APPENDIX

PART IV

ACTION PLAN ON INDUSTRIAL WASTEWATER MANAGEMENT AND WATER QUALITY MONITORING

APPENDIX 1, PART IV (AP/IW)

Introduction

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APPENDIX 1 INTRODUCTION

1.1 Current Situation of Water Quality Monitoring and Issues (Law system, monitoring system, analysis technique)

1.1.1 Current situation of water quality monitoring

Water quality monitoring is clearly described in Chapter Ⅴ, Law on Environment 2005. MEPP has already enacted National Environmental Monitoring Strategy and National Environmental Data Management in which monitoring organization, monitoring procedure, parameters and monitoring report, etc are described. In order to secure data accuracy, national monitoring plan is given the first priority. At the time of enactment of new Law on Waters, municipalities shall establish local monitoring network in cooperation with national water quality monitoring network and all data will be reported to MEPP information center.

There are two kinds of water quality monitoring; one is to monitor environment and another to monitor pollution sources in the form of domestic and industrial wastewater.

(1) Environmental monitoring

Environmental monitoring of river, lake, etc, has been improved by EU's assistance in the form of supply of analyzer and equipment, training and information center project, etc.

As for environmental water quality, MEPP information center has established a database using the data transmitted from HMI (Hydro Meteorological Institute) under MAFWE (Ministry of Agriculture, Forest and Water Economy) and CHPI (City Health Protection Institute) laboratories under Ministry of Health. HMI is also analyzing groundwater quality and the data is transmitted to MEPP information center. Vodovod's laboratory sends data to MEPP information center through the City of Skopje.

MEPP information center has been preparing a pollution map of each water body, white paper. The data information can be accessed by internet.

(2) Pollution source Monitoring (Sewage, Industrial wastewater)

As for sewage and industrial wastewater monitoring, monitoring system is so far not sufficient compared to environmental water quality monitoring due to the concept of self-monitoring by each enterprise. Sewage and industrial wastewater quality analysis have been conducted mainly by MEPP central laboratory and Vodovod's laboratory. MEPP central laboratory has been analyzing them only after report of any accident by inhabitants such as fish is dead. In such cases the inspector visits the site and collects samples to be analyzed by MEPP central laboratory. If the cause of the accident is identified with the analysis result, MEPP has been entrusted to conduct administrative disposition over the factory causing any such accident.

MEPP information center has been collecting and establishing a database using the data obtained from MEPP central laboratory, from the enterprise or out-sourcing laboratories. However, this kind of data is still very limited. With the start of IPPC system, regular industrial wastewater monitoring has just started in 2008. An inspector is scheduled to collect samples once a month in principle.
MEPP information center has prepared cadastre of pollutants of each installation to show main polluters on Auto CAD with the information of existing analysis results and quality and quantity of kinds of pollutants including toxic substances.

Vodovod regularly collects samples of outlets of sewage and industrial wastewater along Vardar River and its tributaries and analyzes them. However, in the laboratory of Vodovod, AA (Atomic absorption analyzer) is not available to analyze heavy metals. Tendering process to purchase this equipment has already been finished and Vodovod expects to have this equipment around June 2008.

Alkaloid (Chemical industry) and OKTA (Oil refinery, located out of area of this Study) are the only industries that can conduct self-monitoring of its own industrial wastewater through analysis in its own laboratories and send the results to MEPP information center.

1.1.2 Reliability of Monitoring

Regarding the monitoring system or network of environmental monitoring, HMI has been implementing surface water quality monitoring based on the designated type of water body; not with all parameters designated by the law. The data is sent to MEPP information center. Although, the issue will be how the City of Skopje and other municipalities can involve themselves in monitoring with financial background in future, the data by the laboratories of HMI, CHPI and Vodovod will be enough for the time being.

MEPP central laboratory is equipped with ICP, GC-Mass, liquid chromatography, UV/photo mater, TOC analyzer, etc. granted by EU. EU also carried out training on how to use the analyzers. However, at present there is no staff in MEPP central laboratory to handle GC-mass and TOC analyzer. Biological test is not conducted. This laboratory has a potential capacity of analyzing complicated industrial wastewater quality; but it seems there is lack of personnel resources including number of staff members.

The laboratories of Vodovod, HMI and Republic Health Protection Institute are also analyzing industrial wastewater quality. As mentioned earlier, Vodovod can not analyze heavy metal because its laboratory is not equipped with AA at present.

The laboratory of Republic Health Protection Institute is the only one laboratory accredited in Macedonia for analyzing drinking water quality. It analyzes industrial wastewater quality only upon request. HMI also analyzes industrial wastewater quality upon request.

Analyzers are common in analysis of environment, sewerage and industrial wastewater quality. However sewage and industrial wastewater contain very complicated matrix. That is why in-depth knowledge and abundant experiences of analysis, in particular, of pre-treatment of industrial wastewater sample is required. As an overall impression of existing level of sewage and industrial wastewater analysis in various laboratories, basic knowledge and training are insufficient and the followings should be improved.

- Insufficient understanding of accuracy management
  - The analysts understand general analysis procedures; however, knowledge and equipment for pre-treatment of sample in sewage and industrial wastewater analysis are insufficient.
  - Lack of the concept of accuracy management. Except MEPP central laboratory, laboratories indicate the analysis result as “O” or meaningless four or five effective figures.
  - Insufficient knowledge of advantages and disadvantages, limits, application conditions of analyzers
  - Insufficient knowledge of the meaning and amount of reagents to be added

In this Study, thirteen (13) points of river water quality, three (3) sewage outlets and two (2) outlets of industrial wastewater quality were analyzed twice. Based on the replies of the analysts to the questions of the Study team regarding the results, the above issues were justified.

- No unified analysis standards of sewage and industrial wastewater

As for quality analysis of drinking water, there is a law “Sampling and Laboratory Analyses of Drinking Water 1987”. On the other hand, there are no unified analysis procedures for sewage and industrial wastewater quality analysis. Each laboratory refers to the procedure above or uses other procedures.

- Absence of appropriate analysis manual

In analysis manuals, the procedures on preparation of reagents and amount of ml of reagents to be added are written. However, detailed pre-treatment procedures or what needs to be paid attention to during analysis procedures are not described. In addition, there is no clear flowchart showing the procedures, and in most cases the manuals have been prepared by themselves and only simple procedures are written. Even the analyst could not answer such simple questions that how he/she conducted pre-treatment or how many ml of reagent was consumed to get such a low value.

- There is no accredited official laboratory for sewage and industrial wastewater analysis

HMI and MEPP central laboratories are aiming to get ISO 17025. However, only MEPP central laboratory seems to have the potentiality to get it from view points of analyzers and accuracy management. Furthermore, there is no doubt that MEPP shall have the initiatives in environmental problems. From the roles of the MEPP central laboratory, it is expected to become an accredited official laboratory in Macedonia.

To assist MEPP central laboratory to get ISO 17025, the following assistances for certain period will be necessary;

- Preparation of unified analysis manual by the central laboratory
- Analysis accuracy management including preparation and storage of reagents, pre-treatment procedure, detail manuals of what to pay attention to in analysis processes;
- Data management

APPENDIX 3, PART IV (AP/IW)

Implementation of Workshop and Other CD related Activities

Table of Contents

APPENDIX 3 IMPLEMENTATION OF WORKSHOP AND OTHER CD RELATED ACTIVITIES

3.1 Contents of Seminars by Power Point

3.1.1 An Experience of Toxic Industrial Waste Treatment

Background of the Project

1. IMO added to regulate dumping of Cu, Zn and F
2. Impossible to treat these three substances by only neutralization due to high concentration of chelating agents and complexes
3. Concentration of these three substances changes from mg/L to 100,000 mg/L

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The Objectives of the Project

1. To develop a new treatment system and to construct a new plant to meet the new regulation (IMO) with easy operation,
2. To discharge the treated waste to the sewerage system as much as possible,
3. To combine wastes in the treating process as much as possible.

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What to proceed

1. Analysis of each waste for classification
2. Classification of waste
3. How to average the quality
4. Develop treatment system
5. Construction of treatment plant
6. Formulation of Operation Manual
7. Intermediate Evaluation of the system
8. Further Study
9. Conclusion and Recommendation

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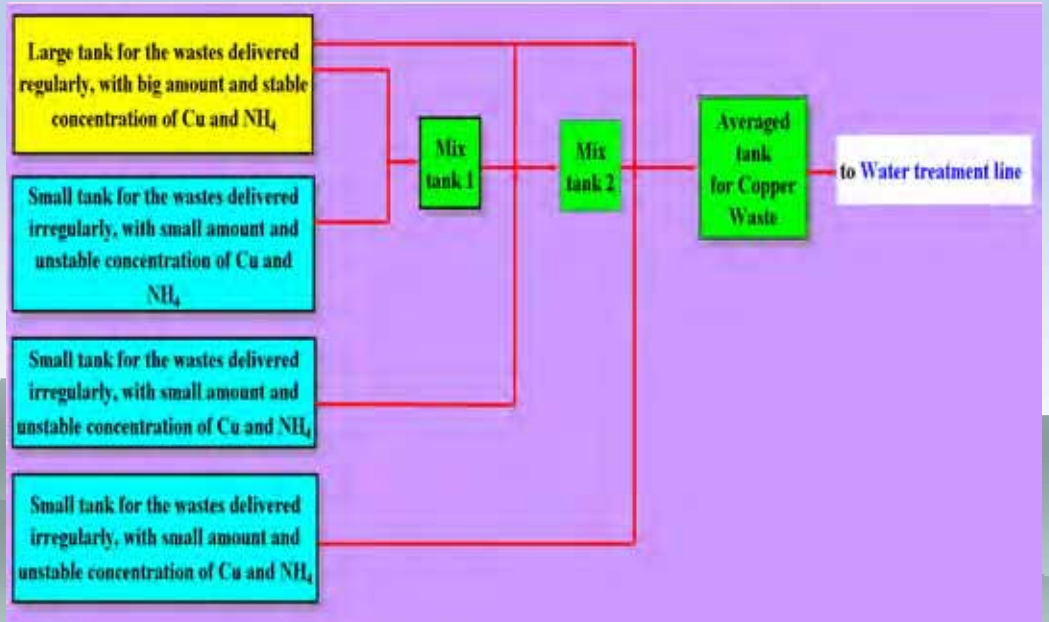
How to average the quality



Cu waste with chelating agents for Water Treatment Line

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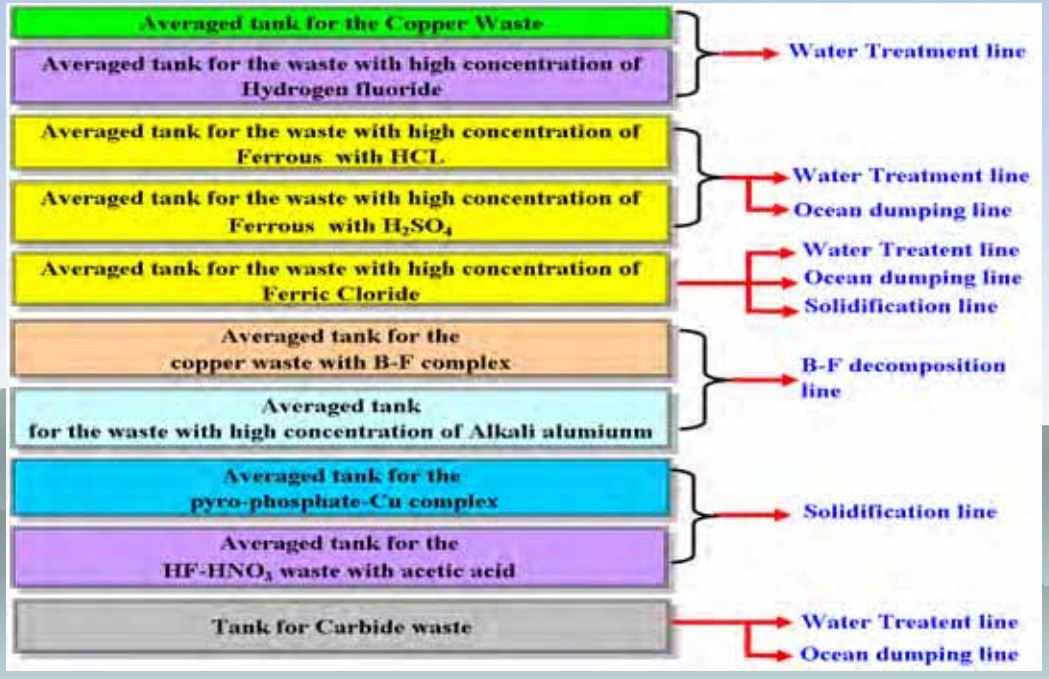
Classification of Waste



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Average Concentration of Each Liquid Waste

	Mixed acid waste[1)]	Ferric waste with HCl	Ferrous waste with HCl	Ferrous waste with H_2SO_4	Soda-Aluminum waste
Cupper (Cu)	7,000	11,000	24	52	less than 10
Zinc (Zn)	1,500	590	18,000	11,000	less than 10
Total Manganese (Mn)	less than 10	890	740	270	less than 10
Total iron (Fe)	less than 10	186,000	100,000	48,000	less than 10
Fluoride (F)	7,000 (700) [2)]	3.6	33	7.1	less than 3.0
Aluminum (Al)	less than 10	less than 10	less than 10	less than 10	100,000
Ammonia (NH_3-N)	9,100	less than 10	less than 10	less than 10	less than 10

