WI_DB, such as disposal costs for each type of industrial waste, when analyzing the conditions.

Step 4. Formulate an Industrial Waste Improvement Plan

Gather together the concerned stakeholders to discuss possible solutions to the issues identified in both On-site and Off-site Management which were identified in Step 3. Based on that, formulate a factory industrial waste improvement plan.

5.4 Industrial Waste Management Improvement Guidelines for Waste Service Companies (WSC/Receptor)

5.4.1 Industrial Waste Management related Responsibilities of Industrial Waste Service Companies

a. Industrial Waste Management related Responsibilities of Industrial Waste Service Companies

Although responsibility for appropriate disposal of industrial wastes discharged from factories lies with the generator of the waste, waste service companies (WSC) are directly responsible to rectify environmental pollution caused by inappropriate disposal. WSCs must be fully aware of this point and establish a management system for wastes they were entrusted to transport or dispose by the generator. In order to establish such a system, WSCs will need to execute the following items.

- Assign an industrial waste management officer
- Make a waste inventory (WI) (if the factory has one or they are required to submit one)
- Make a waste manifest (WM)
- Obtain an operation license (OL)
- Promote industrial waste management improvement and 3R

b. **Assign an Industrial Waste Management Officer**

In order for a WSC to establish a system for the management of industrial wastes, they will need to appoint a technician who will be responsible for that system, the IWM officer. This person will apply for an operation license (OL) granted by IPAAM. Then, based on the acquired OL, the officer is responsible for industrial waste management, and bears the first responsibility of proper management for the industrial wastes they are entrusted with. Thus, IPAAM will issues notices and provide guidance through this IWM officer.

Also, the IWM officer will receive instruction from IPAAM and, according to those provisions, make a waste inventory (WI), if required, and submit it to IPAAM. Moreover, through making the WI, they will become aware of the issues concerning factory industrial waste management. Then, in order to improve those issues, they receive instruction from IPAAM and formulate an industrial waste management plan.

5.4.2 Production and Use of the Waste Inventory (WI)

It is necessary for waste service companies (WSC) to produce a waste inventory (WI) if they are operating on a factory level. In general, WSCs operating intermediate treatment or recycling factories must submit a WI. On the other hand, it is generally accepted that collection/transportation companies that do not own a factory do not need to submit a WI. Therefore, the methods to produce and use the WI are put forth here keeping in mind waste service companies that have a factory.

a. **Summary of Waste Inventory Database**

A summary of the waste inventory database is given in Figure 5-3: Summary of Waste Inventory Database.

Usually, intermediate treatment and recycling companies will generate residues as a result of their operations. Accordingly, WSCs operating intermediate treatment and recycling plants may need to discharge these residues to another company for treatment and disposal, which puts them in the position of waste generator along with other factories. Therefore, similar to other factories (generators), by making use of the two databases, the WI_DB and WSC_DB, they will be able to include highly accurate information concerning off-site disposal of their wastes (i.e. residues).

b. **Using the Waste Inventory Database (WI_DB) System File**

It is possible to understand the conditions of waste management at each respective factory if they properly report their situation (i.e. the WI produced by each factory) using the database system file developed with the WI_DB system in this study. Accordingly, for those WSCs that are operating at the factory level, their industrial waste management officer must receive the system file from IPAAM and, with the necessary instruction, produce an accurate waste inventory.

c. **Using the WI_DB User Guide**

By using the WI_DB system file, a proper waste inventory can be produced. When making the WI, it is necessary to have a sufficient understanding of the common items presented in these guidelines, and fully utilize the WI_DB User Guide.

d. **Using the WI**

The WI is used in a manner similar to that shown above in 5.3 "Industrial Waste Management Improvement Guidelines for the Generator (Factory)", in the section on "Using the WI", but adapted to the particular needs of waste service companies. The important thin in using the WI, is that the waste inventory is made properly.

5.4.3 Production of the Waste Manifest (WM)

As mentioned in "Industrial Waste Management Improvement Guidelines for the Generator (Factory)", the method to produce the waste manifest (WM) is based only on suggestions in the M/P, and will need to be revised according to the WM for Amazonas State formulated by IPAAM.

The waste manifest (WM) is made by the factory, which is the generator of wastes, according to the 92 waste codes when discharging their waste to a WSC, as shown in Figure 5-4: "The Proposed Waste Manifest System". The WSC will receive a copy of the WM from the generator and fill in the required items, and then give a copy of that to the final destination. The final destination will fill out the necessary items and return a copy to the original generator. For those WSCs that are not operating as a final destination (recyclers, etc.), they will need to confirm the final destination of the wastes in order to obtain an operation license (OL).

5.4.4 Obtaining an Operation License (OL)

IPAAM is now planning to make substantial revisions to the current environmental license system for waste service companies (WSC) based on recommendations by the JICA Study Team. The revisions to the environmental license system must be approved by the Amazonas State Congress, so the new environmental license system for WSCs has not yet been established as of this writing (August 2010). Nevertheless, these guidelines were written on the premise that the new environmental license system will be executed as per recommendations by the JICA Study.

The main items in the environmental license system for WSCs to be revised are as follows:

1. Make a clear division between the environmental license for waste service companies and other licenses. To do so, a special license code will be set aside (33** ~ 34**).
2. Divide the license code into two types, for Municipal Waste (where the first two digits begin with 33**) and Industrial Waste (first two digits are 34**).
3. Furthermore, as shown in Table 5-7: Waste Service Company Classification and Code (Draft) the code will be categorized into four types depending on the type of operation: 1. Collection and transportation, 2. intermediate treatment, 3. recycling, 4. final disposal. Moreover, announce categories for operations 2, 3 and 4, which are sub-divided according to the relevant operations shown in Table 2, 3 and 4, respectively.

4. In addition, the wastes to be targeted are: Hazardous; Non-Hazardous & Non-Inert; Non-Hazardous & Inert

Given the above revisions, waste service companies will have to understand the common items in these guidelines and utilize the User Guide to apply for an operation license.

5.4.5 Promotion of Industrial Waste Management Improvement and 3R

As mentioned previously, the promotion of appropriate disposal and 3R for industrial wastes is expected in the current age. Also, the world is focused on the environmental conservation of the Amazon Region. Consequently, waste service companies operating in the Amazon region to collect, treat and dispose industrial wastes are seeing demand gradually increase to promote appropriate disposal and 3R.

Based on this situation, it is necessary for waste service companies, and especially for those in the industrial sector, to formulate industrial waste improvement plans that promote appropriate disposal and 3R for the waste generated at their factories or through the their business operations. It is recommended that when formulating an industrial waste improvement plan, reference is made to "Methods to Promote Industrial Waste Management Improvement and 3R at Factories" as shown in "Industrial Waste Management Improvement Guidelines for the Generator (Factory)".

5.5 Industrial Waste Management Improvement Guidelines for Administration

5.5.1 The Role of Administration in Industrial Waste Management

a. **Improving the Administrative System for Industrial Waste Management and Establishing a System for Appropriate Industrial Waste Management**

In order to "establish an appropriate industrial waste management system", it is essential for administration to fulfill its role, as shown in Table 5-7: Waste Service Company Classification and Code (Draft). Accordingly, it is unlikely that the goal to "establish an appropriate industrial waste management system" would be reached without first improving the administrative system, to which the M/P formulated in the JICA Study gives top priority. In order to realize the goal, an implementation plan was formulated and now being implemented, as shown in the following figure. These guidelines were formulated on the premise that "1. Improving the Administrative System for IWM" has already been implemented.

