

## **4 Conclusions and Recommendations**

### **4.1 Conclusions**

1. In Japan, various kinds of waste are utilized by the cement factories in large quantity, and the cement industry is not only one of the manufacturing sectors but also a waste management service provider inevitable for Japan's industry as shown in Figure 4-1. Waste recycling has helped the cement factories to reduce the cement production cost and to carry on their business.
2. The same is equally true of the non-ferrous smelting industry, which has built its position as a waste recycler along with their original business. As shown in Figure 4-2 receiving waste containing heavy metals, the non-ferrous smelters complements waste recycling by the cement factories which do not use such waste.
3. Waste recycled by the both industries is significantly various and large in volume.
4. Their expansion into the recycling business has largely depended on the waste blenders. The conversion of waste into alternative fuel and/or raw material by the waste blenders enabled the manufacturers to integrate recycling activities into their production lines. In this way, the waste blenders play an important role in establishing an industrial cluster in which material circulates most efficiently.
5. Some of the waste blenders in Japan intend to transfer their technical know-how abroad. It is worth considering making the best of their intention to promote the waste blending industry in Thailand.
6. The team considers that the study by the DIW officers in Japan should be of great help for the promotion of the waste recycling by the cement industry and the non-ferrous smelting industry.

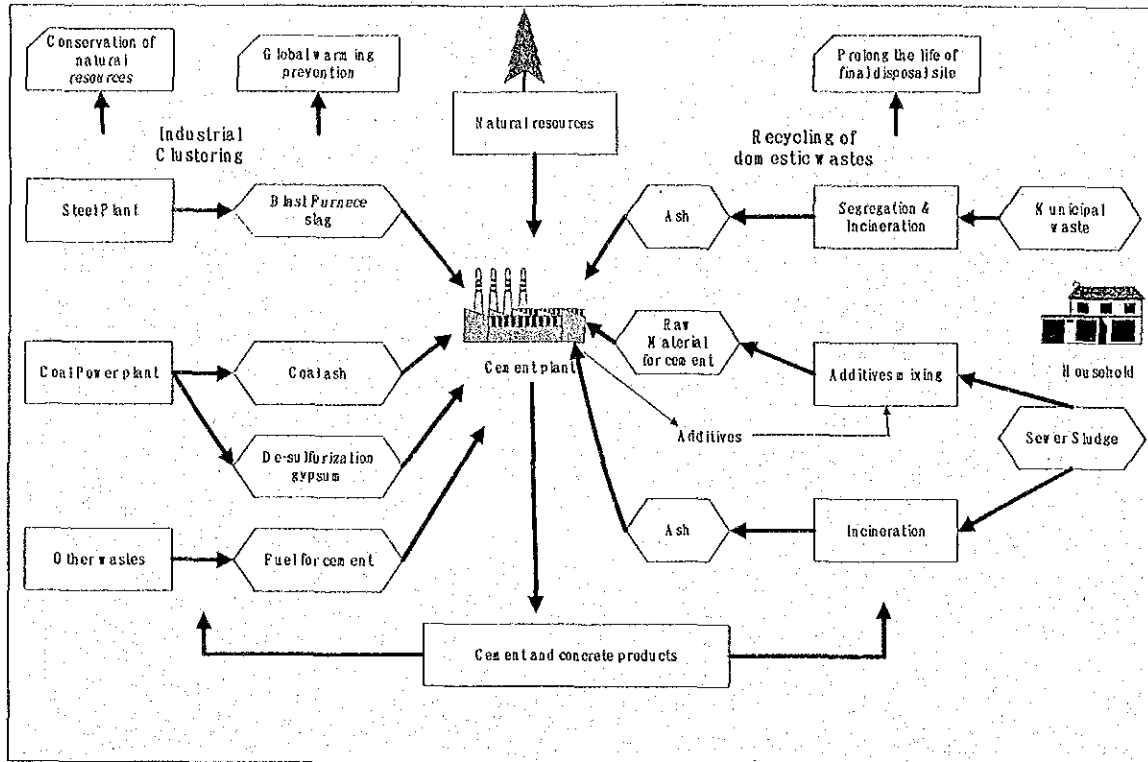


Figure 4-1: Concept of a Recycling-based Society with a Cement Factory

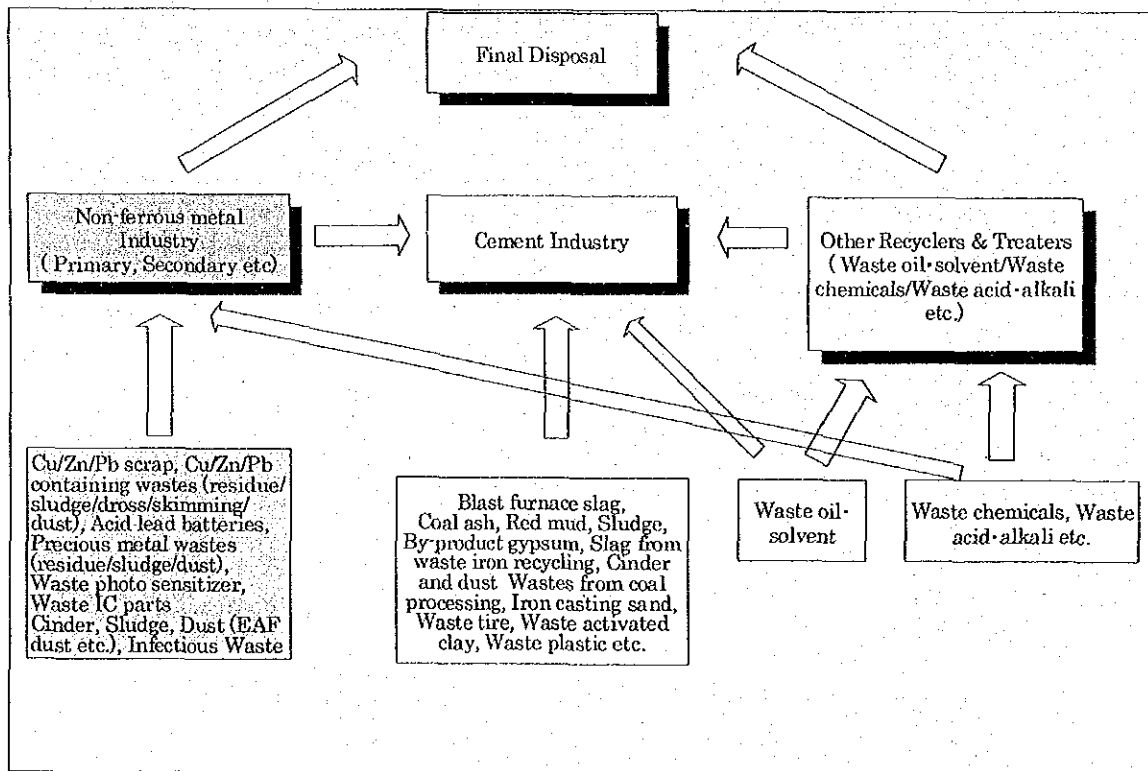


Figure 4-2: Heavy Metal Waste Recycling with Non-ferrous Smelting Industry