Remarks :

1) : Mixed acid waste means Cu including acid waste and Hydrogen Fluoride including acid for waste treatment line

2) Fluoride concentration of in B-Fluoride

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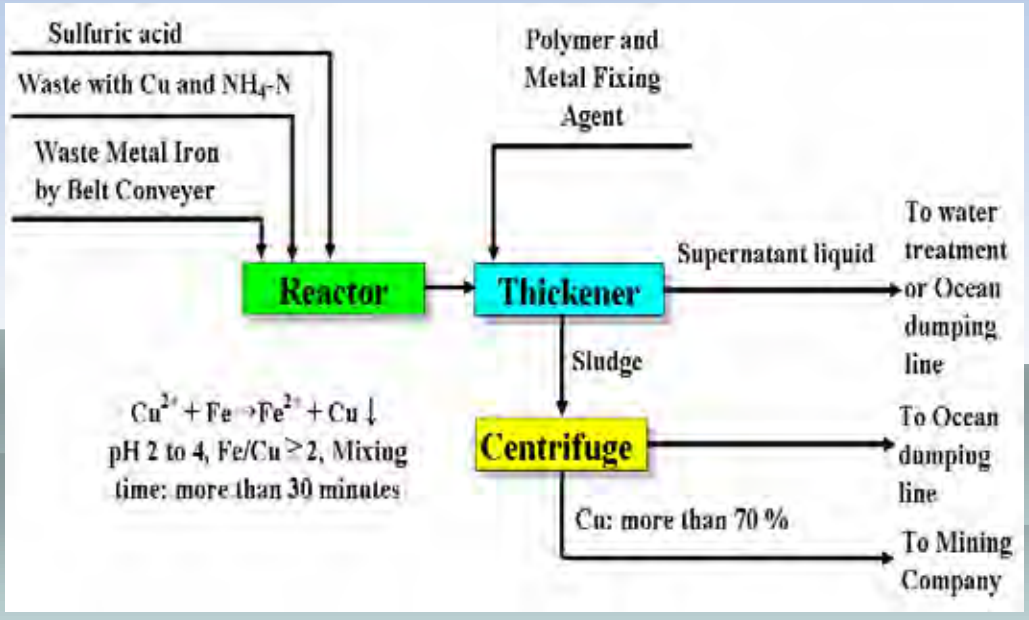
Treatment of Copper and Recycle with Waste Fe Powder



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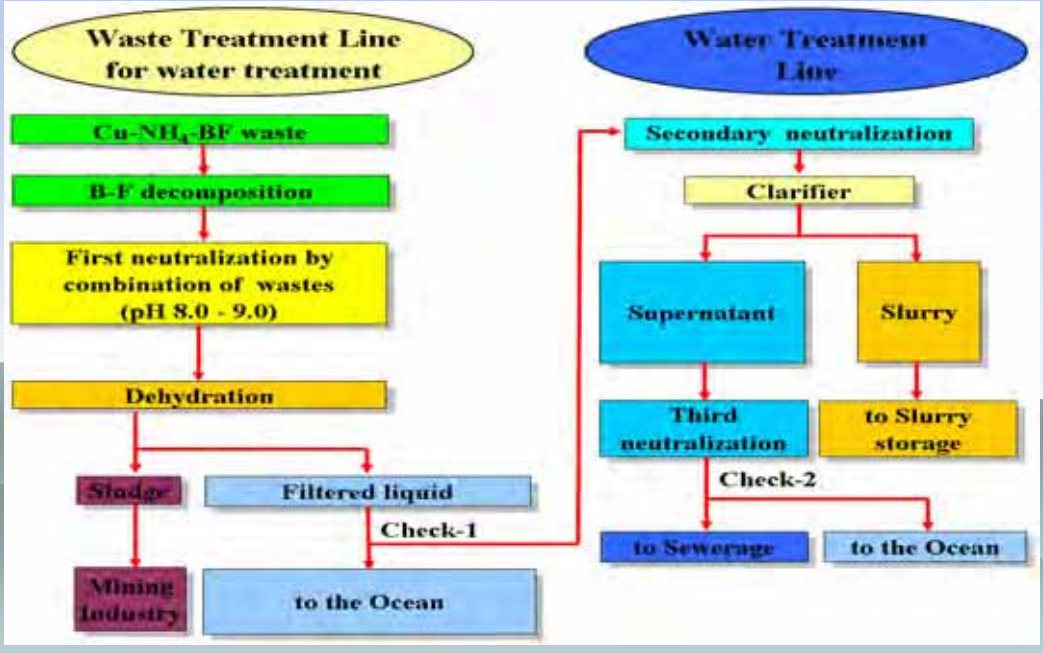
Concept of Treatment Flowchart



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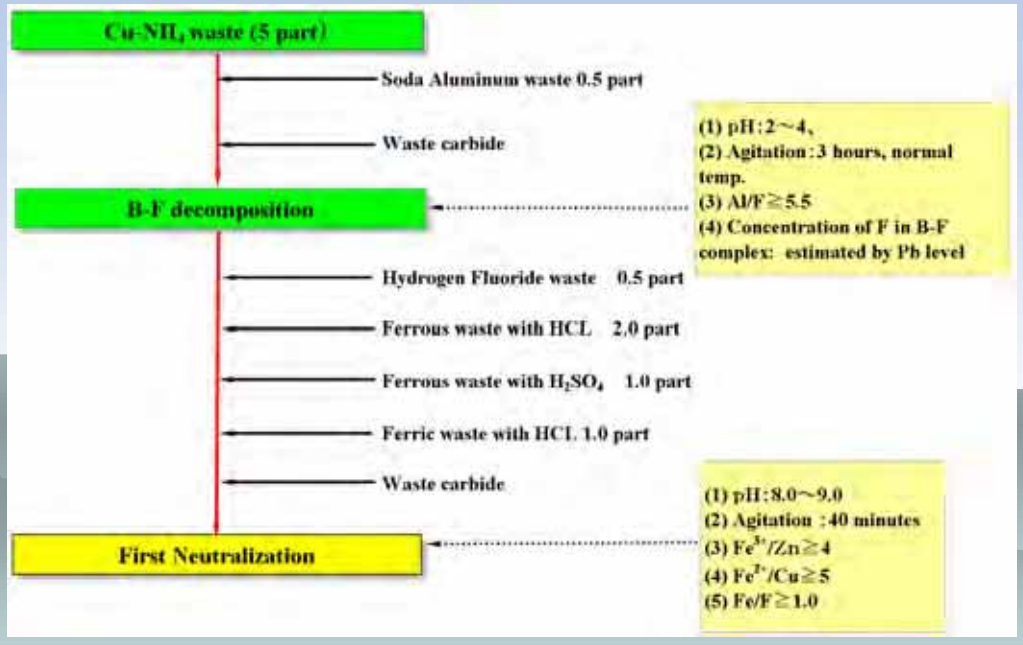
Combination of Waste



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Check-1: Water Treatment Line

- CODMn＜300mg/L
- Within the criteria as raw water for water treatment line

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Check-2: Sewerage Discharge

- Within the discharge criteria to sewerage system

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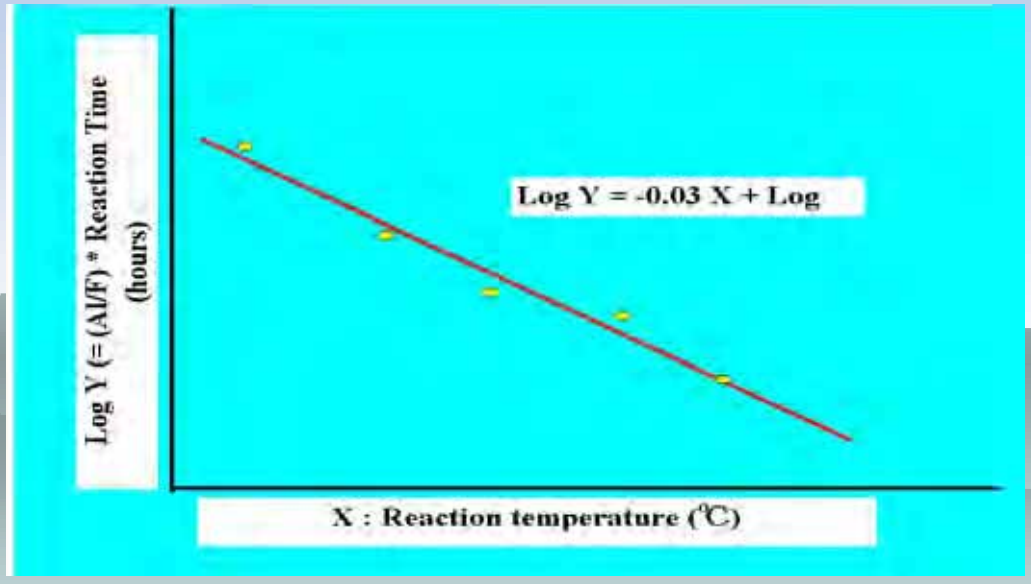
Decomposing Condition of B-fluoride-Pb Complex



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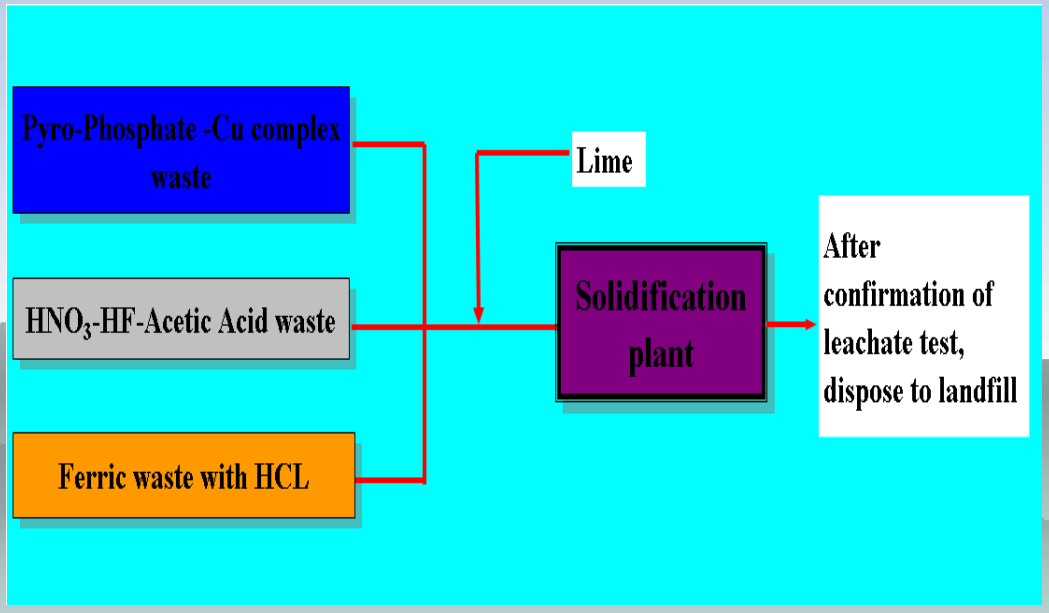
Solidification flowchart



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Intermediate Evaluation

1. The treatment system was appropriate from the view of the criteria for dumping waste (filtrate) into the ocean, discharging to sewer line and disposing to landfill at that time.

2. Basically the treatment system consists of the reaction by combination of wastes including alkali waste

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Intermediate Evaluation

3. The process was very easy to operate. After the project, the numbers of operators and maintenance workers reduced from 50 to 10
4. It is possible to discharge 300 m^3/day of effluent to municipal wastewater treatment plant,

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- **However, considering the capacity of the municipal wastewater plant next to the company, I limited the discharge up to 120 m^3/day. It was because that high concentration of salt (average 100,000 mg/L) would obstacle biological activity in the municipal wastewater plant.**

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Further Study

1. R & D of Biological Treatment
2. Estimation of Leachate Quality of Landfill

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Average Filtrate Quality

(Unit: mg/L except pH)

BOD_5	COD_{Mn}	SS	T-N	T-P	Cu	Zn	Cd
6,000	4,000	60	9,000	100	2.8	4.0	≦0.1
Pb	As	F	Fe	Mn	pH	TDS	
≦1.0	≦0.1	12	8.5	5.0	8.7	100,000	

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Biological Treatment of Average Filtrate with high concentration of salt

- Biological treatment experiment for six months ended successfully as for BOD_5 reduction to the level of discharge criteria of 600 mg/L-BOD_5 into sewerage line with three times dilution of the filtrate.

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- However, the construction of the biological plant was costly and there was a strong objection to use industrial water a lot to dilute the filtrate.
- In addition, to discharge such a lot of amount of salt (50 ton/day) to the municipal sewerage plant next to the company might cause a trouble in WWTP.