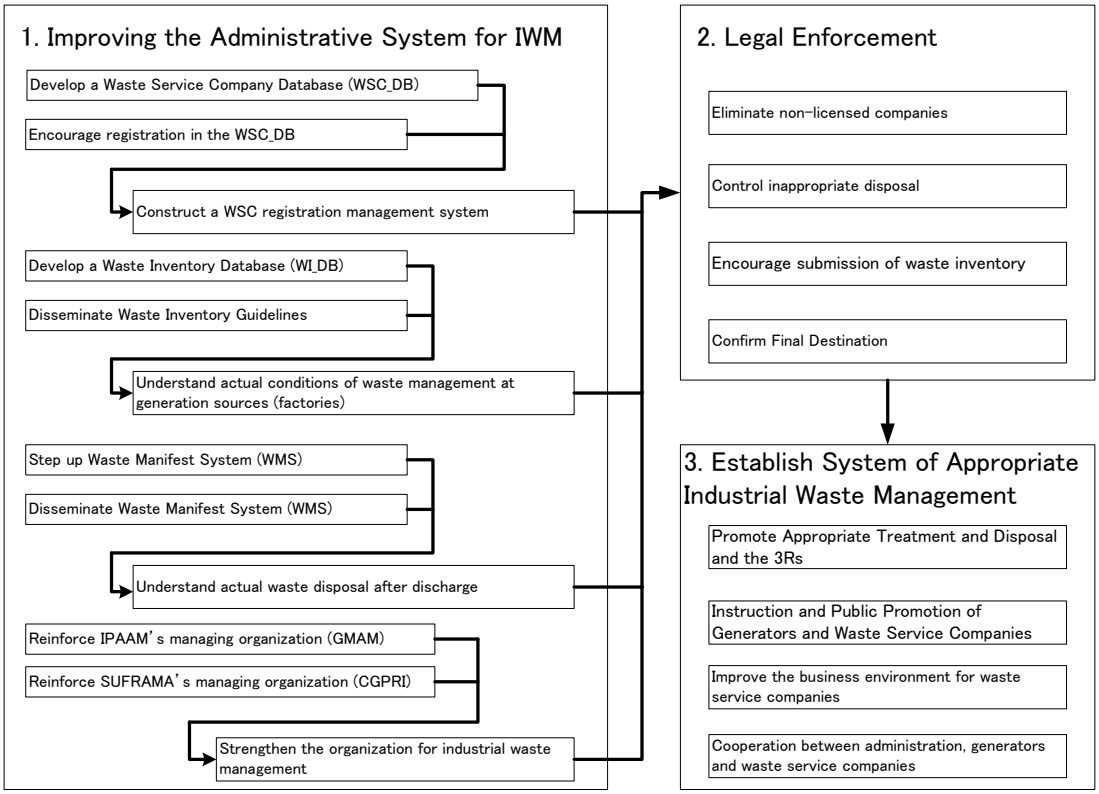


Figure 5-5: Improving the Administrative System of IWM and Establishing a System for Appropriate IWM

b. **The Role of Administration in Industrial Waste Management**

Having implemented the first step, "Improving the Administrative System for IWM", administration will need to carry out the following items.

- Encourage generators and waste service companies to appoint industrial waste management officers
- Use the waste inventory database (WI_DB)
- Use the waste manifest (WM)
- Use the waste service company database (WSC_DB)
- Improve industrial waste management and promote 3R

c. **Encourage Generators and Waste Service Companies to Appoint Industrial Waste Management Officers**

In order to "establish an appropriate industrial waste management system", administrators will need to collaborate closely with generators and industrial waste service companies, as shown in Figure 5-1: Interaction between Administrators, Generators and Receptors to implement industrial waste management. Namely, for administration to enforce the laws and regulations that have been put in place, waste generators and industrial waste service companies need to demonstrate they are carrying out appropriate industrial waste management based on those regulations. To do so, it is not only the enforcement of those regulations, but generators and WSCs must be poised to receive instruction on methods to promote industrial waste management improvement and 3R.

To achieve this, generators and WSCs must appoint a technician as an officer in charge of industrial waste management so that IPAAM can establish a system for appropriate industrial waste management. IPAAM can communicate with that officer to notify and provide guidance about regulation, as well as provide training, education and guidance on improving IWM and promoting 3R. The IWM officer would produce and submit the waste inventory, produce and manage the waste manifest and apply for the operation license (OL) from IPAAM.

5.5.2 Legal Enforcement

As written above, once the administrative system for industrial waste management is improved, it is necessary to strengthen the enforcement of laws and regulations and provide guidance to generators of industrial waste and the waste service companies enlisted to dispose of that waste appropriately. It will be worth demonstrating to business entities the environmental responsibility of the wastes Generator, Transporter and Receptor; and why the integrated information and control system recommended herein facilitate the definition of their responsibilities.

a. **Elimination of Non-Licensed Companies**

Non-licensed companies can mainly be classified into two categories.

1. Those carrying out waste related services without having obtained an environmental license
2. Those which have obtained an environmental license, but are carrying out activities other than those for which they are licensed.

Under the current conditions, in which there is insufficient understanding of how many licensed waste service companies there are, what activities they are licensed for and what activities they are actually engaged in, it is very difficult to eliminate non-licensed companies. It is recommended that, to ameliorate these conditions, IPAAM eliminate Non-Licensed companies (including those conducting activities other than those for which they are licensed), by following the steps below.

1. Immediately make the waste service company registration management system developed in this study a legal requirement and require companies to obtain an operation license for waste services as a condition to engaging in waste related services.
2. Then, instruct those companies currently conducting waste services which have obtained an environmental license[1] to acquire an operation license according to their activities, for collection and transportation, intermediate treatment, recycling or final disposal, respectively. IPAAM will grant a specific license for each activity so that the general licenses are no longer too varied; such criteria may be very useful when renewing the license.
3. When approving the operation licenses, any discrepancy between the activities applied for and actual activities are confirmed. The approved companies should be registered in the waste services companies data base (WSC_DB) developed in this study, according to the guidelines of the WSC_DB, and the information registered about the WSC should be made public.

[1] 67 such companies were identified in the survey of waste service companies.

4. By publicizing information about these WSCs, waste generators will have access to the basic information they'll need, such as which companies have a license and what activities they are licensed to conduct. In addition, IPAAM shall remind the waste generators that the main responsibility of proper IWM lies with them, whereas the transporter/receptor has only joint responsibility. Also the generator, as well as the environmental authority, must audit IW disposal activities of the transporter/receptor.

5. Providing waste generators with information about sound operators they can hire will push out both non-licensed companies and those conducting non-licensed activities. At the same time, non-licensed companies conducting waste services without an environmental license[1] will be instructed to acquire the appropriate license.

The data on waste service companies entered in March 2010 into the WSC_DB, developed in the JICA study, is that of the 67 companies which were confirmed in the survey of waste service companies to have operational licenses. In addition, the data entered concerning the activities of those 67 companies are not the activities they are licensed for, but the actual activities they are undertaking. Accordingly, once IPAAM establishes its license/registration system, it will be necessary to promptly instruct those companies to obtain licenses in compliance with their actual activities.

The above-mentioned procedure is summarized in the following figure.

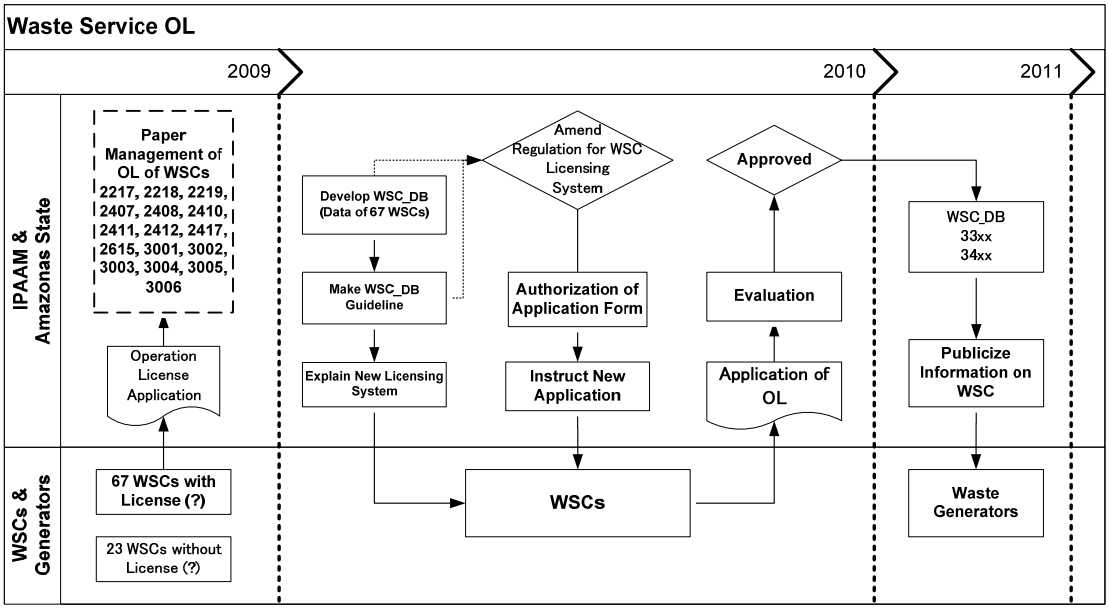


Figure 5-6: Proposed Schedule of Establishment of WSC_DB

b. Controlling Inappropriate Disposal

By eliminating non-licensed companies and non-licensed activities through the above procedures, it is possible to focus on monitoring the activities of companies that have acquired licenses for collection and transportation, intermediate treatment, recycling and final disposal, respectively. Accordingly, IPAAM will be able to check whether companies that have obtained operation licenses are conducting business according to the appropriate standards and carry out regular monitoring activities to control improper treatment and

[1] 23 such companies were identified in the survey of waste service companies.

disposal. Nevertheless, IPAAM should retain surveillance over any kind of landfill in order to avoid the dumping of improper wastes and make sure the corresponding manifest is being used.