## 4.2 Recommendations

1. DIW should nurture and encourage the waste blending industry in order to promote waste recycling at the cement factories further and newly introduce waste recycling at the non-ferrous smelters. The policy to nurture and encourage the waste blending industry can have a twofold approach: one is directed to the waste supplying side (discharging factories) and the other is to the waste receiving side (cement industries).
  - In order to stimulate the demand of the waste dischargers for the waste blending industry, DIW should strengthen the requirement to factories for proper IWM. This should start with strict control over on-site waste final disposal. For example, the factory survey revealed that as much as 74.4% (120,000 tons/year) of waste oil and grease generated (W08), which should be valuable waste for the cement industry, is disposed of on-site. The final disposal of such kind of waste has to be environmentally careful, and if not, it must be stopped. Secondly, DIW should enforce the factories to discharge waste to licensed waste business enterprises and impose responsibility on the factories to ensure proper waste management even after they discharge it. Furthermore, DIW should clearly place a higher priority on waste reuse and recycling than on proper final disposal. Such changes in waste policy will shift waste, which is currently difficult to recycle by conventional methods and mostly disposed of on-site or off-site, to the cement factories. For example, most of sludge (W11) is at present treated and disposed of off-site after volume reduction, but some of it can be alternative raw material of cement production.
  - In order to encourage the cement factories to accept waste, DIW should provide them with information about the demand of the waste generators for waste recycling at the cement factories. Information will include information on what kinds of waste can be recycled at cement factories, and how such waste is currently treated and disposed of in Thailand. Also, DIW should promote and support the cement factories to prepare waste reception standards.
2. DIW should convey the output of its study visit to Japan to relevant people.
3. DIW should invite Japanese experts and to hold seminars to introduce the following subjects about waste blending.