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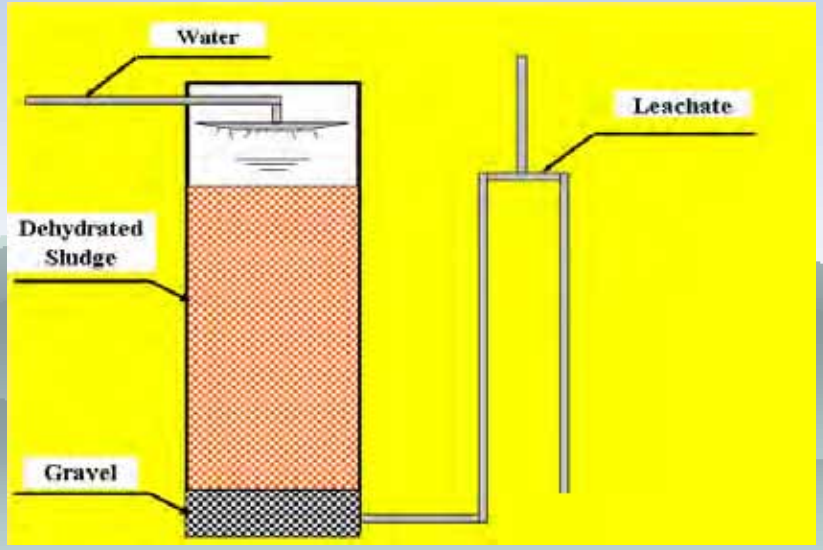
Estimation of Leachate Quality of Landfill



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Estimation of Leachate Quality

The process was only the one with the great help of absorption by ferric and ferrous oxide. Most of all metals and chelates such as ammonium and organic matters absorbed on the sludge were dissolved again.
Particularly, the first leachate quality was as the table below.

BOD_5	COD_{Mn}	SS	T-N	T-P	Cu	Zn	Cd
300	1,000	120	8,000	150	6,000	200	1.2
Pb	As	F	Fe	Mn	pH	TDS	
3.6	0.7	150	250	200	5.6	100,000	

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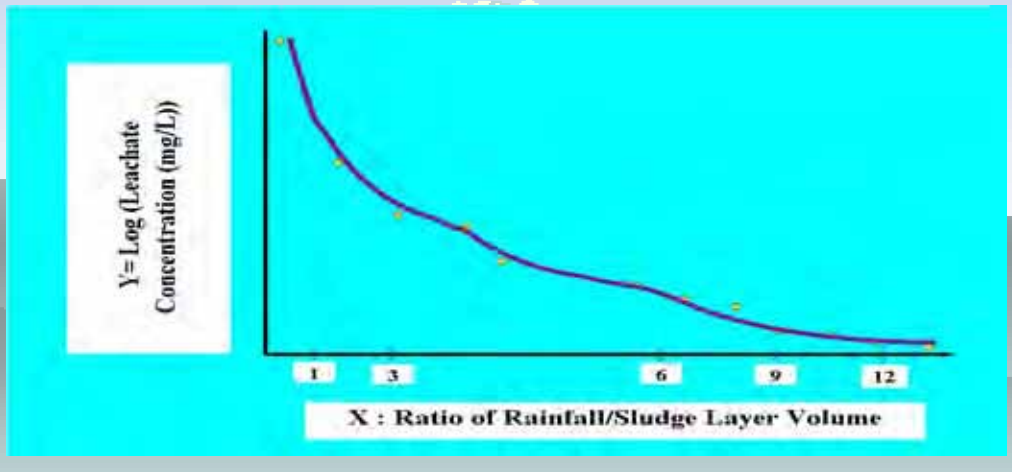
Leachate Quality Change

The result showed that twelve (12) times of rainfall of sludge layer volume would be necessary to be judged stable and to use normal water treatment procedure.



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- **However, in the actual landfill, such high level of heavy metals are not found. It is because that the leachate test was done without cover soil which is expected the absorption of such substances to some extent.**
- **From the different results between actual landfill and test column, I could not help feeling the power of nature.**

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Conclusion and Recommendation

- The process was not completed, even though the sludge disposed to landfill and filtrate dumped into the ocean or sewerage line met each criteria, considering the difficulty of leachate treatment and the risk of it.
- The dehydrated sludge should be delivered to a mining company, not to the landfill to avoid the risk of the environmental problem.
- The sludge contained more than 30 % of copper and 15 % of zinc. A mining company willingly accepted it.

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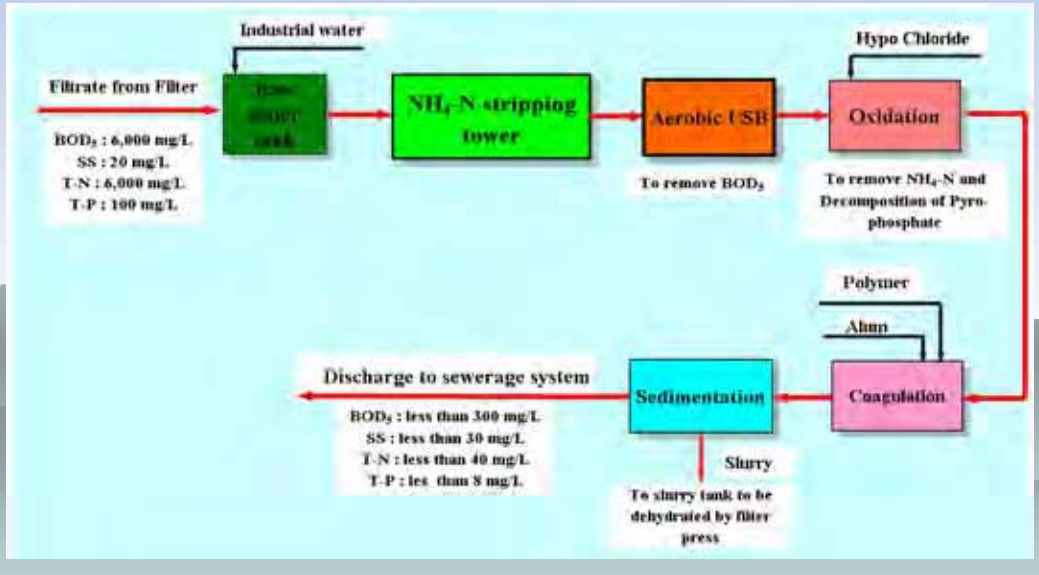
The current Treatment System to discharge all filtrate



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- There was no quality deterioration by a lot of salt inflow from the company into the municipal waste treatment plant that had been rehabilitated in order to increase the treatment capacity.
- Moreover, some kinds of peculiar bacteria that are not found in the literatures were found in the UASB in the company and some of the universities and companies were interested in its another application to other sites. I could not help feeling the power of nature here, again.
- Solidification plant was removed due to bad odor and heat. The process was risky both for the workers and neighboring residents.

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What to be learned from the Project

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Analysis

- Understand the principals of the procedure and characteristics of analyzer,
- Official standards are not always adopted to waste analysis. Sometimes other analysis procedure will be better,
- Establish the best pre-treatment procedure by yourself,
- Unless the result of analysis is used for another purpose, it is meaningless,
- Use the analysis results to improve the situation like plan –do –see.

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Treatment

- Don't satisfy to develop the system only to meet the criteria.
- Open your eyes to another field. The system you developed should be evaluated from all directions.
- Use the power of nature but don't be too much confident of it.

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- To solve environmental problem, wide variety of knowledge is required. The knowledge covers the fields of chemical, chemical engineering, mechanical, electrical, civil, geological, biological, etc. Therefore, men or women from many fields should involve in it.
- There is a limit in the ability for treating the complex of industrial waste only by one company with only chemical procedures. Cooperation of other companies that use heat like steel industry or chemical industry companies should be considered.

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- Another technology such as carbonizer or melting process should be studied, although these processes need exhausted gas treatment.
- Cooperation of proper waste management by discharging company and treatment company is a must for good performance of treatment system.
- Construction materials, machine and equipment should be considered carefully. Industrial waste with such high concentration of salt and erosive waste would very easily erode construction materials, machines and equipment

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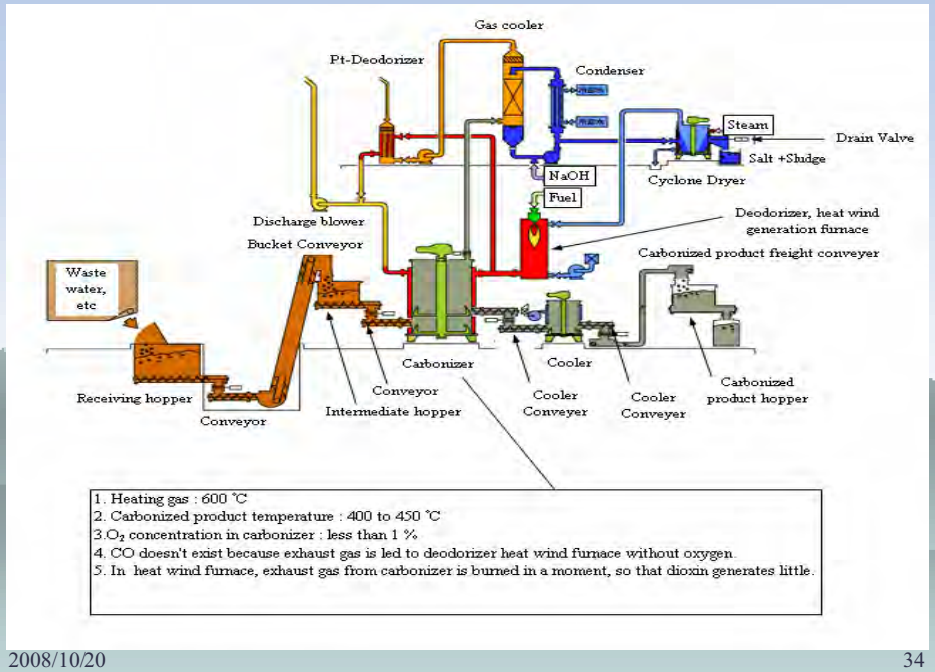
Carbonizer Process



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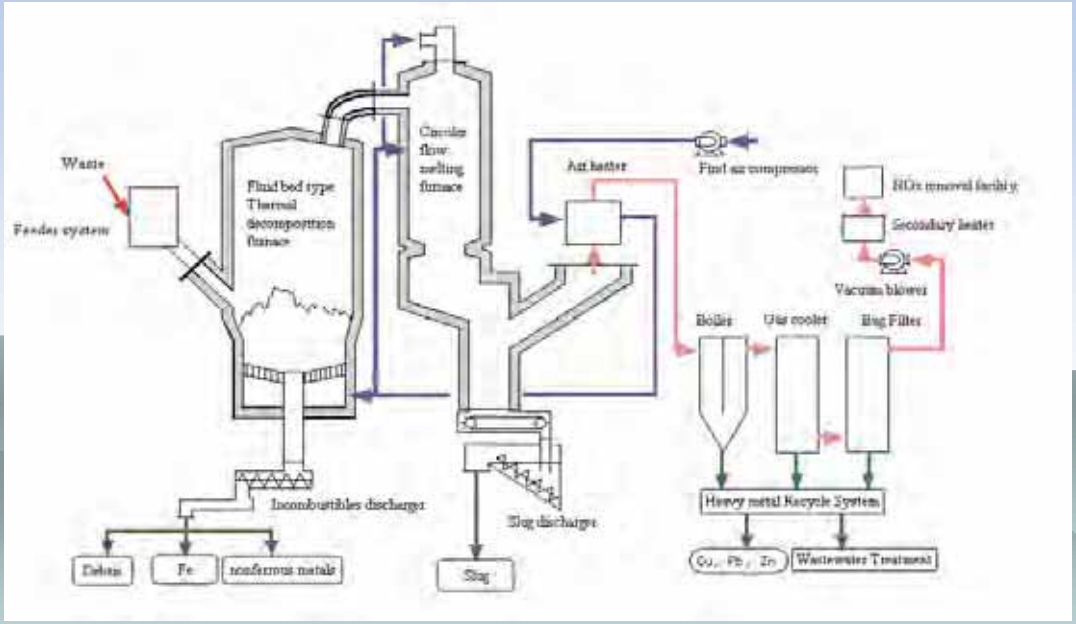
Melting Process



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Pictures of Lectures in Kenya

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Pictures of Lectures in Kenya

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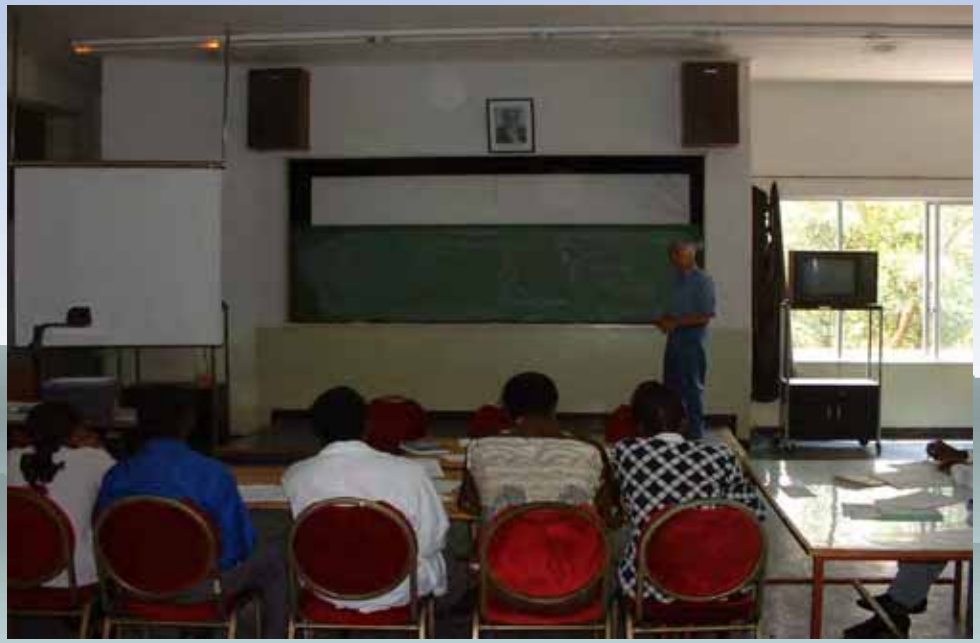
Pictures of Lectures in Kenya



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Pictures of Lectures in Kenya

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Pictures of Lectures in Kenya

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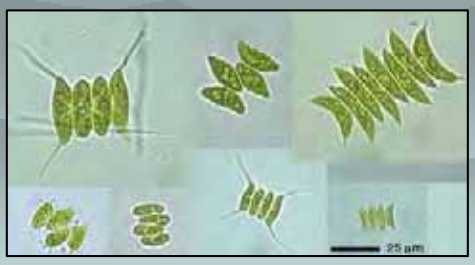
Monitoring Water Quality By Microscope

3) Green Algae

Chlorella

Chlorella becomes the priority species when decomposition of organic matters is going on vividly.