It is equally important to monitor the companies which co-process industrial wastes into usable construction-related products, in bulk or not. This will assist in preventing those companies from utilizing wastes or processes different from those for which they are licensed, and ensure the correct use of the manifests.

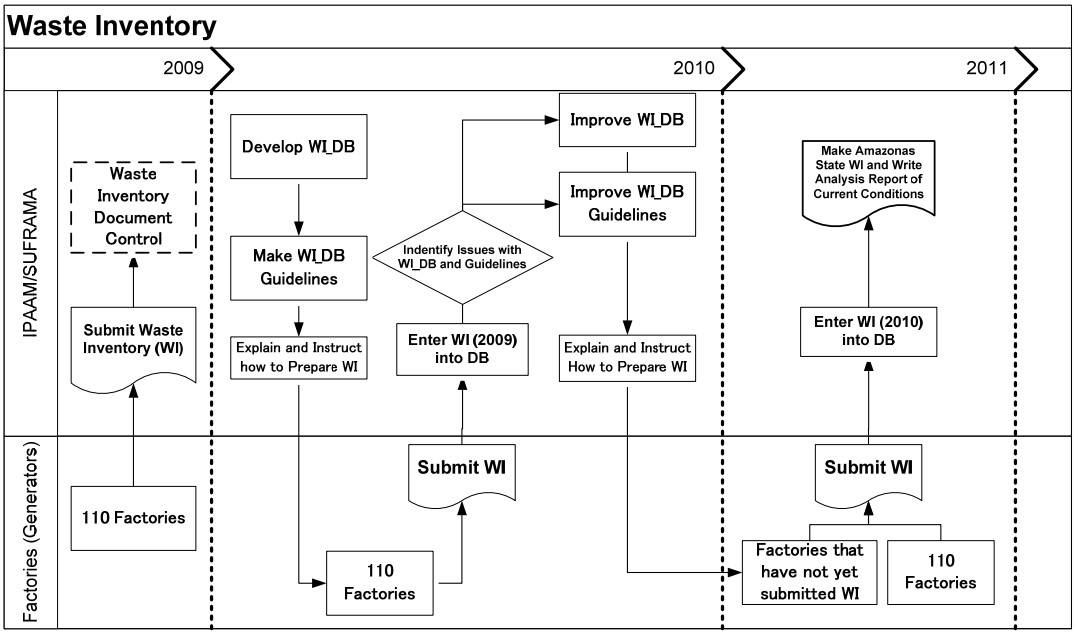
c. **Encourage Submission of Waste Inventory**

In accordance with CONAMA Resolution 313, in the State of Amazonas, all PIM factories are required to submit a waste inventory. However, only about 1/4 of the factories have complied with submitting their waste inventory. Meanwhile, IPAAM and SUFRAMA have made little progress in analyzing the waste inventories which have been submitted. Therefore, they have not yet submitted a report on waste inventories to the Brazilian Institute for the environment and Renewable Natural Resources (IBAMA)[1]. Based on these conditions, it is recommended that IPAAM and SUFRAMA follow the steps given below to encourage factories to submit the waste inventories.

1. In order to encourage the submission of waste inventories, the first step is to put a system in place to aggregate and analyze them in order to gauge the current conditions of industrial waste management and formulate an improvement plan, as required by CONAMA Resolution 313.
2. To do so, guidelines were written to instruct how data will be entered in a uniform fashion into a waste inventory database (WI_DB), developed in this study.
3. In order to analyze the aggregated data from the waste inventories entered into the WI_DB to understand current conditions on industrial waste management in PIM, it is essential to standardize the data entry methods. To do so, it is presumed that the person at each factory in charge of writing the waste inventory will collaborate in producing the inventory and have a good understanding of how to fill out the forms. Therefore, a certain amount of time will be necessary until the uniform data input is achieved for all PIM factories.
4. A number of improvements will need to be made to the WI_DB and related guidelines developed in this study in order to sufficiently comply with the requirements of CONAMA Resolution 313. IPAAM/SUFRAMA will first focus on the factories that submitted waste inventories in 2009[2], provide them with guidance concerning how to write the inventory for the WI_DB format, and then analyze the inventories that are submitted. This process will clarify any issues related to factories properly making the WI so that the WI_DB and guidelines can be improved. In other words, this will improve the WI_DB and guidelines developed in this study for data on actual conditions at PIM factories.
5. After the improvement of them, public information and guidance will be provided for all PIM factories so that the waste inventories will be submitted.

[1] CONAMA Resolution 313, Article 6 obligates the environmental agency in each state to submit the report.
[2] In 2008 110 factories have submitted.

6. SUFRAMA should require companies, in the requirements to receive tax benefits, to link to the respective DB and the manifests system, as well as to submit a Wastes Management Plan.



WI (Waste Inventory), **WI_DB** (Waste Inventory Database)

Figure 5-7: Promote Submission of Waste Inventories

d. Confirm Final Destination

In order to "establish a system for appropriate industrial waste management", it is necessary to construct a tracking system that ensures wastes are properly treated and disposed of after being discharged from the generation source until they reach their final destination. To do so, IPAAM requires a waste manifest be submitted when granting environmental (operation) licenses. However, no specific format or system has been designated so tracking efforts have not been established satisfactorily. In order to confirm proper treatment and disposal until final destination, it is recommended that IPAAM uses the following measures.

1. Immediately establish and normalize waste manifest documents and a system for the State of Amazonas.
2. Until the documents and system are established and normalized, in order to clarify responsibility of the factories which discharge wastes, and for their own legal protection, instruct them to demand that the collector submit the waste destination certificate together with the respective units of measurement (in weight).
3. Once the documents and system are ready, instruct all related parties, from the generator to final destination, to submit the waste manifest documents.

The Wastes Manifest System (WMS) should include both public and private entities which generate or receive wastes, with the exception of municipal wastes.

5.5.3 Using the Waste Inventory Database (WI_DB)

As shown in the following image, the WI_DB system will clarify the waste management conditions at each factory (see a.1, below). This is made possible if each factory correctly fills out files on the system (if the factories complete the waste inventory). Then, based on what is known about these conditions, it is possible for each factory to formulate a management plan for industrial waste (see b.1).

Next, the factories will use the system files to prepare their WI, and if the individual results are compiled for the industrial park, it is possible to know the waste management conditions for it (see a.2). Then, based on what is known about the waste management conditions of the industrial park, it is possible to each industrial park to formulate their own industrial waste management plan (see b.2).

If the same is done in each State, it is even possible to clarify the waste management conditions for the country (see a.3, a.4), and formulate an industrial waste management plan .

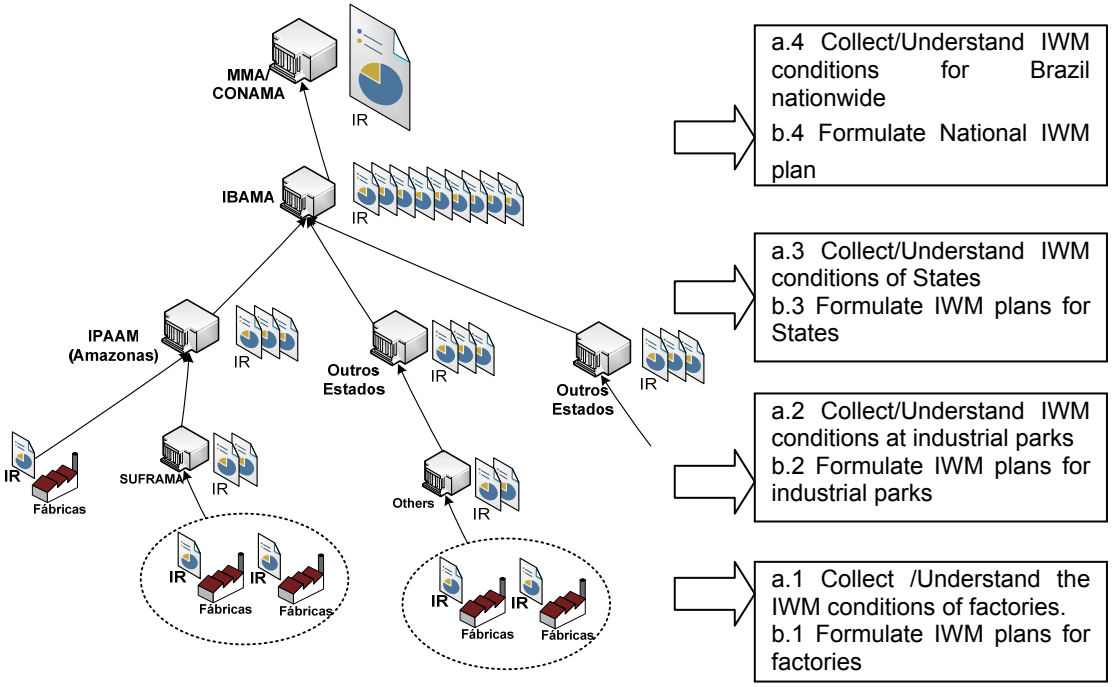


Figure 5-8: Using the WI_DB system and its relationship to understanding waste management at the factory, industrial park, state and national levels

IPAAM uses the waste inventory database (WI_DB) and produces the following reports, which are then submitted to IBAMA, the Brazilian Institute for the Environment and Renewable Natural Resources. Also, based on these reports, and cooperating with generators and waste service companies, it is necessary for IPAAM to drive toward establishing a system for the appropriate management of industrial wastes in Amazonas State.