  - Waste blending technology.
  - Types of waste dischargers from which waste is collected and types of waste collected.
  - Types of receivers of the product of blenders.
4. DIW should establish a licensing system of the waste blenders in order to give authorization to them so that they can be trusted by waste dischargers, and to control a waste collection/transportation system.
5. DIW should carry out the following to encourage waste recycling at the non-ferrous smelters.

- Step 1. Investigation of actual conditions of non-ferrous smelting factories which can serve as waste recycling/treatment facilities (in the whole country, if possible).
  - Step 2. Selection of the smelting factories with higher possibility as waste recycling/treatment facilities.
  - Step 3. Investigation of waste that can be accepted at the selected smelting factories (investigation of the source of zinc, i.e. electric furnaces, if zinc smelting factories are selected in Step 2).
  - Step 4. Formulation of a project implementation plan and evaluation of financial viability.
6. DIW should assist waste blenders with investment by giving them information on possible financial supports. The most possible financial support program is the Environmental Fund that the IFCT (Industrial Finance Corporation of Thailand) is responsible for. The detailed loan conditions of the fund are presented in Annex 2 of this report. If the investment involves a Japanese firm, there is the Private-Sector Investment Finance Program of JBIC (Japan Bank for International Cooperation). The Program, which is also called "support for private activity", is designed to support private enterprises planning to undertake business in developing countries with funds provided as either equity investments or loans. The detailed information of the program is available at JBIC Thai Office (TEL: 2-252-5050).

# Annex 1

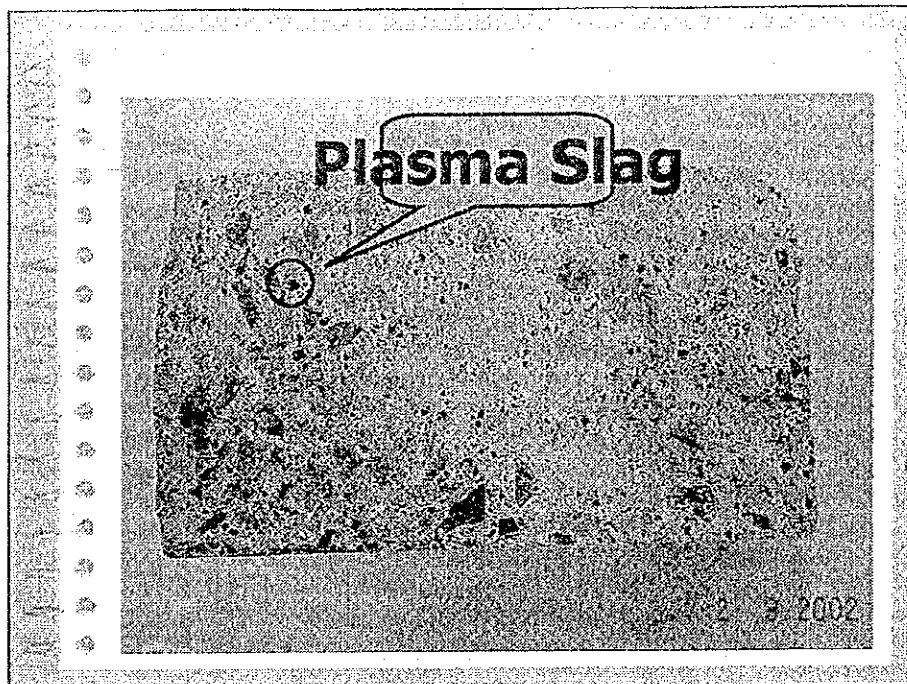
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*Field Trip Report  
from Study Tour on  
"Waste Blenders in Japan"*