Scenedesmus

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Monitoring Water Quality By Microscope

2) Ciliata

Cyclidium sp.

Phascolodon vorticella

Vorticella sp.

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Monitoring Water Quality By Microscope

3. Metazoa
1) Rotatori (magnifying 100 to 200)

Brachionus

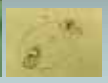
Keratella

Colurella

Lepadella

Lecane

Notommata



Asplanchna

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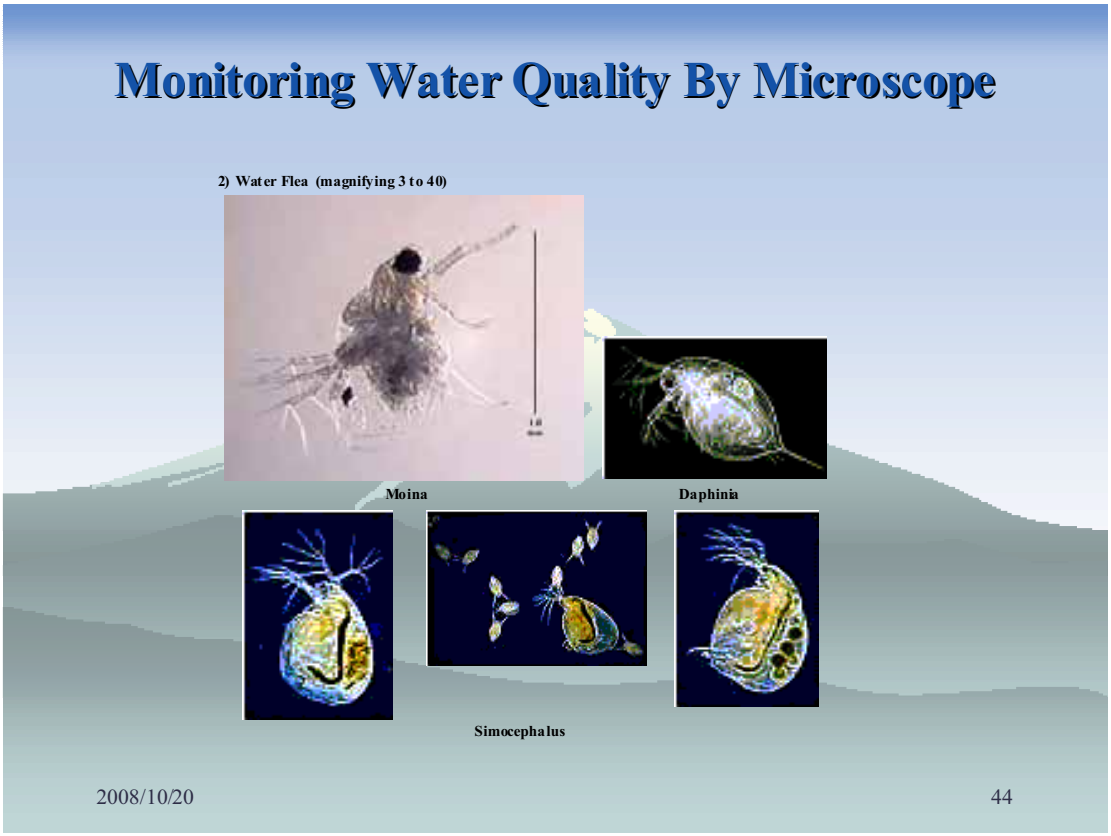


3.1.2 Environmental Law System in Japan

Topics of This Seminar

- Background of enactment of pollution control laws
- Pollution control law system
- Required knowledge for certified pollution controller
- Certified pollution controller system and ISO14001
- Introduction of environmental management of some companies
- Current Environmental situation in Japan
- Discharge standards into sewerage and water body
- Waste generation and recycle
- Sludge disposal evaluation procedure
- Structures of landfill
- Others

2

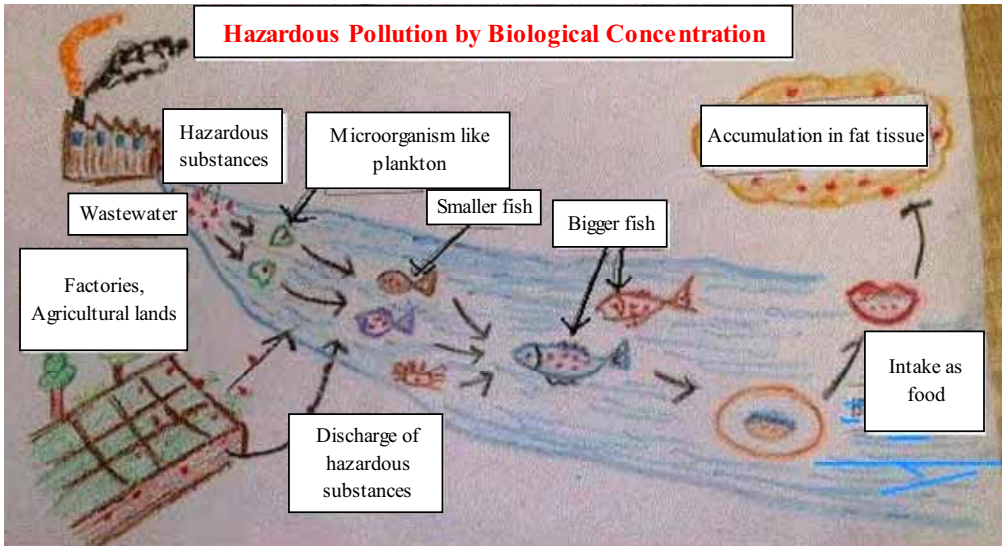
Minamata and Itai Itai Diseases

Mercury pollution caused this birth defect. The girl in the photo is 15 years old.

The crippled hand of a Minamata disease victim

3

Hazardous Pollution by Biological Concentration



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Compensation for Minamata and Itai Itai Diseases

- Minamata Disease: 6.2 million Euros as the compensation to the designated 2,268 victims. But the settlement has not been completed, yet.

- Itai Itai Disease: the average annual health expense compensation in 1992, 33 million Euros. Compensation for agricultural damage, a total of annually 112 million Euros. Another 28 million Euros were invested annually to reduce further pollution of the river.

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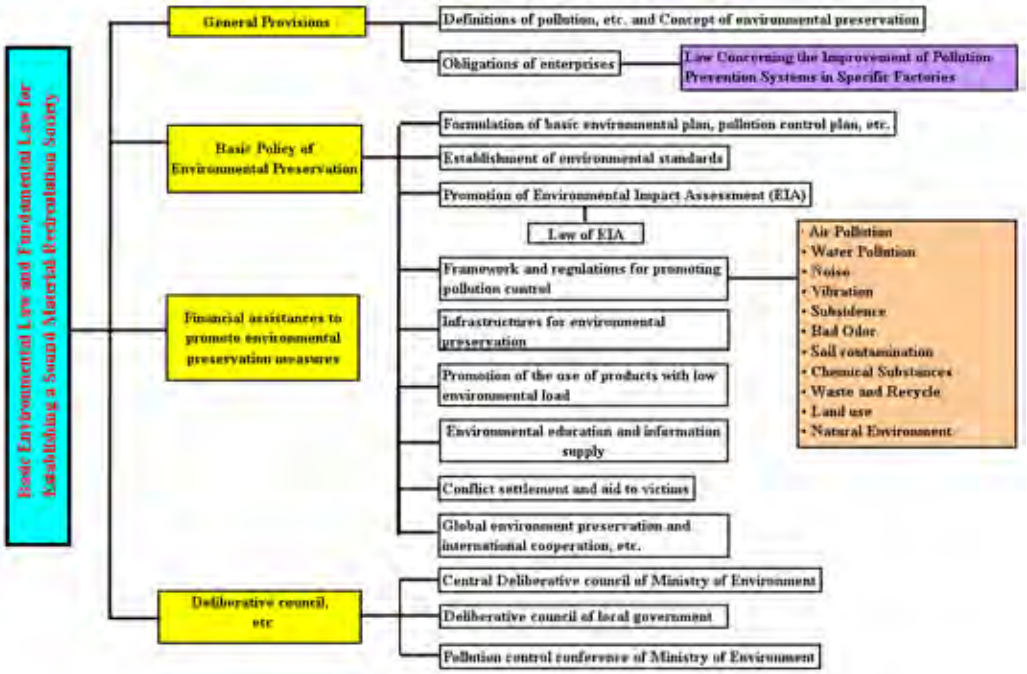
Environmental Law System in Japan



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Range of Environmental Policy in Japan

Environmental Policy in Narrow Sense		Environmental Policy in Wide Sense
Maters in charge of Ministry of Environment	**Matters in charge of Ministry of Environment and Ministry of Finance and Industry**	**Matters in charge of other Ministry**
• Planning and promotion of governmental environmental policy • Basic Environment Plan, Pollution Control Plan • Waste Management • Regulations and monitoring to prevent obstacles in environmental preservation and pollution • Conservation of nature and wild animals • Compensation of health damage by pollution	• Evaluation of chemicals, PRTR, Regulation of production • Construction of recycle/ pollution control facilities • Regulation of factory location • Monitoring of radioactivity, Global warming measures • Ozone layer conservation, Ocean pollution control • Conservation of forest, green belts, rivers, marsh and lakes, sea coast • Environmental Impact Assessment	• Radio active substances • Atomic safety • Water sources, forest • Environmental sanitary, nature disaster • Energy, transportation • Cultural properties

• Right of advise by Ministry of Environment, request of reporting
• Opinions to Prime Minister

7

The Rolls of Local Government

In the Basic Policy of Environmental Preservation,

- Ministry of Environment directs basic policy of pollution control plan, the concerned governors formulate the plan and the plan is given acceptance by Ministry of Environment
- The Government and local municipalities take necessary measures to execute the plan.
- The expenses for measures to execute the measures by local municipalities are compensated by subsidiary by the Government.