- Amazonas State Industrial Waste Management Status Report
- Amazonas State Industrial Waste Management Improvement Plan

Furthermore, SUFRAMA would be able to cooperate with IPAAM, as necessary, utilizing the WI_DB, to produce an Industrial Waste Management Status Report and formulate an Industrial Waste Management Improvement Plan for PIM.

5.5.4 Using the Waste Manifest (WM) and Waste Service Company Database (WSC_DB)

a. **Using the Waste Manifest (WM)**

The waste manifest is a system for each factory to submit their summary report to IPAAM, as shown in Figure 5-4: The Proposed Waste Manifest System. Also, when waste service companies obtain their operation license (OL), they will submit a report of the waste manifest, including the Final Destination, to IPAAM.

IPAAM will analyze the waste inventory database (WI_DB) and use those results, as well as the above-mentioned waste manifest summary reports as reference to clarify the status of industrial waste management in Amazonas State and uncover any issues that may exist.

b. **Using the Waste Service Company Database (WSC_DB)**

As written in Section 5.5.2 "Legal Enforcement", in order to eliminate non-licensed companies and control improper disposal, IPAAM must make effective use of the waste service company database (WSC_DB). Of particular importance is that the clients of waste service companies in the industrial sector—the waste generators—are provided the most up-to-date and accurate information as possible.

5.5.5 Improving Industrial Waste Management and Promoting 3R

In March 2010, the National Congress approved the Substitute of Draft Bill No. 203, National Policy on Solid Waste, which stresses appropriate treatment and disposal, and the 3Rs. Regardless of on- or off-site disposal, strengthening regulation is the most effective means to promote proper treatment and disposal, and the 3Rs.

Namely, if the administrative side (IPAAM) develops a management system and strengthens control of appropriate treatment and disposal, the off-site disposal fee will be raised. By raising the off-site disposal fee, it will not be possible for generation sources (i.e. factories) to commission 95% or more of the waste generated, as it is now. The result is that PIM factories, like those in Japan, will promote on-site 3R and reduce the amount disposed of off-site.

Also, in response to regulations and putting various environmental measures in place, disposal costs will rise even for off-site treatment and disposal. With that, waste service companies will want to reduce the disposal costs by reducing the amount of residues after treatment or by actively reusing or recycling residues. In states with more advanced destination practices, such as Rio de Janeiro, co-processing is widely used, mainly by cement factories which do not generate any waste after processing.

In order to encourage co-processing at cement factories, in addition to introducing a disposal fee, waste blending techniques that do not affect product or cement quality will need to be introduced. With that, to encourage even better treatment and disposal techniques and 3R measures, IPAAM should be encouraged to not only strengthen regulation, but to actively provide information to both waste generators and WSCs about appropriate treatment and disposal and the 3Rs, and offer training and guidance where needed. Furthermore, ideally, IPAAM would hold a training seminar for both waste generators and WSCs with the cooperation of stakeholders from states and countries with more advanced practices.

Finally, IPAAM should instruct the companies to elaborate their Wastes Management Plan, the basic instrument used to devise rational and economic handling and destination, including the procedures to minimize the wastes and costs they bear.

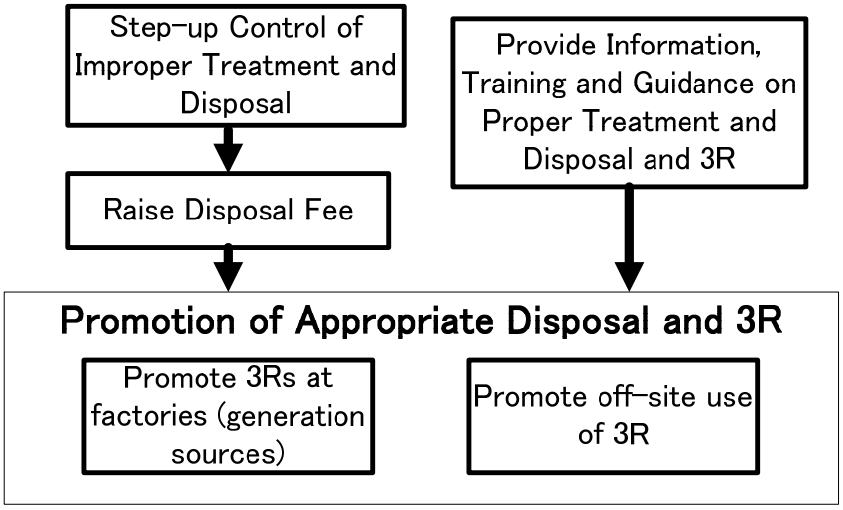


Figure 5-9: Promotion of Appropriate Disposal and 3R

5.6 Good Examples of IWM

5.6.1 Good Examples of Industrial Waste Management at Generation Sources (Factories)

Since the 1990s, many factories in Japan have been aiming for "Zero Emission" from their factories due to the following reasons:

- Since the off-site disposal cost is extremely expensive--especially the landfill disposal fee--they shall reduce, reuse and recycle waste in the factory as much as possible to reduce the cost of IWM.
- The Japanese Government set up a waste management policy, "Recycling-based Society ", through the Basic Law for Establishing the Recycling-based Society (enacted in 2000); and
- Recently, consumers tend to support companies they consider to be environmentally friendly.

"Zero Emission" is the concept that there is "zero" waste going to the landfill from a factory. The Manaus municipal landfill takes waste at no charge so it is unlikely that most PIM factories would enact waste management in the way that Japanese factories have. Nevertheless, if the Manaus landfill becomes fee-based as proposed in the Master Plan and things proceed similar to other Brazilian States, it should be possible for factories in PIM to work toward a similar situation as Japanese factories in the near future. As such, five counterpart personnel received training in Japan from the end of January to early February 2010, receiving training on efforts at the following two places.

- Kokubo Industrial Estate
- Honda Suzuka Factory

a. **Kokubo Industrial Estate**

The Kokubo Industrial Estate is a 958,400 square meter area established in 1975 which now has 28 factories (as of April 2009), and 5,041 employees. The total production value in 2008 was 363.7 billion yen. Kokubo Industrial Estate is located inland, away from the ocean, in Yamanashi Prefecture, and a problem with the landfill was revealed in early 1990. As a result, all 28 companies began working together so that the industrial estate generated zero landfill waste.

A diagram of their activities to do so is shown below:

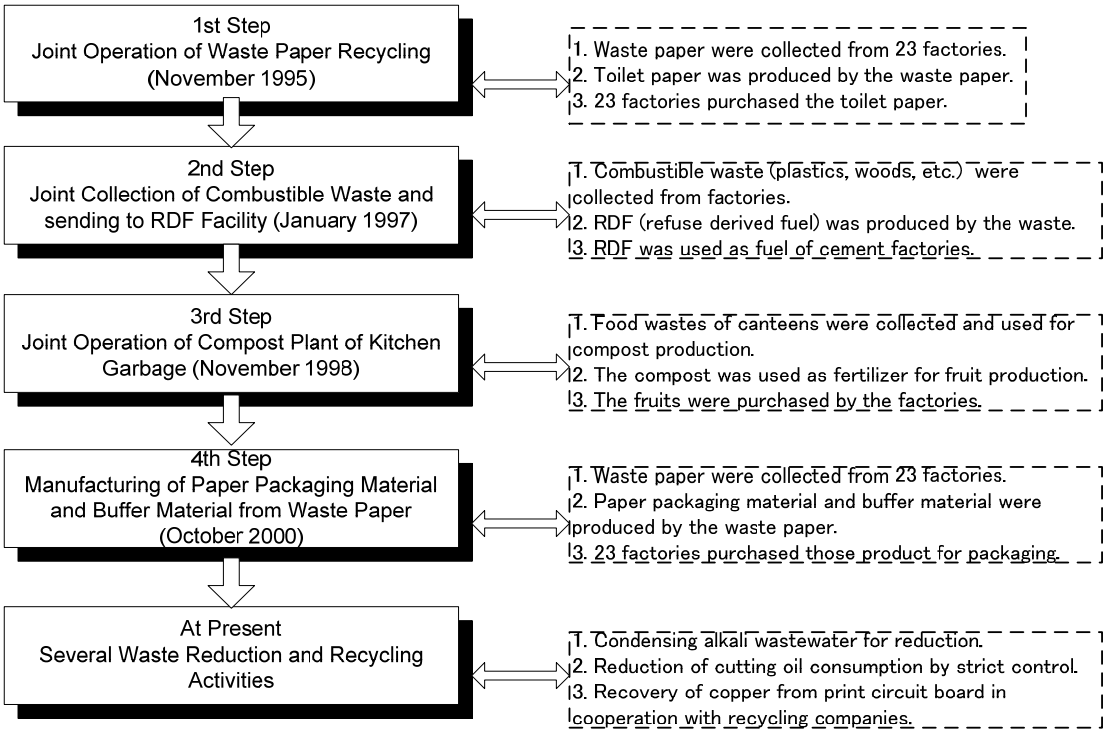


Figure 5-10: Kokubo Industrial Estate efforts for Zero Emission

b. **Honda Suzuka Factory**

Honda Suzuka Factory is one of the factories that achieved Zero-emission. Zero-emission is one of targets of the "Green Factory Plan" presented in the following figure. A Zero-emission team was created in the "Green Factory Project" in 1997. Zero-emission is defined as "No IWM for final disposal shall be discharged outside the factory". In 1999, Honda Suzuka Factory became the first zero-emission automobile manufacturing company in Japan.