**Field Trip Report from Study Tour  
on “Waste Blenders in Japan”**

**List of companies that the team visited**

1. TAIHEIYO CEMENT CO.,LTD.
2. SNK TECHNO CO.,LTD.
3. KINKI ENVIRONMENTAL  
INDUSTRY CO.,LTD.
4. SUMIEITO CO.,LTD.
5. MIKE SMELTING CO.,LTD.



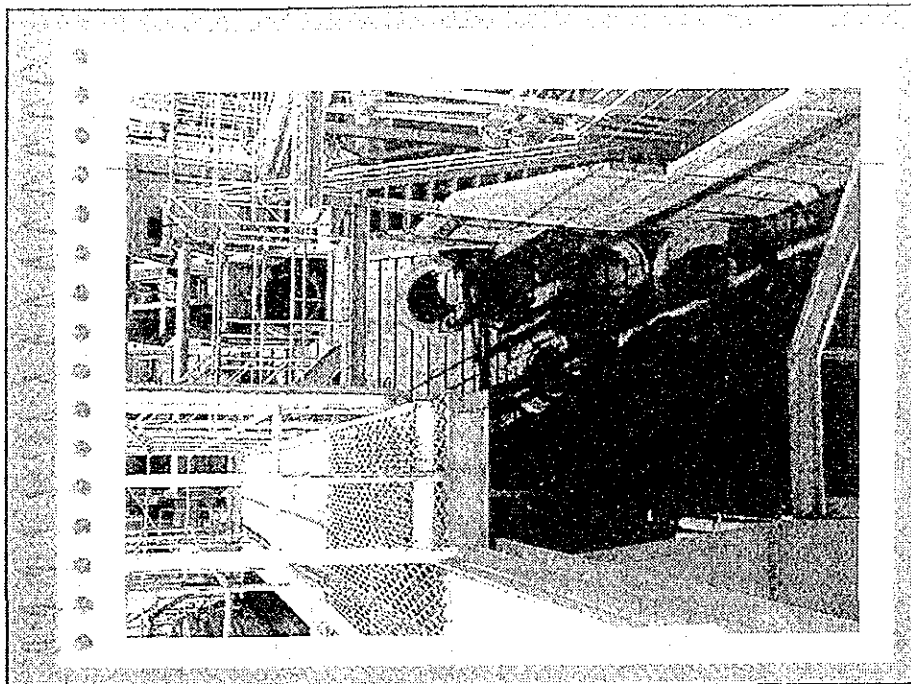
## 1. TAIHEIYO CEMENT CO.,LTD.

### Business Activities

- Cement Factory

### Industrial Waste accepted in cement kiln

- Mixed Fuel from Waste Blender
- Plastics, almost are PE, PP
- Used tire and rubber waste
- Sludge from waste water treatment plant





### **Tire and Plastic Crusher**



### **Benefits**

#### **Treatment of Industrial Waste**



**40% of energy consumption in cement kiln**

**12% of raw material in production process**

### **Quality of Mixed Fuel from Waste Blender**

- Control amount of heavy metals
- Chloride less than 2000 ppm
- Heat value more than 5,000 Kcal/Kg
- Control flash point more than 40°C
- Particles smaller than  $\phi$  5 mm.