The rolls of local government in the Law System are formulations of;

- Nature Conservation Law by local government
- Local ordinance of pollution control
- Local ordinance of life environmental preservation
- Environmental Impact Assessment Law
- Conclusion of agreement on pollution control

8

Financial Assistances

Name of Fund	Facilities for Assistance
Fund for facility modernization of medium and small sized enterprises (Local government is the window), with 50 % of investment cost and less than 1.8 million Euros, No interest, Period: 12 years for pollution control facility (Period of deferment: 1 year)	Wastewater treatment facility, Smoke or dust treatment facility, Noise prevention facility, Vibration prevention facility, Specific substance treatment facility, Odor treatment facility, Sea water pollution prevention facility, Waste treatment facility, Conversion facility for industrial water
Japan Finance Corporation for small and Medium Enterprises	Wastewater or waste liquid treatment facility, Smoke and dust or specific substance treatment facility, Noise prevention facility, Industrial waste treatment facility, Industrial waste treatment business facility and recycle facility, Odor treatment facility, Conversion facility for industrial water, Rationalization facility to use industrial water, Cost Liability by Companies based on Law Concerning the Pollution Control Cost Liability by Companies, Recycle and reuse of Fluorocarbon, Factory move of medium and small sized enterprise for congestion dissolution and pollution control , Fund for business change for pollution control
National Life Finance Corporation	Same as the Smaller Business Finance Corporation
Organization for Small & Medium Enterprises and Regional Innovation	Common pollution control facility for wastewater, soot and dust, noise, industrial waste, odor, etc.,Lease for pollution control facility for the union members
Development Bank of Japan	Liquid natural gas receiving facility, pollution control facility like process change to non-pollution process, Soot control and wastewater treatment, waste treatment, smoke de-sulfide and de-nitrogen facility, Recycle of waste, Move of factory, Commercialization of pollution control technique
Okinawa Development Finance Corporation	Same as Japan Finance Corporation for small and Medium Enterprises, National Life Finance Corporation, Development Bank of Japan and Agriculture, Forestry and Fisheries Finance
Agriculture, Forestry and Fisheries Finance	Treatment facility for cattle discharges
Japan Oil Gas and Metals National Corporation	Mining waste treatment of stopped and abandoned mine, Cost Liability by Companies based on Law Concerning the Pollution Control Cost Liability by Companies

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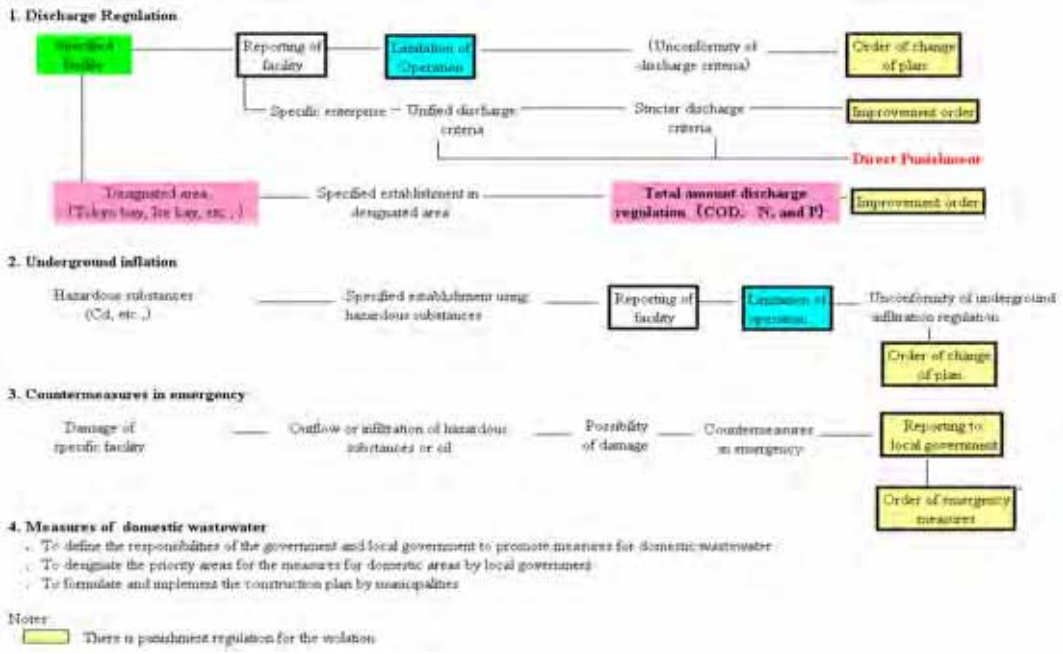
Tax Reduction System

Tax	Financial Assistance	Target Tax	Target Facility	Contents
National Tax	Special repay of general pollution control facility	Income tax, Corporation tax	Soot treatment facility including high chimney, NOx reduction facility, Recycle facility of designated substances (Benzene, tri-chloroethylene, tetra-chloroethylene), Wastewater treatment facility, Dioxins discharge reduction facility and destruction facility of specified Fluorocarbon	14 % of special repay of acquisition cost in the first year (As for high chimney and structures designated by government ordinance, 10 % in the first year
	Special repay of volatile organic compounds reduction facility	Income tax, Corporation tax	Volatile organic compounds reduction facility	14 % of special repay of acquisition cost in the first year
	Special repay of recycling facility	Income tax, Corporation tax	Specified recycling and reuse production facility (Recycling of waste plastics, destruction and recycling facility of waste wood, segregation facility of mixed	14 % of special repay of acquisition cost in the first year
			Recycling and reuse production facility of waste glass, specified household waste, cardboard production from used paper	23 % of special repay of acquisition cost in the first year
	Special repay of industrial waste	Income tax, Corporation tax	High temperature and melting facility and treatment facility of polluted by PCB	14 % of special repay of acquisition cost in the first year
			Asbestos waste treatment facility	
Local Taxes	Special exemption of fixed property tax	General pollution Control Facility	NOx reduction facility	Standard of assessment: 1/2, Superior renewal: 2/3
			Soot treatment facility	Standard of assessment: 1/6, Superior renewal: 2/3
			Specified substances discharge reduction facility	Standard of assessment: 1/3
			Dioxins discharge reduction facility	Standard of assessment: 1/3, Superior renewal: 2/3
			Specified facility designated in water pollution control law or wastewater treatment facility generated from specified facility in designated area	Standard of assessment: 1/6, Superior renewal: 2/3
			Wastewater treatment facility generated from designated facility in Clean Lake Law	Standard of assessment: 2/3
			Groundwater purification facility	Standard of assessment: 1/2
			Soil purification facility	Standard of assessment: 1/3
		Volatile organic compounds reduction	Volatile organic compounds reduction facility	Standard of assessment: 1/6, Superior renewal: 1/2
		Waste Treatment Facility	PCB treatment facility, Incineration melting facility	Standard of assessment: 1/6
			Waste oil, waste plastics treatment facility, general waste treatment facility	Standard of assessment: 1/2
			Superior renewal of incineration, car destruction, intermediate industrial waste treatment facilities with a certain factor	Standard of assessment: 2/3
			Other facilities excluding the above	Standard of assessment: 1/3
			Asbestos waste treatment facility	Standard of assessment: 1/3
		Waste recycle and reuse facility	Waste recycle and reuse facility	The first three years: 3/4 (Parts of facilities: 2/3)

10

Water Pollution Control System



11

Definitions of Words-1

- ”**Specified Facilities**" :Facilities discharging polluted water or wastewater meeting either of the following conditions, and which are to be specified by Cabinet Order:
- (1) Containing cadmium or other substances to be specified by Cabinet Order as substances which may cause harmful damage to human health:
- (2) Being of a degree, that may cause damage to the living environment, as chemical oxygen demand (COD) and other substances, to be specified by Cabinet Order as showing the condition of water pollution (including thermal pollution, but excluding pollution by the substances as referred to (1)

12

Definitions of Words-2

- **"Effluent"** : The water discharged from the factories or the establishments ("the specified establishments"), which have the specified facilities discharging to the public water areas.
- **"Polluted water, etc."** polluted water or wastewater discharged from specified facilities.

13

Uniformed Discharge Criteria

	Parameter	Unit	Effluent Discharge Criteria to Water Body
Parameters concerning human health	Cadmium (Cd)	mg/l	0.1
	Cyanide (CN)	mg/l	1
	Organic phosphorus	mg/l	1
	Lead (Pb)	mg/l	0.1
	Hexavelent chromium (Cr^{6+})	mg/l	0.5
	Arsenic (As)	mg/l	0.1
	Total mercury (T-Hg)	mg/l	0.005
	Alkyl-Hg	mg/l	ND
	Poly Biphenyl Chloride (PCB)	mg/l	0.003
	Tri-chloroethylene	mg/l	0.3
	Tetrachloroethylene	mg/l	0.1
	Di-chloromethane	mg/l	0.2
	Butyl chloride carbon (CCl_4)	mg/l	0.02
	1.2-dichloroethane	mg/l	0.04
	1.1-dichloroethylene	mg/l	0.2
	cis-1.2-dichloroethylene	mg/l	0.4
	1.1.1-trichroroethane	mg/l	3
	1.1.2-trichroroethane	mg/l	0.06
	1.3-dichloropropene	mg/l	0.02
	Thiuram	mg/l	0.06
	Simazine	mg/l	0.03
	Thiobencarb	mg/l	0.2
	Benzene	mg/l	0.1
	Selenium (Se)	mg/l	0.1
	Boric acid (B)	mg/l	50 (Sea area 230)
	Fluorine (F)	mg/l	15
	NH_3, NO_2 and NO_3 compound[1)]	mg/l	100
	Dioxins[2)]	pg-TEC/l	10

(Note) Different from the parameter or criteria for Pre-Treatment Criteria to Sewerage

1. NH_4-N x 0.4 + NO_2-N + NO_3-N
2. by Law Concerning Special Measures against Dioxins

14

Uniformed Discharge Criteria

	Parameter	Unit	Effluent Discharge Criteria to Water Body
Parameters concerning living environment	pH		5.8 to 8.6 (Sea area 5-9)
	Biochemical oxygen demand (BOD_5)	mg/l	160 (daily ave. 120)
	Chemical Oxygen Demand (CODMn) : Sea area	mg/l	160 (daily ave 120)
	Suspended solid (SS)	mg/l	200 (daily ave.150)
	n-hexane extract (Mineral oil)	mg/l	5
	n-hexane extract (Animal and vegetable oil)	mg/l	30
	Phenol	mg/l	5
	Cupper (Cu)	mg/l	3
	Zinc (Zn)	mg/l	2
	Iron (Fe)	mg/l	10 (soluble)
	Manganese (Mn)	mg/l	10 (soluble)
	Total chromium (Cr)	mg/l	2
	Daily Total Coliform	cfu/ml	3,000
	Total nitrogen as N[2)]	mg/l	120 (daily average 60)
	Total phosphorus as P[2)]	mg/l	16 (daily average 8)

(Note) Different from the parameter or criteria for Pre-Treatment Criteria to Sewerage

2. To be adapted to marshes and lakes designated by Ministry of Environment where these parameters may promote significantly growth of marsh and lake plant planktons and seas designated by Ministry of Environment where these parameters may promote significantly growth of sea plant planktons and to be adopted to water bodies that flow to these areas.

15

Key Points of Discharge Regulation

- Wastewater from specified establishment with the capacity of more than 50 m^3/day is regulated by discharge criteria to water body,
- Local government can use severer criteria,
- Discharge criteria to sewer (Pre-treatment Criteria) are regulated by Sewerage Law.

16

Specific Factory

(1) The objective industrial category

- Manufacturing industry including processing of articles
- Electricity supply
- Gas supply
- Heat supply

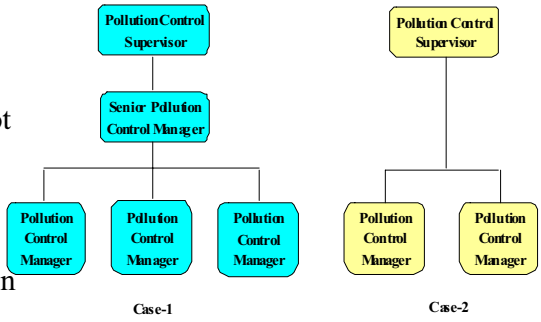
(2) Objective factory

- Smoke generation facility
- Specified dust generation facility
- General dust generation facility
- Wastewater generation facility
- Noise generation facility
- Vibration generation facility
- Dioxin generation facility

17

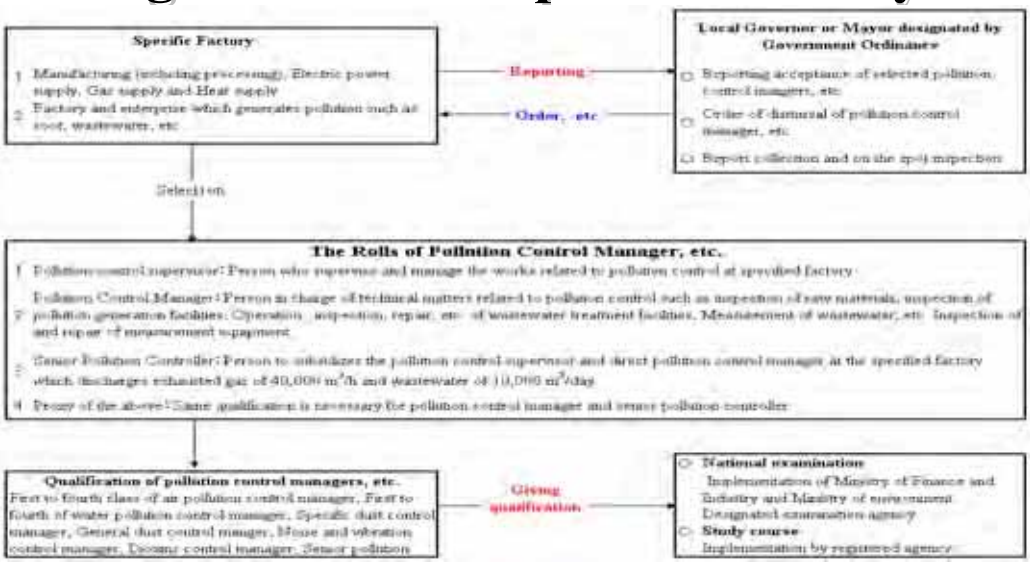
Pollution Control Organization

- Senior Pollution Manager: Smoke Generation of 40,000 m^3/hour with wastewater discharge of 10,000 m^3/day average
- Pollution Control Supervisor: not required official certification
- Arrangement of pollution control manager is regulated in accordance with the classification of pollution generation facility
- One control manager at each factory except the case for small and middle class enterprises.



18

The Outline of Pollution Control Organization in Specific Factory



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Pollution Control Manager

- Not all the "Specified Establishments", are required to arrange pollution manager.
- Factories without facilities generating hazardous water pollutants and less than 1,000 m^3/day are not covered by the law.
- Senior pollution control manager and pollution control manager have to pass a national test, as a principal.
- There are 13 official qualifications of pollution control managers, including senior pollution manager with the capacity of the specified facilities.