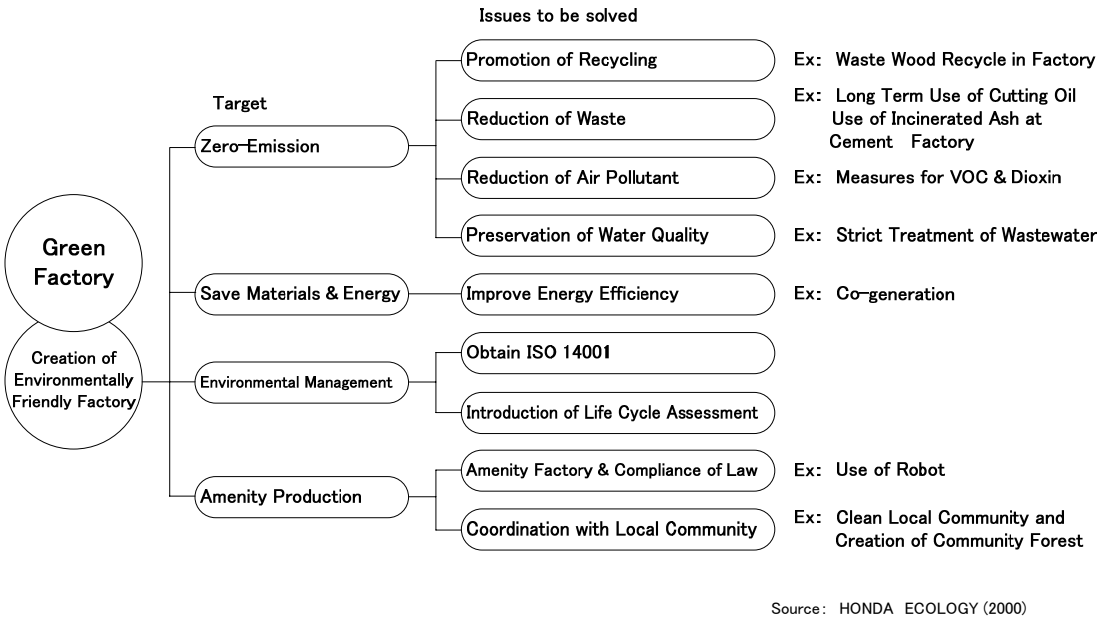


Figure 5-11: Green Factory Project of Honda Suzuka Factory

5.6.2 Good Example of Off-site IWM

a. Good Example of IW Administration in Japan: Waste Service Company Rating System and Environmental Fund in Iwate Prefecture

a.1 Introduction

Industrial waste administration in Japan is legally entrusted to prefectural and dedicated (large population) city governments by the central government according to a nationwide essentially uniform standard so that some regions are engaging in effort to promote appropriate industrial waste administration.

a.2 Background

Iwate Prefecture is located in Japan's northeast, with an area of approximately 15 thousand square kilometers and a population of around 1.4 million.

It is a picturesque prefecture largely dominated by primary industries such as agriculture, but in recent years had been wrestling to get to the bottom of a large-scale illegal dumping case near the border with Aomori Prefecture to the north, to prosecute those responsible and return conditions to normal.

In 1991, two WSCs of Iwate Prefecture, which has operation licenses for intermediate treatment (composting industrial wastes) but not licensed for landfill operations, had began illegal dumping of industrial wastes, including hazardous wastes. Those industrial wastes were mainly brought from the Tokyo metropolitan area. In 1999 the WSCs were prosecuted for illegally dumping of 920,000 m3 of industrial wastes (IW). The WSCs went bankrupt and the Prefectural Government was left responsible for the clean-up costs in 2000. Iwate Prefectural Government found generators which entrusted their IW to those companies by 2010. In March 2010, 28 generators agreed to pay the clean-up costs.

This incident led to the introduction of a waste service company (WSC) rating system & environmental fund system in Iwate Prefecture.

a.3 System Summary

As detailed below, a WSC rating system and an environmental fund system were established based on Iwate Prefecture's "Ordinances for a Recycling-based Society".

a.3.1. Rating System

The prefecture announced a system to approve waste disposal contractors (and rate them) according to a prescribed and fixed standard. Waste Service Companies (WSCs) that are approved (and rated) can expect more social trust, and generators of waste have meaningful information to select preferred WSCs. Those companies are rated into one of 3 levels that is valid for 2 years.

a.3.2. The Fund

WSCs prepare a fund to be set aside for unforeseen incidents, which would be returned if it is necessary to deal with urgent incidents. Each company contributes 1 million yen, or 500 thousand yen for members of the Iwate Prefecture Industrial Waste Consortium, which operates the fund. Thanks to this fund, WSCs are able to appeal to waste generators with more reliable disposal qualification.

a.3.3. Public Announcement

The ratings and fund contributors are publicly announced on a website and in local newspapers.

Number of Companies (F.Y. 2008)

Rated WSCs:	54
Fund Contributors:	81

a.4 Results

Waste generators are able to select preferred WSCs, fostering preferred operators and eliminating malicious ones.

WSCs raise their awareness through participating in the system and improve self management and regulation.

a.5 Application to Improve Industrial Waste Management in Manaus

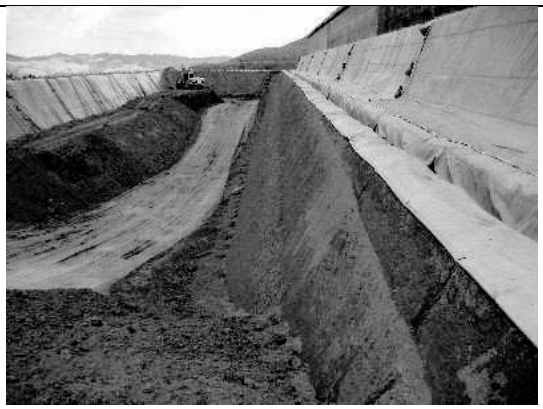
Fostering healthy WSCs is a key issue and lies at the heart of this guideline. Introduction of this system would further clarify and foster preferred operators, and the introduction of an environmental fund will enable reliable and assured service to waste generators

b. Sao Jose Dos Campos Landfill of Sao Paulo State

b.1 Outline of the Landfill

The Sao Jose Dos Campos Landfill is the first HW landfill in Brazil, established in 1985. It is also the first landfill in Brazil to have received ISO 14000. Now its area has been expanded up to 756,000 m^2. The HW landfill has been developed step-by-step and its operation area is limited. Each landfill is 120m (Length) x 30m (Width) x 8m (Height) with a roof. Each site must receive an operation license.

Current HW Landfill



New HW Landfill under Construction

b.2 Good Example

In 2007, Sao Jose Dos Campos City refused to accept hazardous wastes as well as non-hazardous industrial wastes. The factories requested that non-hazardous industrial waste be accepted at a private hazardous waste landfill, Sao Jose Dos Campos Landfill. Then, from 2007, the HW landfill began operations to dispose the Class II-A waste (Non-HW) of factories. Accordingly, the municipal regulation has provided a new business opportunity for the private entity, and has contributed to the city to avoid mixed disposal of low-risk municipal waste with non-hazardous industrial waste that was at high risk of being mixed with hazardous waste.