### **Air Quality Control**

1. Install Continuous Monitoring System to check SO<sub>x</sub> NO<sub>x</sub> Co and O<sub>2</sub>
2. Dust Monitoring every month
3. Dioxin Monitoring twice a year

**2. SNK TECHNO CO.,LTD.**

**3. KINKI ENVIRONMENTAL  
INDUSTRY CO., LTD.**

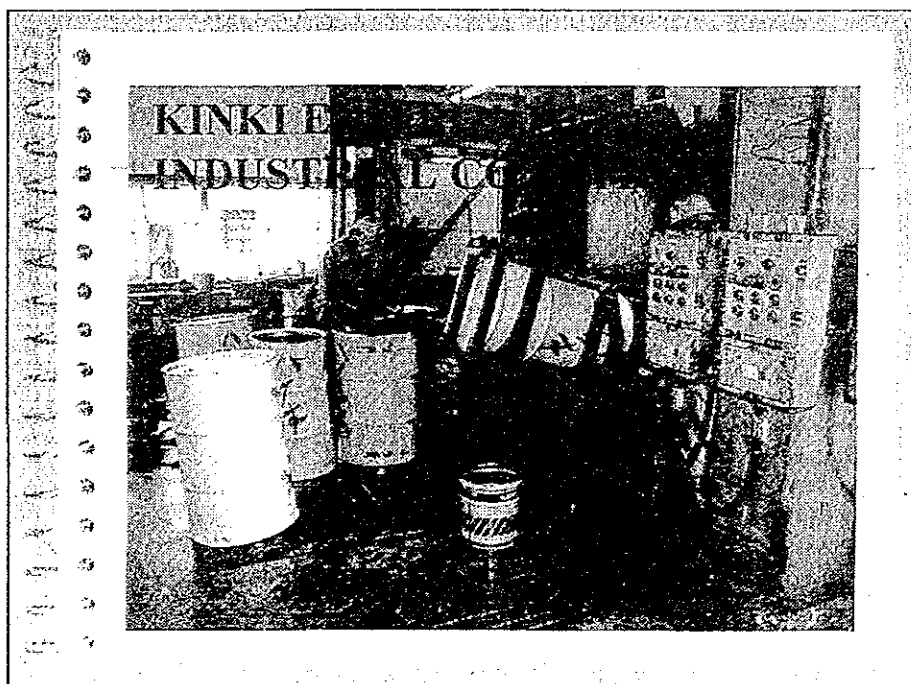
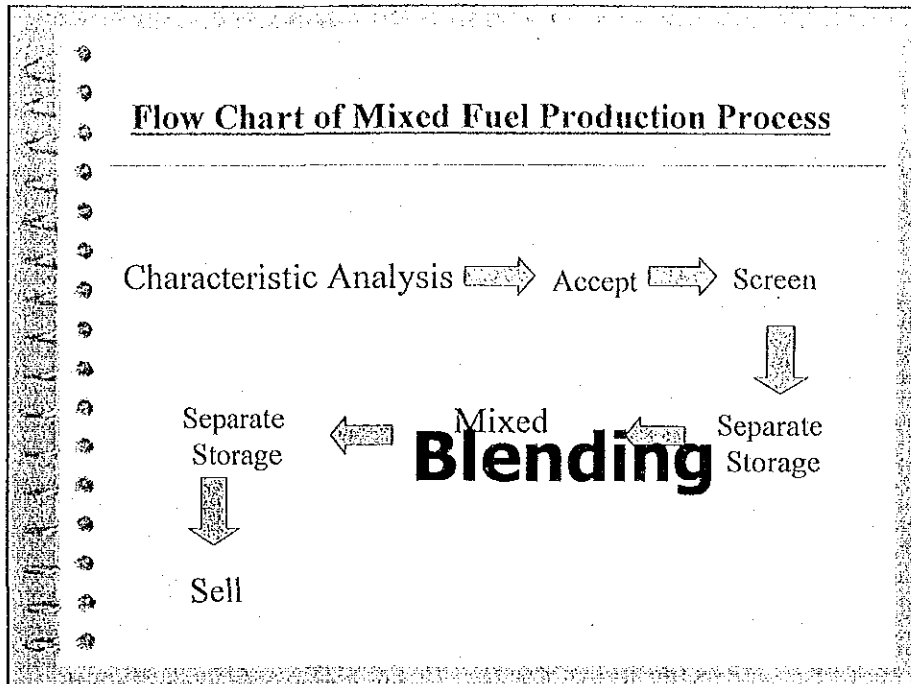
**4. SUMIEITO CO., LTD.**