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Classification of Water Pollution Control Manager

Type of pollution generating facility	Type of control pollution manager	Type of qualification
Facilities generating water pollutants installed in factories generating more than 10,000 m^3 of wastewater per day including hazardous substances	First class water pollution control manager	First class water pollution control manager
Facilities generating water pollutants installed in factories generating less than 10,000 m^3 of wastewater per day or factories specific types of underground percolating water including hazardous substances	Second class water pollution control manager	First and second class water pollution control manager
Facilities generating polluted water other than facilities generating water pollutants installed in factories generating more than 10,000 m^3 of wastewater per day, not including hazardous substances	Third class water pollution control manager	First and third class water pollution control manager
Facilities generating polluted water other than facilities generating water pollutants installed in factories generating 1,000 to 10,000 m^3 of wastewater per day, not including hazardous substances	Fourth class water pollution control manager	First and fourth class water pollution control manager

21

Required Knowledge for the First Class Water Pollution Control Manager

	Title	Coverage of the examination		Contents
1	Generalities of Pollution	1)	Basic Law of Environment	• Objectives the laws, law system and contents seven pollutions), EIA, circulation society
		2)	General environmental issues	• Tendency of recent pollution issues, historical background: Global environment, Air, water, soil, noise, vibration, waste, recycle, chemical substances
		3)	Environmental management	• EIA, Environmental management, environmental harmonious production, risk assessment and management
		4)	International Assistance	• Overseas development assistance
2	Outline of Water Quality	1)	Law and regulation of water pollution control	• Environment standard in water pollution, Water pollution control law system and Pollution control manager system
		2)	Current situation of pollution control	• Historical background of water pollution, current situation of recent water pollution, factors of water pollution
		3)	Water pollution sources	• Water pollution causing substances and water quality indicator
		4)	Mechanism of water pollution	• Material balance in nature
		5)	Effects of water pollution	• Effects on health, aquatic animals, agricultural and or marine products by water pollution
		6)	Countermeasures of water pollution by the government and local municipalities	• Financial assistance, Current situation of health damage, Pollution conflicts,
3	Wastewater treatment	1)	Plan of wastewater treatment	• Wastewater treatment within the facto, procedure of treatment plan, selection of treatment process
		2)	Physical and chemical treatment	• Outline of physical and chemical treatment, sedimentation, coagulation, floatation, filtration, pH adjustment, oxidation and reduction, activated carbon absorption, ion exchange, membrane separation, sludge treatment
		3)	Biological treatment	• Outline of biological treatment: Activated sludge, bio-filter, anaerobic treatment, biological nitrification-denitrofication process, biological removal of phosphorus,
		4)	Operation and maintenance of wastewater treatment facility/equipment	• Operation and maintenance of physical-chemical and biological treatment facility/equipment
		5)	Analysis	• Sampling, flow measurement, basis of analysis, analysis procedures of the substances regulated, including hazardous substances, kinds of analyzer and characteristics
4	Hazardous substances	1)	Characteristics of hazardous substances and treatment	• Characteristics of hazardous substances and treatment regulated in the wastewater pollution control law
		2)	Operation and maintenance of wastewater treatment facility/equipment for hazardous	• Operation and maintenance of wastewater treatment facility/equipment for hazardous substances regulated in the wastewater pollution control law
5	Large-scale water	1)	Behavior of water pollution	• Spread of substances in river, marsh and lake, sea
				• Vertical distribution of water pollution substances
				• Density inclination of salt water
				• Mechanism of accumulation of water pollution substances, europhication, biological concentration, groundwater contamination, blue tide, poor oxygen water, water pollution in the sea and simulation
		2)	Recycle, reuse of effluent	• Rationalization of water usage and reuse/recycle of effluent plan
				• Treatment process for reuse or recycle of effluent
				• Examples of recycle /reuse of effluent for cooling, cleaning and process
		3)	Measures of water pollution management in large-scale enterprise	• Actual cases of water pollution management in large-scale enterprise

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Reporting of Specific Factory

(1) Name or appellation and address, and in case of a juridical person, the name of the representative;
(2) Name and address of the factory or establishment;
(3) Type of the Specified Facility using hazardous substances;
(4) Structure or construction of the Specified Facility using hazardous substances;
(5) Method of using the Specified Facility using hazardous substances;
(6) Method of treatment of polluted water, etc.;
(7) Method of percolation of Specified Underground Percolated Water;
(8) Other matters stipulated by Order of the Prime Minister's Office.

23

The Relation of Pollution Control Manager system and ISO 14001

- 20,317 enterprises got ISO 14001 in September 2007.
- Pollution Control Manager: more than 500,000 in 2004
- ISO 14001: Voluntary accreditation system mainly focusing on improvement of environmental performance step by step by continuous improvement of management system, not regulate the technical capacity of a person to be arranged.
- Pollution control manager system: National Minimum to secure the necessary and least organization and personal asset with technical capacity in order to execute the obligation by arranging the pollution control manager.
- In 96 % of the enterprises that have ISO14001, most of all the pollution control managers play a part in environmental management as internal inspector and technical education.
- It is not appropriate to ease the legal restriction of pollution control manager system for the enterprise that has ISO14001.
- Recent pollution control manager is required to have the knowledge of the concept of ISO 14001 such as standards of evaluation technique for environmental performance, life cycle assessment (LCA) to evaluate quantitatively environmental impacts of products on lifecycle, environmental label to show environmental adaption design (DfE: Design for Environment) or environmental characteristics of the product, etc.

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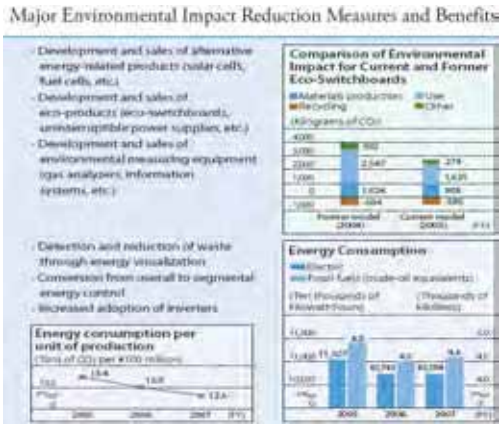
Examples of Environmental Management Reports

- You can find easily through internet: "Environmental Management Report"

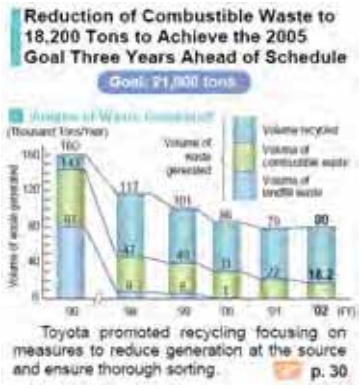
A Part of Environmental Management Report (Pioneer)

25

Examples of Environmental Management Reports



A Part of Sustainability Report 2008 (Fuji Electric Group)



A Part of Highlights of Environmental Initiatives
in FY 2002 (TOYOTA)

26

Current Environmental Situation

Object	Item	Achievement rate (%)	Remarks
Public water body	Environmental criteria relating to health protection like cadmium, etc. (26 parameters)	99.1	As, F, NO_3-N + NO_2-N, Dichloromethane and 1.2-dichloromethane exceed the environmental criteria
	Parameters related to life environment such as BOD_5, COD, etc.	83.4	COD in closed water body exceeds the environmental criteria.
Groundwater		93.7	As, F, NO_3-N + NO_2-N, tri-chloroethylene and tetra-chloroethylene exceed the environmental criteria among 6.3 % of ground waters,
Sea			Pollution sources were oil (65.1%), waste (22.6 %), industrial wastewater, etc, (5.1 %), red tide (4.9 5), harmful liquid waste (1.7 %), blue tide (0.6 %)
Soil environment			454 cases of violation by Pb. As, tri-chloroethylene and tetra-chloroethylene were occurred in 2004 in city areas.
			7,327 ha of agricultural land was polluted but 87.2 % is already coped with in 2005.

■Environmental criteria performance of photochemical oxidants is less than 1%.

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Strengthening Environmental Water Quality Criteria

- The criteria is an advisable one, not the maximum allowable limit or acceptable limit.
- Concerning aquatic animal life, discharge criterion of zinc was strengthened from 5 to 2 mg/l in 2006.
- Zinc is regulated as less than 30 μ g/L, regardless of fish living areas in fresh water area. In sea area, it is regulated as 20 and 10 μ g/L, in general and specified sea area, respectively.
- Chloroform, phenol and formaldehyde are the observed parameters and the goal levels are different from water area and fish living area.

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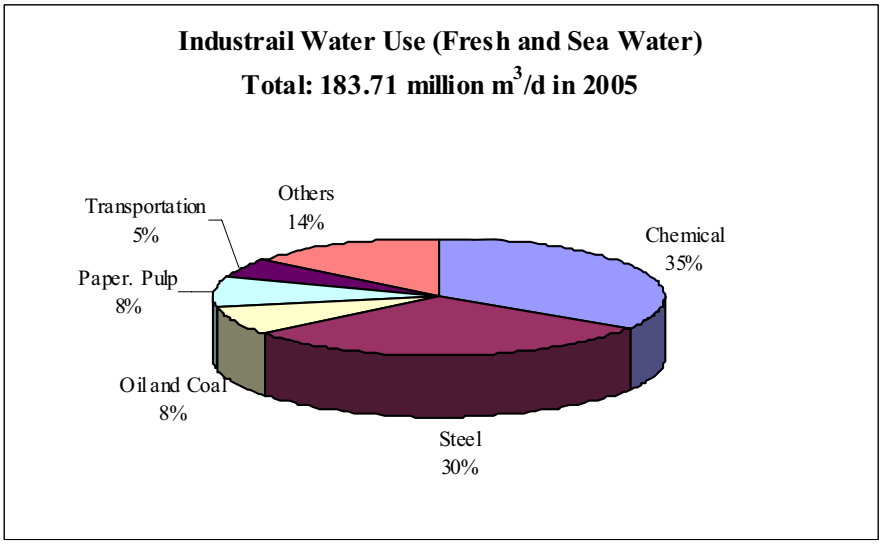
Reduction of Pollution Load in Water Use



29

Reduction of Pollution Load in Water Use

- Fresh water occupies 77 % of industrial water.
- Among which 80 % is by recycled water, followed by industrial water supply system, other fresh waters, well and water supply system in order.
- Among the recycled water, about 67 % is used in chemical and steel industries which consume lots of water, followed by machinery and equipment industry for export, oil production, coal production, pulp/paper and paper processing industries.
- These five (5) industries occupy about 90 % of the recycled water.
- With the increase of recycled water, pollution discharge amount became smaller.

30

For Your Reference-1: N and P

- 1 mg of algae is equivalent to 0.5 mg of COD_{Mn}.
- 1 g of nitrogen and phosphorus produces about 12 and 154 g of water plankton, respectively.
- To get the effluent of less than 10 mg/l, 10 mg/l and 1mg/l of BOD_5, T-N and T-P, respectively, eco-engineering by using water plant, soil, etc., shall be used with the consideration of the characteristics of catchment area.

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For Your Reference-2: Water Quality Indicator

- BOD_5 and COD
- Microcystin
- Biological Indicator of Pollution
- Pollution by trace hazardous substances like environmental hormone

Cyanobacteria

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For Your Reference-3

- Water pollutant by industry: Refer to Progress Report Appendix 5.4 and I will explain some examples in the next seminar-Wastewater Treatment
- Health Risk of regulated parameters, including temporary guideline: In the materials I leave
- Water quality criteria for Agriculture (paddy rice), fishery use, acceptable level of Industrial water by purpose: In the materials I leave
- Concept of Environmental Management, Life Cycle Assessment)LCA), Environmentally Conscious Design (ECO), Design for Environment (DfE), Environmental Label, Laws and regulations to realize Environmentally Conscious Products (ECP), Risk Evaluation and Management: In the materials I leave
- Risk assessment: In the materials I leave

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Monitoring System

(1) Water Quality Monitoring System of Water Bodies

- ♦ Monitoring itself: by local and designated cities.
- ♦ Ministry of Environment assists them necessary expenses;
  - to prepare measurement plans,
  - to install automatic analyzers for continuous water quality monitoring of water bodies or,
  - to prepare analyzers for local pollution control institutes
- ♦ Ministry of Land Development and Transportation installed automatic water quality analyzers at the points of the first class and major rivers based on the water quality monitoring plans prepared by local government and designated cities and established telemeter system.

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Monitoring System

(2) Inspection of Wastewater

- ♦ Local government and designated cities can request factory and enterprise reporting and inspection at the site in case of necessary.
- ♦ Based on the inspection, they execute the necessary administrative directive like improvement order. The number of site inspection was 47,393 in 2005.
- ♦ Among them, the number of improvement order regarding structure, use and wastewater treatment was 43.
- ♦ The number of temporary order of stopping operation of the specified facilities was 4.
- ♦ The number of improvement order of structure, use and wastewater treatment of the specified facilities related to underground inflation was 1 and,
- ♦ The number of temporary order of stopping operation of the specified facilities was 10.