Current Non-HIW Landfill

Previous Non-HIW Landfill

c. A Blender for a Cement Factory in Curitiba State

c.1 Outline of the Blender

Processa Tecnologia Ambiental Ltda is a blender for the cement factory, Rio Blanco Factory of Votorantim in Curitiba. The Processa Tecnologia Ambiental Ltda had a license for blending waste in 2003 from SEMA (State Environmental Agency of Parana). It is operation a blending factory of area 16,800 m^2 in the suburb of Curitiba City. The factory receives the Class I waste (hazardous waste) except PCB, etc. The blending factory locates 38km from the Rio Blanco Cement Factory. The Rio Blanco Cement Factory produces 10,000ton/day of clinker and 15,000 ton/day of cement. There are 5 to 7 blenders for the cement factory and 3 are in the compound of the cement factory. The cement factory receives 200 ton/day of the

Class I waste in total and 1/4 of it, i.e. 50 ton/day, is brought from the Blender. The Blender charges the following price for the treatment of the Class I waste, i.e. blending wastes:

- Sludge: 350 R$/ton without transportation. Then 90 – 100 R$/ton to be paid for the cement factory
- Solid wastes to be shredded: 700 R$/ton without transportation. Then 90 – 100 R$/ton to be paid for the cement factory

Shredding IW

Screening IW

c.2 Good Example

Co-processing of IW at a cement plant including hazardous waste is an ideal treatment method of IW treatment because it will not generate residues after processing. And it is very common in industrialized countries including Japan. However, although there is a bid cement plant in PIM, co-processing of IW at the cement plant is very limited in Manaus due to none existence of blenders and their market. The blender for a cement factory in Curitiba State provides a good example for the promotion of co-processing at a cement plant.

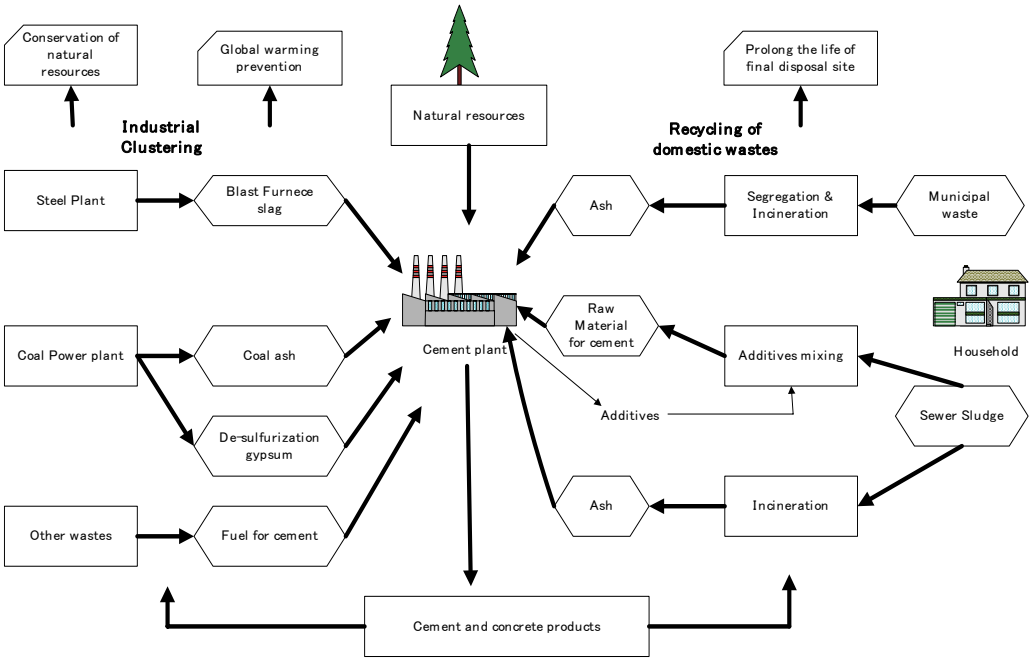


Figure 5-12: Promotion of Co-processing at a Cement Plant

5.7 WI_DB System User Guide

THE STUDY FOR
THE DEVELOPMENT OF
AN INTEGRATED SOLUTION RELATED TO
INDUSTRIAL WASTE MANAGEMENT
IN THE INDUSTRIAL POLE OF MANAUS

Waste Inventory Database
System

User Guide

Contents

1 Purpose

Registered factories currently make waste inventories based on CONAMA Resolution 313 and submit these to IPAAM. Once these are processed and analyzed, it is possible to gauge the current conditions of industrial waste management and then formulate plans to resolve any issues.

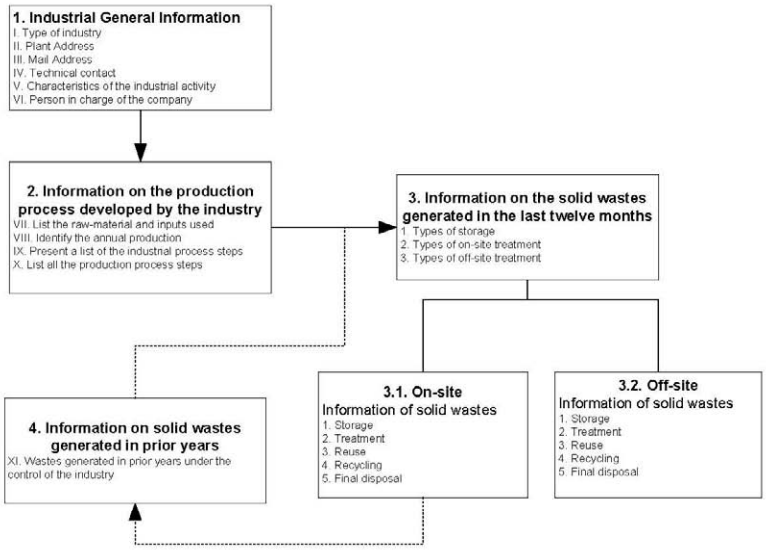
However, there are differences in how waste inventories are filled out by the factories. Therefore, IPAAM and SUFRAMA need a great deal of time to process the data, so the inventory hardcopies are filed and kept. Although a system for the waste inventories was introduced in 2002, IPAAM have been not able to report the current conditions of IWM in PIM to IBAMA and the factories which submit the waste inventories.

To resolve this problem, IPAAM and SUFRAMA have decided to unify how factories fill out the waste inventory and create a waste inventory database (hereafter, WI_DB) for those which are reported. This WI_DB will be used to establish a sound management system for all industrial waste.

2 CONAMA Resolution 313

Forms and information required by CONAMA to present the waste inventory report

2.1 Scheme of the information required by CONAMA resolution



2.2 Form to be submited (Industrial waste inventory- CONAMA)

I. Factory General Information:

	Reference Period			
	Intial date:		Final date:	

II. Plant address:

Street Nº:			
Suburd/District:		ZIP:	
Municipality:		Telephone:	
CGC/TE:		CNPJ:	

III. Mail address:

Street Nº:			
Suburd/District:		ZIP:	
Municipality:		Telephone:	

IV. Technical Contact:

Name:		Job title:	
E-mail:			
Telephone:		Fax:	

V. Características da atividade industrial:

1. Main industrial activity:				Código CNAE:	
2. Production time					
Hour/Day:		Day/Month:		Month/Year:	
3. Total number of employees					
Production:		Administration:		Others areas:	
4. Facilities (m^2):					
5. Geographic coordinates of the industrial facilities:					
Latitude	Degree:		Minute:	Second:	
Longitude	Degree:		Minute:	Second:	

VI. Responsible of the Factory:

Name:		Job title:	
I declare, under the feathers of the Law, the truthfulness of the information rendered in the present form			
date / /			
Signature:			

Information on the production process developed by the industry

VII. List of the raw material and inputs used

Raw material and inputs	Actual quantity (year)	Maximum capacity (year)	Unit

VIII. Identify the annual production

Products	Actual quantity (year)	Maximum capacity (year)	Unit

3

IX. Present a list of the industrial process steps

Production process steps of the industry

X. Relate all the steps of the production process

Steps Name	Description
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	
11.	
12.	
13.	