**Business Activities**

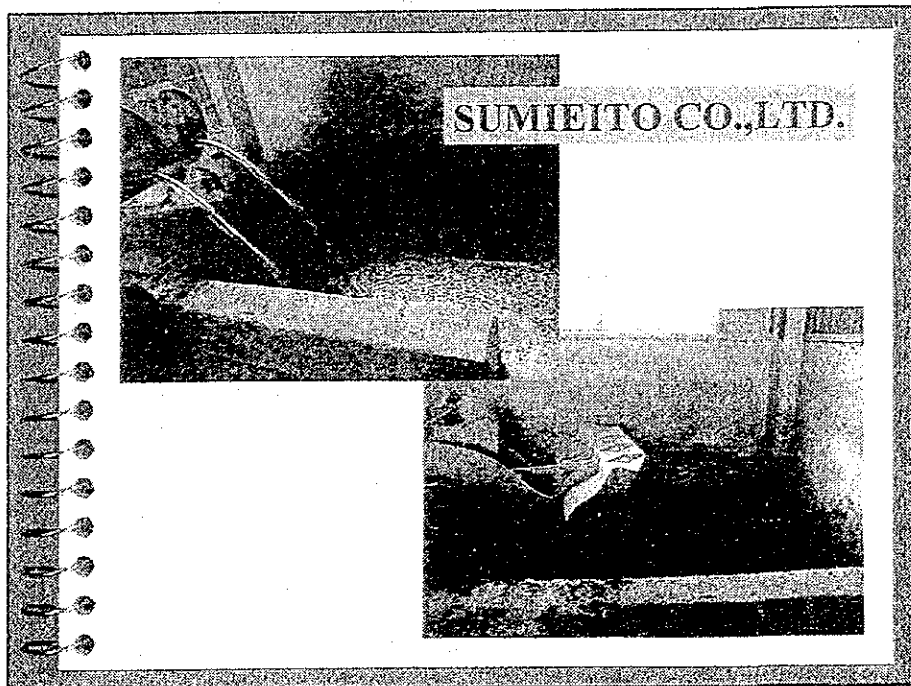
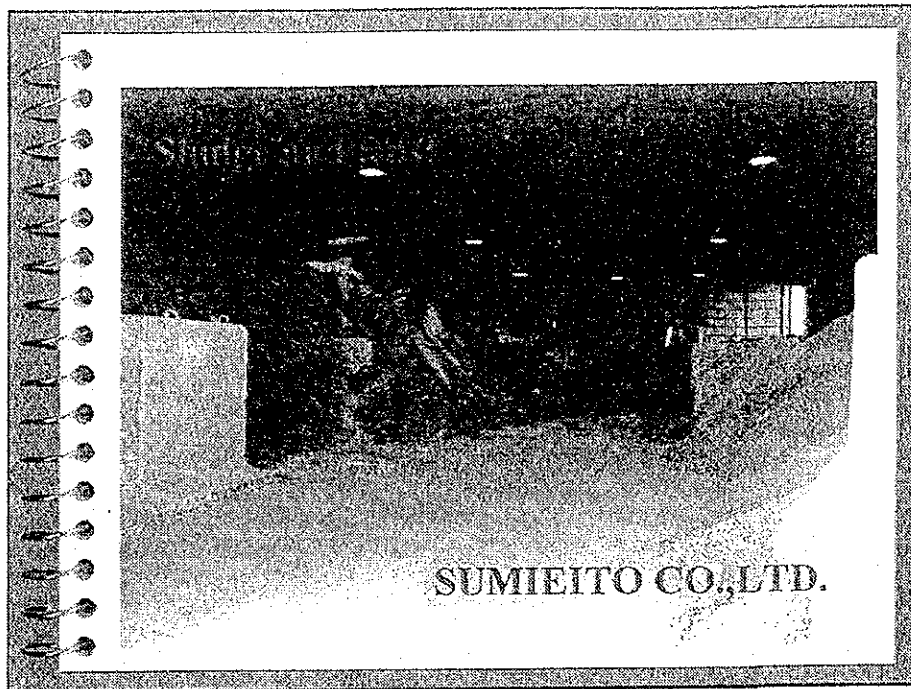
- Mixed fuel and alternative raw material from industrial waste for cement factory and metal smelting factory