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Pre-Treatment Facility Discharging into Sewerage

- Industrial pre-treatment facility: Facility to treat industrial wastewater to meet the discharge criteria into sewerage
- Law of sewerage can regulate water quality of all users as principal. Accordingly, small sized restaurants and clinics which are not regulated in water pollution control law are regulated to install industrial pre-treatment facility such as oil separator, plaster trap and so on.
- Reporting to municipal government to manage municipal wastewater treatment plant

36

Pre-Treatment Criteria (Okayama City)

		Parameter		Unit	Specified Enterprise		Other Enterprise	
					More than 50m³/day	Less than 50 m³/day	More than 50m³/day	Less than 50 m³/day
Criteria by local ordinance	General parameters	Temperature		℃	45	45	45	45
		pH			5 to 9	5 to 9	5 to 9	5 to 9
		Biological oxygen demand (BOD_5)		mg/l	600	-	600	-
		Suspended solid (SS)		mg/l	600	-	600	-
		n-hexane extract	Mineral oil	mg/l	5	5	5	5
			Animal and vegetable oil	mg/l	30	-	30	-
		Iodine(I_2) consumption		mg/l	220	220	220	220
Criteria by governmental law	Uniformed environmental parameter	Phenol		mg/l	5	5	5	5
		Cupper (Cu)		mg/l	3	3	3	3
		Zinc (Zn)		mg/l	2	2	2	2
		Iron (Fe)		mg/l	10 (soluble)	10 (soluble)	10 (soluble)	10 (soluble)
		Manganese (Mn)		mg/l	10 (soluble)	10 (soluble)	10 (soluble)	10 (soluble)
		Total chromium (Cr)		mg/l	2	2	2	2
	Toxic substances	Cadmium (Cd)		mg/l	0.1	0.1	0.1	0.1
		Cyanide (CN)		mg/l	1	1	1	1
		Organic phosphorus		mg/l	1	1	1	1
		Lead (Pb)		mg/l	0.1	0.1	0.1	0.1
		Hexavelent chromium (Cr^{6+})		mg/l	0.5	0.5	0.5	0.5
		Arsenic (As)		mg/l	0.1	0.1	0.1	0.1
		Total mercury (T-Hg)		mg/l	0.005	0.005	0.005	0.005
		Alkyl-Hg		mg/l	ND	ND	ND	ND
		Poly Biphenyl Chloride (PCB)		mg/l	0.003	0.003	0.003	0.003

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Pre-Treatment Criteria (Okayama City)

		Parameter		Unit	Specified Enterprise		Other Enterprise	
					More than 50m^3/day	Less than 50 m^3/day	More than 50m^3/day	Less than 50 m^3/day
Criteria by governmental law	Toxic substances	Tri-chloroethylene		mg/l	0.3	0.3	0.3	0.3
		Tetrachloroethylene		mg/l	0.1	0.1	0.1	0.1
		Di-chloromethane		mg/l	0.2	0.2	0.2	0.2
		Butyl chloride carbon (CCl_4)		mg/l	0.02	0.02	0.02	0.02
		1.2-dichloroethane		mg/l	0.04	0.04	0.04	0.04
		1.1-dichloroethylene		mg/l	0.2	0.2	0.2	0.2
		cis-1.2-dichloroethylene		mg/l	0.4	0.4	0.4	0.4
		1.1.1-trichroroethane		mg/l	3	3	3	3
		1.1.2-trichroroethane		mg/l	0.06	0.06	0.06	0.06
		1.3-dichloropropene		mg/l	0.02	0.02	0.02	0.02
		Thiuram		mg/l	0.06	0.06	0.06	0.06
		Simazine		mg/l	0.03	0.03	0.03	0.03
		Thiobencarb		mg/l	0.2	0.2	0.2	0.2
		Benzene		mg/l	0.1	0.1	0.1	0.1
		Selenium (Se)		mg/l	0.1	0.1	0.1	0.1
		Boric acid (B)		mg/l	10 (230)	10 (230)	10 (230)	10 (230)
		Fluorine (F)		mg/l	8 (15)	8 (15)	8 (15)	8 (15)
		T-N as N		mg/l	240	-	240	-
		T-P as P		mg/l	8 (32)	-	8 (32)	-
		Dioxin		pg-TEQ/l	10	10	10	10

(Note)
1, Column : direct punishment, Column : regulated criteria for pre-treatment facility
2,Discharge volume is the daily average
3, Criteria in parentheses for boronic acid, fluorine is used in case municipal wastewater discharges its effluent to the sea or for designated areas
4, Criteria of T-N and T-P the criteria in designated areas
5. The criteria of each parameter is possible to change more stricter or add parameters by local government

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Contents of reporting

General Information:	New, remodel or extension of the facility; Name of enterprise or factory; Location of enterprise or factory
Outline of factory or enterprise	Industry category; Capital; Total area; Building area; Working area; Date of starting operation; Number of employees; Operation hours; Holidays; Person in charge of water quality management, telephone number; Main products and amount of production; Flowchart of production process
Wastewater treatment method:	Classification of industrial pre-treatment facility; Name of industrial pre-treatment facility; Location of the facility with figure; Construction, completion and start of operation date; Kind of the facility, type, structure, dimensions, capacity and treatment process with figures; Wastewater collection and water conducting with figures; Outline of the operation time of the facility and seasonal fluctuation; Consumables per day by use necessary for wastewater treatment; Wastewater quantity (maximum and normal) and quality (parameters and values) before and after treatment; **Sludge and waste generation per month and treatment method**; Way of discharge into public sewer; Notes
Wastewater quantity and quality:	Discharge point; Type of wastewater; Discharge effluent (maximum and normal) and quality (parameters and values)
Systematic flow of water and wastewater	Flowchart of water and wastewater; Water use and wastewater generation by purpose

39

Key Points of Law of Sewerage

(1) Site inspection of the operational conditions of specified facility, industrial pre-treatment facility, etc, and order change or improvement of the operation of the facilities.

(2) Collection of reporting on situation of the establishment, industrial pre-treatment facility, etc and wastewater quality.

(3) Selection of water quality manager who is responsible for maintenance of the facility or wastewater quality

40

Key Points of Sewerage Law

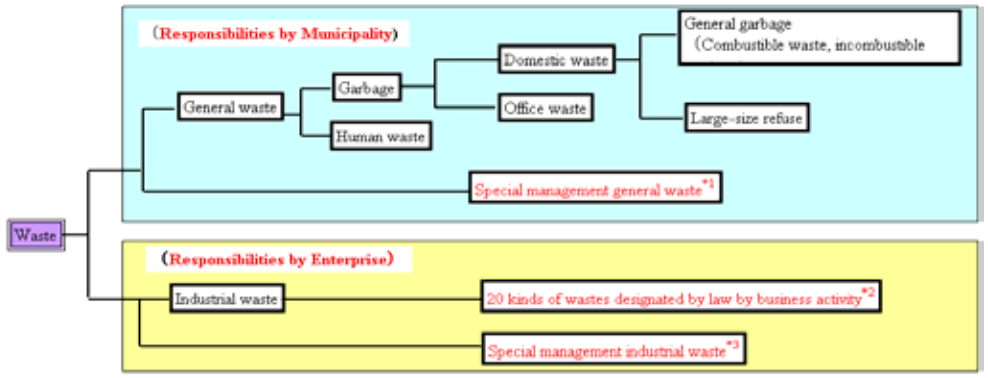
(4) Obligation of water quality measurement
- Wastewater quality analysis results should be kept in 5 years (in water pollution control law, 3 years).
- Analysis method: By ministerial ordinance (Ministry of Land and Transportation)
- Frequency of analysis: Not regulated clearly. For example, everyday for temperature and pH, every two month for BOD_5 and SS, every two weeks for Cd, CN, Organic –P, Pb, Cr^{6+}, As, Total-Hg, Alkyl-Hg, PCB, Every month for other parameters

(5) Sample and analysis: at the time to be assumed the worst, from middle of the water depth and at the point just before discharging into public sewer

(6) Emergency Measures and reporting to municipal government
- Accident: Fire occurrence, stop of facility operation due to power failure, etc, damage of storage tank or pipe, inflow of hazardous substances or oil into sewerage due to operation error
- Emergency Measures: Stop of supply of hazardous substances or oil to the damaged storage tank or pipe, heaping-up of sandbags to prevent from outflow, spilt oil recovery by adsorption mat

41

Waste and Recycle of Waste



*1and *3 Explosive, toxic and infectious wastes and others which may cause damage on human health or life environment
*2 Burnt residue, sludge, waste acid, waste alkali, waste plastics, wastepaper, waste woodchip, fiber dust, animal and plant residue, unnecessary animal solid, rubber dust, metal dust, glass dust, concrete and ceramic dust, mining residue, debris, animal waste, dead animal, dust and what is treated for disposal of the above.

Classification of Waste

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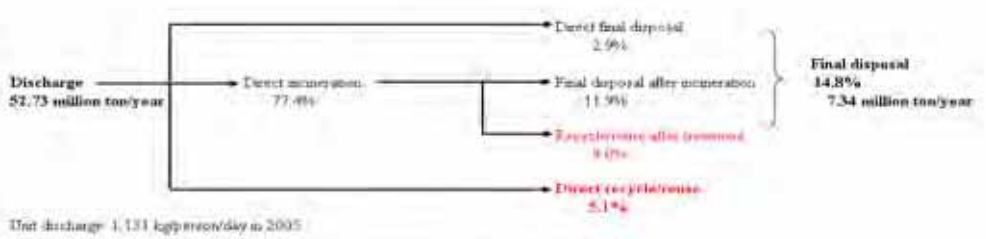
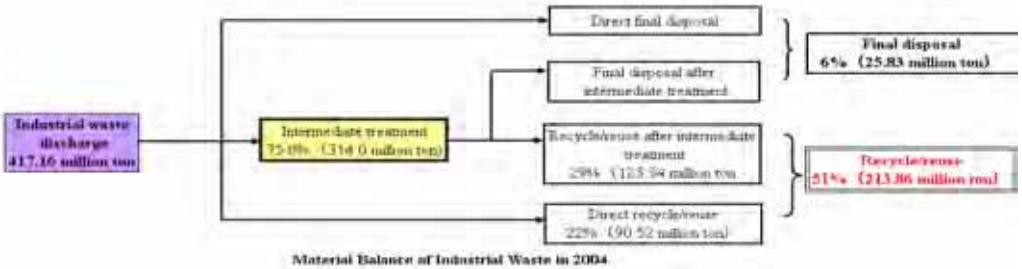
Material Balance of Waste



Unit discharge: 1,131 kg/person/day in 2005

Material Balance of General Waste



Material Balance of Industrial Waste in 2004

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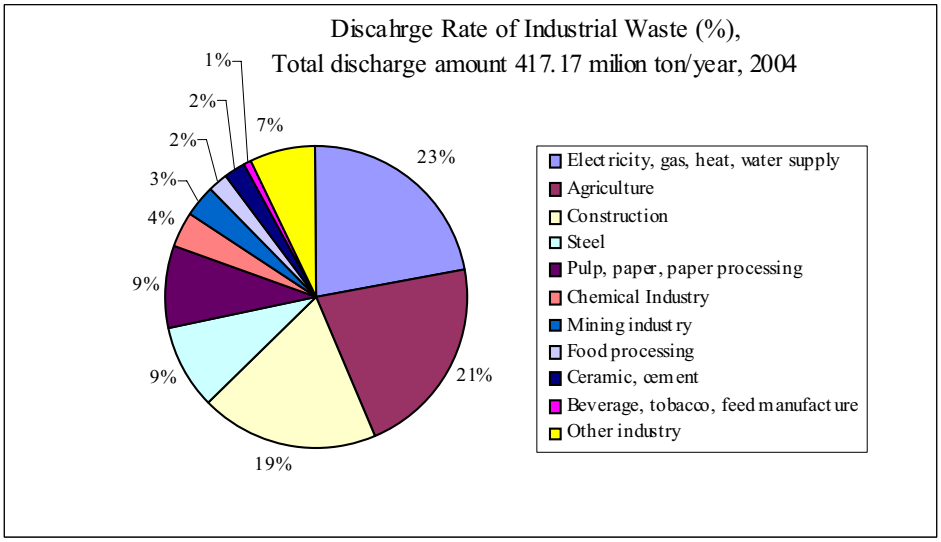
Discharge Rate of Industrial Waste



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Recycle/reuse Rate of Industrial Waste

- High recycle/reuse rate wastes: Animal waste, debris, and mining residue, metal dust. The recycle/reuse rates are 95, 92, 90 and 88 % of the discharged wastes, respectively.
- Low recycle/reuse rate wastes: Sludge, waste alkali and fiber dust. The recycle/reuse rates are 10, 23, 31 % of the discharged wastes, respectively.
- Wastes with high ratio of final disposal rate: Rubber dust, glass dust, concrete and ceramic dust, waste plastics and burnt residue. The rates are 44, 32, 32, and 21 % of the discharged waste, respectively.