Information on the solid wastes generated in the last twelve months

1. Waste code:			Description:		
Type of storage					
Code:	Description:		Type of storage:	In the Industry?	
Quantity (ton/year)?			Physical state:		
Geographic coordinates of the site					
Latitude	Degree:		Minute:	Second:	
Longitude	Degree:		Minute:	Second:	

Information on the solid wastes generated – in the Industry

1. Treatment, Reuse, Recicling and final disposal in the industry		
Code	Description	Quantity (ton/year)
2. Treatment, Reuse, Recicling and final disposal in the industry		
Quantity (ton/year)	Quantity (ton/year)	Quantity (ton/year)
3. Treatment, Reuse, Recicling and final disposal in the industry		
Quantity (ton/year)	Quantity (ton/year)	Quantity (ton/year)

Information on the solid wastes generated – outside the Industry

1. Treatment, Reuse, Recicling and final disposal in the industry outside of the industry

Code of the destiny:			Description of the destiny			
Company/Name of the destiny 1:	CGC/TE		CNPJ		Enviromental license Nº:	
Address of the destiny 1						
Street/nº:		Municipality			ZIP:	
E-mail		Telephone			Fax	
Quantity(ton/year)?		Phisical state:				
Latitude	Degree:		Minute:		Second:	
Longitude	Degree:		Minute:		Second:	

XI. Information on solid wastes generated in prior years

Wastes generated in prior years under the control of the industry

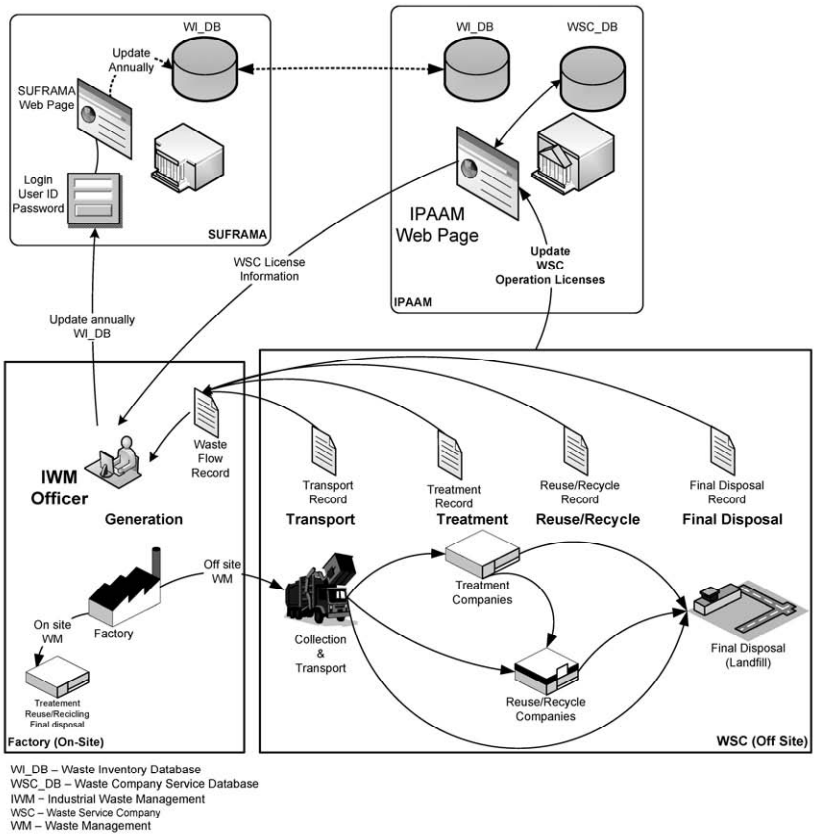
1. Waste code:	Description of the waste				
Type of storage:					
Storage description:				In the industry?	
Quantity (ton/year)?		Phisical state:			
Posição geográfica do local					
Latitude	Degree:		Minute:	Second:	
Longitude	Degree:		Minute:	Second:	

3 Waste Inventory Database (WI_DB)

3.1 General scheme of WI_DB

As shown in the next figure, the WI_DB will operate within next steps:

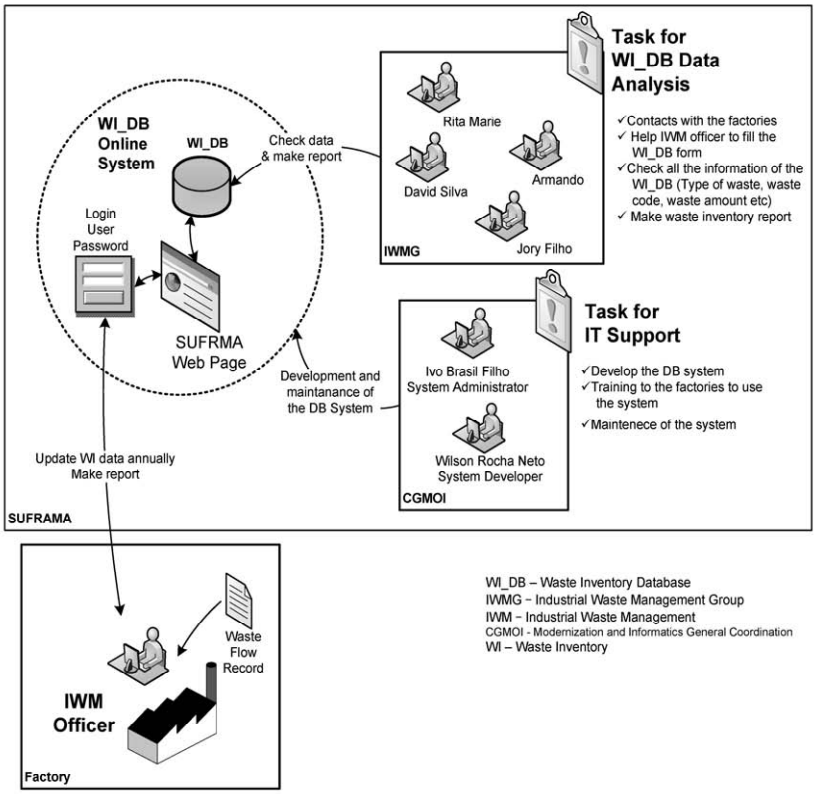
- The factory IWM officer will record all the information about the waste generation and their management (on site and off site transport, treatment, recycling and final disposal). Also from IPAAM web page check the licensed Waste Service Company (WSC).
- Annually the Factory IWM officer, will update the waste inventory in the SUFRAMA online WI_DB
- SUFRAMA waste management group will chek the WI_DB information and make waste inventory report and summit to the IPAAM



3.2 General Scheme for implementation of the WI_DB

As shown in the next figure to implement a WI_DB, SUFRAMA establish a group of human resources (IWMG) and support of the IT department (CGMOI). The CGMOI department will develop and maintain the online system to manage de WI_DB and IWMG will manage all the information on the database.

- The IWMG will help and support to all IWM officer of the factories to fill in the waste inventory information in a uniform WI_DB system
- The IWM officer of the factories will record all the information of generated waste within a year and update the waste inventory information annually using the online system



3.3 Information needed for update waste inventory

a. General information of the factory

b. List of input raw material

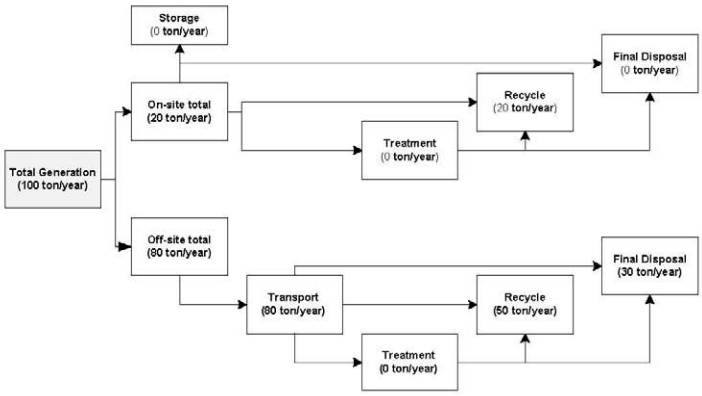
c. List of the product amount and production process

d. Information of the generate waste

- Select waste code for each waste from CONAMA waste category or JICA waste category
- Record the information of each generated waste amount and if they are manage on site or off site
  - On-site (information about storage, treatement, recycle and final disposal)
  - Off-site (information about storage, treatement, recycle and final disposal)
- To obtain the waste stream as shown in the figure will be necessary record the next WSC informations
  - Tranport: General information of the transport company, waste amount

transported for each company

- Treatmen: General information of the treatmen company, waste amount and type of treatment made by each company
- Recycling: General information of the recycling company, waste amount and type of recycle made by each company
- Final disposal: General information of the final disposal company, waste amount and type final disposal



3.4 How to fill the WI Report form

3.4.1 F1. Factory General Information

Field	Data	Remark
Company Registration Number:		
Suframa Registration N.		
Company Name		
Mail address:		
Street/n.:		
Suburb/District:		
Municipality:		
ZIP:		
Telephone:		
Technical contact:		
Name:		
Job-Title:		
E-mail:		
Telephone:		
Fax:		
Characteristics of the industrial activity:		
Main industrial activity:		
CNAE Code:		See CNAE List
Latitude		GPS Measure in Degree/Min/Sec
Longitude		GPS Measure in Degree/Min/Sec

3.4.2 F2 Waste Inventory

Field	Data	Remark
Information on the wastes inventory		
ID_Inventory_Waste		Generated by the system
Company Reg. N.:		
Submission Date		
Initial Date		
Final Date		
Year		
Note		
Address of the industrial unit:		
Street/n:		
Suburb/District:		
Municipality:		
CGCTE		
ZIP:		
Telephone:		
Technician: (In charge of the solid wastes management)		
Name:		
Job-Title:		
E-mail:		
Telephone:		
Fax:		
Characteristics of the industrial activity:		
Production time	Hours/ day: ; Days/ month: ; Months/year	
Total number of employees	Production: ; Administration: ; Other areas:	
Facilities (m^2)		
Geographic coordinates of the industrial facilities:		
Latitude		GPS Measure in Degree/Min/Sec
Longitude		GPS Measure in Degree/Min/Sec