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Measures of Recycle/reuse of Wastes

- To restrict waste generation
- To reuse used products and parts: Material recycle

  In case the material is not appropriate from view point of environmental load,
- To reuse the material as energy with the full consideration of environmental preservation: Thermal recycle

  And
- Finally to conduct the appropriate treatment of the generated waste

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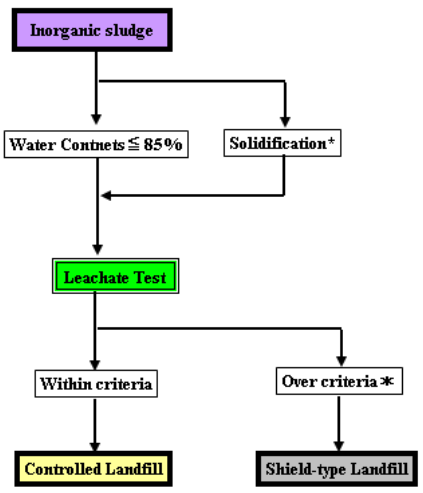
Evaluation of Industrial Waste

Inorganic waste including hazardous substances is called "Specially Controlled Industrial Waste".

By leachate test in laboratory, the sludge is evaluated how to treat and where to be disposed of.

* If sludge contains CN or Hg and leacheate test result exceeds the evaluation criteria of specially controlled industrial waste, the sludge should be solidified by concrete and leachate test shall be conducted again.



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Disposal of Organic Industrial Waste to Controlled Industrial Landfill

Organic sludge: Rot, Organic sludge, Animal residue, Animal solid waste, Livestock excreta, Dead animal and treated solid of these.) are treated as the followings and disposed to Controlled Industrial Waste Landfill.

- Incineration to Ignition residue: less than 15 %
- Concrete solidification
- 50 cm of cover soil to 3 m of industrial waste with less than 40 % of rots, 50 cm of cover soil to 50 cm of industrial waste with more than 40 % of rots.

Criteria for Concrete Solidification

- Material to combine is water hardening cement with the combination rate of more than 150 kg-cement/m^3-concrete solidification
- Concrete solidification strength: more than 0.98 MPa of one axis
- Shape and dimension
  - Volume (m^3)/area (m^2): more than 1
  - The ratio of maximum and minimum size: less than 2
  - Minimum size: more than 5 cm

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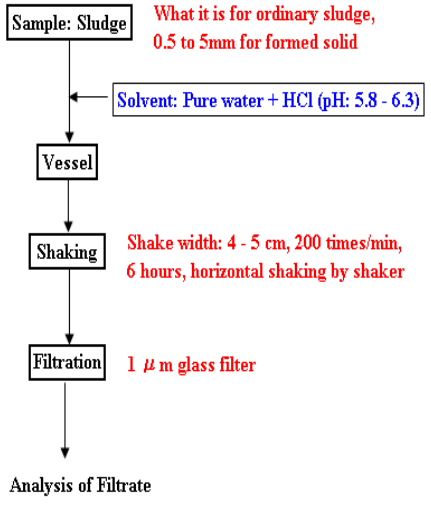
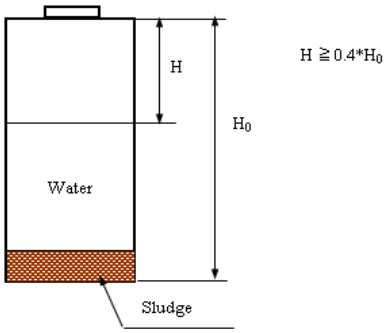
Leachate test procedure





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Comparison of Leachate Test Procedure

Country	Japan		Germany	France	USA/Canada	Switzerland	Holland		
Test Procedure	**Notice 13[1)]**	**Notice 46[1)]**	**DIN38414 S4**	**AFNOR X31-210**	**TCLP**	**TVA**	**Serial Batch**	**Colum test**	**Availability Test**
Preparation of Sample	0.5 -5 mm	<2 mm	<10 mm	<4 mm	<9.5 mm	What it is	<3 mm	<3 mm	<0.125 mm
Solvent	Distilled water +HCl	Distilled water +HCl	Ion-removed water	Ion-removed water	Acetic acid or acetic acid buffer solution	CO_2 Saturated solution	Ion-removed water	Ion-removed water	Ion-removed water + HNO_3
pH	5.8 -6.3	5.8 -6.3	-	-	2.88/4.93	(pH 5.6)	4	4	7.4 to be maintained
Sample (g)	>50	>50	100	150	100	100 - 200	40	-	16
L/S	10	10	10	10	20	10	20	0.1 - 10	100
Temperature(℃)	Normal	Normal	-	Constant temperature in water bath	22.3 ±3	-	-	-	-
Extraction vessel*	-	-	2 L flask	1.5 L flask (100 mm size)	PE bottle	Bottle	1 L PE bottle	Diameter 5 cm, Length 20 cm	Beaker
Mixing	Horizontal shaking, 4 -5 cm, 200 times/min		Reverse shaking	Vertical rotation 60 rpm	Rotation 30 ±2 rpm	CO_2 100 mL/min	Shaking	Upflow	Stirrer
Leachate time (hour)	6	6	24	16	18	24	24 x 5 steps	-	1 or 2
Test number	1	1	1 to 2	1 to 3	1	1 to 2	1 to 5	7	1 to 2
Contact with air	No	No	No	No	No	Yes	No	-	Yes
S/L separation**	1 μm GFF	Centrifuge 3,000 rpm, 20 mins + 0.45 μm MF	0.45 μm MF	0.45 MF or centrifuge >2,000 G	Pressurized filtration 0.6 to 0.8 μm GFF	0.45 μm MF	0.45 μm MF	0.45 μm MF	0.45 μm MF
Remarks	What it is for powdered sample	Test for soil contamination and recycle	-	-	Solvent is determined by pre-test	-	-	-	Test to know the maximum soluble levels

1) Notice of Ministry of Environment
* PE: Polyethylene
** GFF: Glass Fiber Filter MF: Membrane Filter

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An Example of Comparison Result

Leachate Results of a Eco-Cement

Procedure	Country	Parameter (mg/L)													
		Pb	Cr^{6+}	As	Cd	T-Hg	Se	CN	Cu	F	B	Zn	Fe	T-Cr	pH
Notice 46	Japan	NQ	NQ	NQ	NQ	NQ	NQ	NQ	NQ	NQ	0.08	0.02	NQ	NQ	12.8
TCLP	USA	NQ	0.28	NQ	NQ	NQ	NQ	NQ	0.13	NQ	0.37	2.5	NQ	0.24	6.4
TVA	Switzerland	NQ	0.007	NQ	NQ	NQ	NQ	NQ	0.06	NQ	0.09	0.74	NQ	NQ	6.4
Availability Test	Holland	NQ	0.11	NQ	NQ	NQ	NQ	NQ	1.5	NQ	0.33	4.1	0.34	0.17	-

NQ: Less than Quantitative Low Limit

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Leach ate Criteria of Specially Controlled Industrial Waste

Parameter	Unit	Effluent Discharge Criteria[1)]	Sludge	Ash, Dust, Slag
Cadmium (Cd)	mg/l	0.1	0.3	0.3
Cyanide (CN)	mg/l	1	1	
Organic phosphorus	mg/l	1	1	
Lead (Pb)	mg/l	0.1	0.3	0.3
Hexavelent chromium (Cr^{6+})	mg/l	0.5	1.5	1.5
Arsenic (As)	mg/l	0.1	0.3	0.3
Total mercury (T-Hg)	mg/l	0.005	0.005	0.005
Alkyl-Hg	mg/l	ND	ND	ND
Poly Biphenyl Chloride (PCB)	mg/l	0.003	0.003	
Tri-chloroethylene	mg/l	0.3	0.3	
Tetrachloroethylene	mg/l	0.1	0.1	
Di-chloromethane	mg/l	0.2	0.2	
Butyl chloride carbon (CCl_4)	mg/l	0.02	0.02	
1.2-dichloroethane	mg/l	0.04	0.04	
1.1-dichloroethylene	mg/l	0.2	0.2	
cis-1.2-dichloroethylene	mg/l	0.4	0.4	
1.1.1-trichroroethane	mg/l	3	3	
1.1.2-trichroroethane	mg/l	0.06	0.06	
1.3-dichloropropene	mg/l	0.02	0.02	
Thriuram	mg/l	0.06	0.06	
Simazine	mg/l	0.03	0.03	
Thiobencarb	mg/l	0.2	0.2	
Benzene	mg/l	0.1	0.1	
Selenium (Se)	mg/l	0.1	0.3	0.3
Dioxin	pg-TEQ/l	10		3 ng/g

1) Discharge water criteria of the leachate from controlled Landfill

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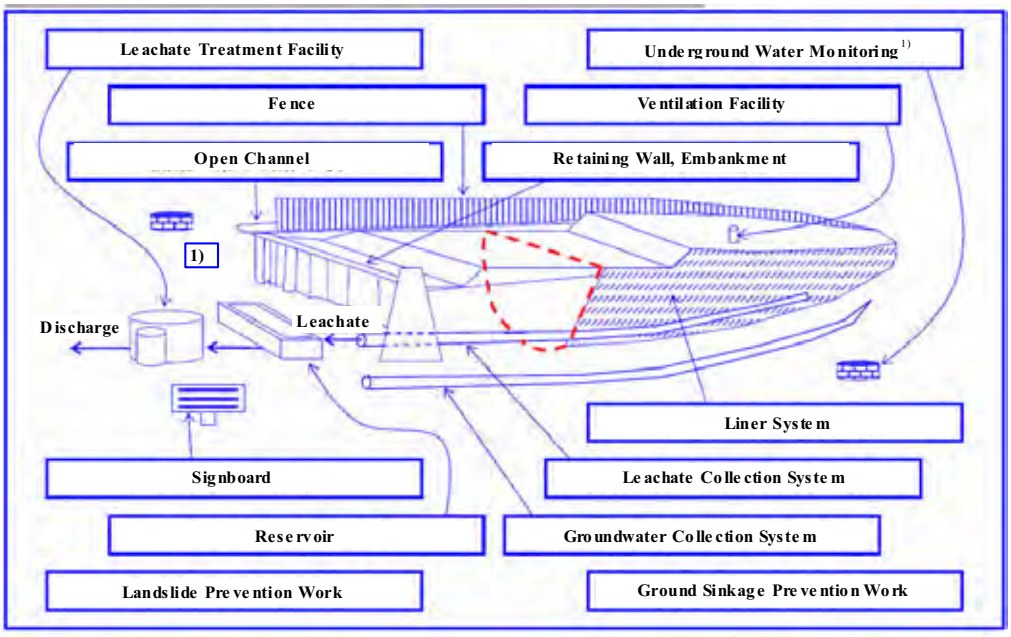
Structure etc. of Controlled Landfill



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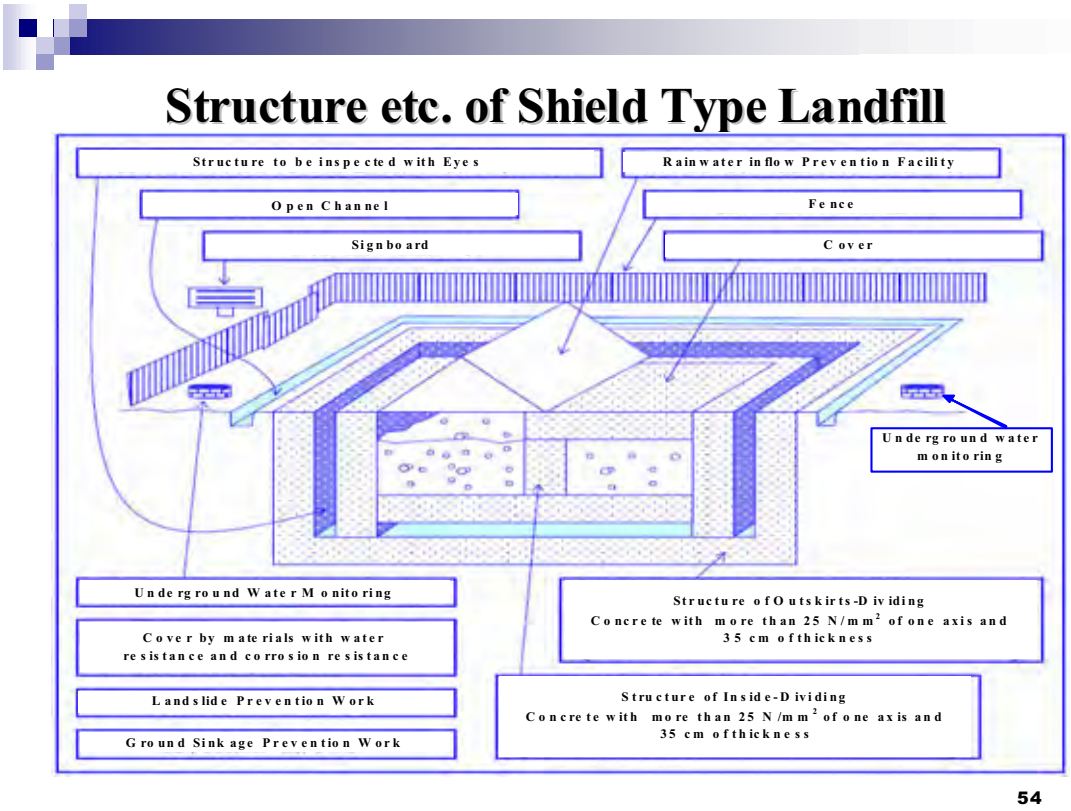

3.1.3 Certified Environmental Analyst System in Japan: How to secure accuracy in analysis