3.4.3 F2.1. Input raw materials

ID		Raw material and inputs	Actual quantity (a year)	Maximum capacity (a year)	Unit
1	1	Inputs 1	20	100	Ton/year
1	2	Inputs 2	30	100	Ton/year
1	3	Inputs 3	40	100	Ton/year

3.4.4 F 2.2 List of Product

		Products	Actual quantity (a year)	Maximum capacity (a year)	Unit
1	1	Product 1	100	150	Qnt
1	2	Product 2			
1	3	Product 3			

3.4.5 F 2.3 Production Process

	Production Process	Description	Observation
1	No	Restaurant waste	
1	Yes	Product 1, line 1, step 2	
1	Yes	Product 1, line 1, step 3	

3.4.6 F 2.4 Generated Waste

Field	Data	Observation
ID_Inventory_GeneratedWaste		Generated by the system
ID_Inventory_Waste		Generated by the system
ID Production process step	Product 1, line 1, step 2	Selection of the production step
Generated wastes		
Category of the waste:	IW (Industrial wastes)	Select from the Wastes Table
Type of waste:	Non-HIW (Non-Hazardous industrial wastes)	Select from the Wastes Table
CONAMA waste code:	A009 (Wood wastes containing non-toxic substances)	Select from CONAMA Wastes Table
IPAAMSUFRAMA waste code:	NW03 (Wood)	Select from JICA Wastes Table
Physical state:	Solid	
Description of the waste:	Wood chips	
Unit code		Ton/year
Total generation	100	Total generation of wastes
Total on-site	0	Total of on-site management
Total off-site	100	Total of off-site management
Observation	All treated off-site	

3.4.6.1 Form. 2.4.1 Information on the flow of which waste generated

Field	Data	Observation
ID_Inventory_GeneratedWaste		Generated by the system
ID_Inventory_ GeneratedWaste		Generated by the system
Flow of the generated wastes		
ID On Off:	Off	
Type of collection:	Private	Own or Private
Transport		
ID Transport CNPJ		CNPJ of the company holding an IPAAM license
Quantity	100	
Observation	Transport 1	
Treatment		
ID Treatment CNPJ		CNPJ of the company holding an IPAAM license
Treatment code		Select from the treatment type table
Quantity	0	
Observation		
Recycling		
ID Recycling CNPJ		CNPJ of the company holding an IPAAM license
Recycling code		Select from the treatment type table
Quantity	0	
Observation		
Final Disposal		
ID Final Disposal CNPJ		CNPJ of the company holding an IPAAM license
Final disposal code		Select from the DF type table
Quantity	100	
Observation	Disposal site 1	
Storage		
Storage code		Select from the storage code table
Description of the site		
Latitude		GPS Measure in Degree/Min/Sec
Longitude		GPS Measure in Degree/Min/Sec

3.4.7 Sample of how to fill in the generated waste information

ID_WasteInventory	ID_WasteInventory_Waste	ID ProductionProcess Steps	Waste Category:	Type of Waste:	CONAMA Waste Code:	JICA Waste Code	Phisical State	Waste Description	Unit code	Total Generation	On site total	Offsite total	Note
1	1	Product 1, line 1 step 2	RI (Industrial Waste)	RINP (Non-Hazardous industrial	A009 (Residues wooden I contend not toxic substances)	NW03 (Wood)	Solido	Residues of wood	ton/ano	100	0	100	All treated offsite
1	2	Product 1, line 1 step 4	RI (Industrial Waste)	RINP (Non-Hazardous industrial waste)	A003 (Residues of varrição of plant)	NH03 (Papel)	Solido	Residues of papel	ton/ano	1000	200	800	
1	3												
1	4												

ID_WasteInventory	ID_WasteInventory_Waste	Generated Waste Flow	ID On Off:	Type of collection	Transport: ID Transport CNPJ	Transport: Quantity	Transport: Observation	Treatment: ID Treatment CNPJ	Treatment: Treatment code	Treatment: Quantity	Treatment: Observation	Recycling: ID Recycling CNPJ	Recycling: Recycling code	Recycling: Quantity	Recycling: Observation	Final disposal: ID Final Disposal CNPJ	Final disposal: Final disposal code	Final disposal: Quantity	Final disposal: Observation	Storage: Storage code	Storage: Quantity	Storage: Description of the site	Storage: Latitude	Storage: Longitude
1	1		Off	Private		100	Transport 1			0				0				100	Disposal site 1					
2	2		On			0				0				200	reuse			0						
2	3		Off	Private		800				0				800										

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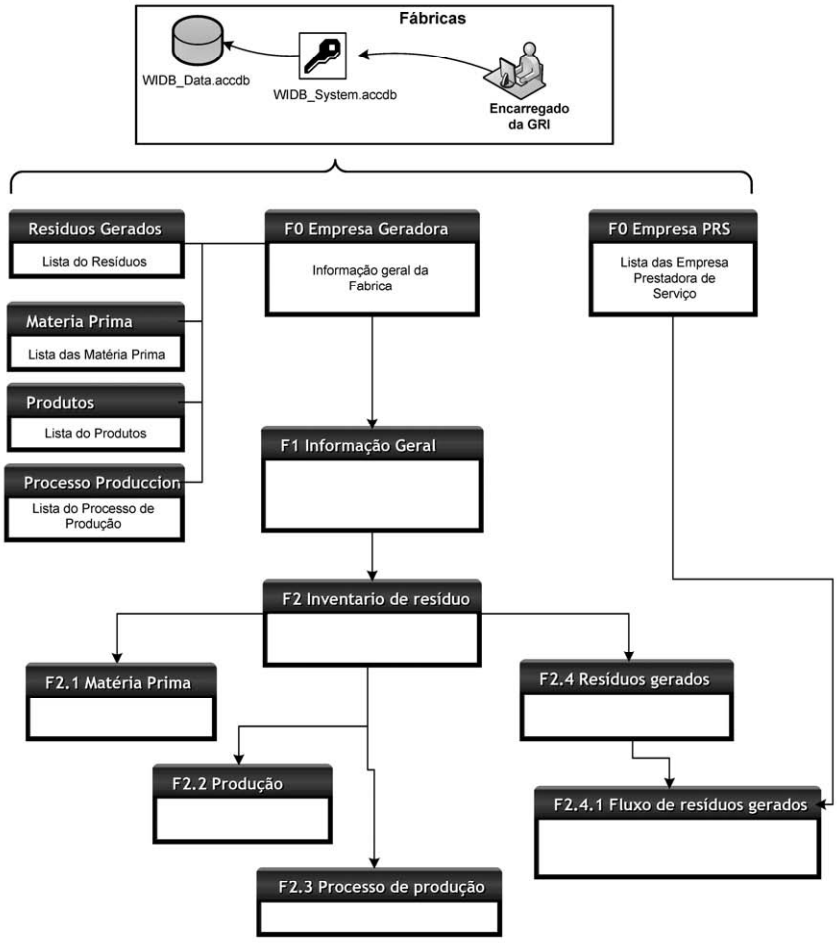
4 Waste Inventory Database System (WI_DB System)

4.1 General scheme of WI_DB System

The WIDB system is developed with Microsoft Access 2007, each factory, can install this DB System in their desktop PC and, input the information of the generated waste and their corresponding flow. The next figure shows the general scheme of the DB system.



4.2 Installation of the WI_DB System

The WI_DB system is developed with Microsoft Access 2007, to use this system it will be necesary the Microsoft Access 2007 program. If the PC doesn't have installed Access, it will be necessary to install the "AccessRuntime.exe". The Microsoft Office Access 2007 Runtime enables to use Access 2007 applications to users who do not have the full version of Access 2007, this file can be downloaded by Microsoft web site.
(http://www.microsoft.com/downloads/details.aspx?FamilyId=D9AE78D9-9DC6-4B38-9FA6-2C745A175AED&displaylang=en)

The WI_DB system use 2 files, **[WIDB_Data.accdb]** that will have the information of the waste inventory and **[WIDB_System.accdb]** is the system that contain the form to manage the information.

- Make new folder [**C:¥WIDB¥**]
- Copy the 2 files (**WIDB_Data.accdb, WIDB_System.accdb**) to the folder [**C:¥WIDB¥**]
- Run the WIDB_System.accdb
- Always make a backup of the [**WIDB_Data.accdb**] because in this file you will store all the information.

4.3 Using WI_DB System

4.3.1 Start

In the folder **[C:¥WIDB¥]**]double click **[WIDB_System.accdb]** to open the DB, and will appear the next form