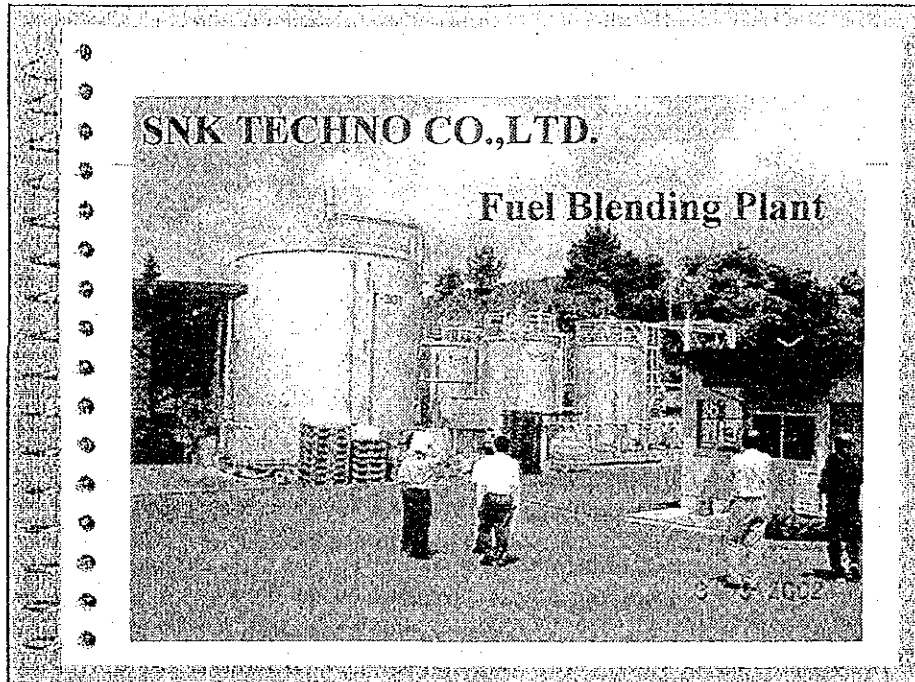
**Type of Industrial Waste for Dispose**

- Waste Oil & Oil Sludge & Solvents
- Waste Water Sludge
- Coolant
- Paint Sludge, Spent Resin, Ac. Carbon
- Off-spec Cream and Emulsion
- Acid solvent and alkali
- Fly ash, china clay, spent catalyst









### Quality of Mixed Fuel

Depends on cement factory. Almost parameter will be set as follows;

- Chloride less than \*\*\* ppm.
- Heat value more than \*\*\* Kcal/Kg
- Flash point more than \*\*\* °C
- Particles smaller than \*\*\* mm.
- Total heavy metals less than \*\*\* ppm.

## 8. MIIKE SMELTING CO.,LTD.

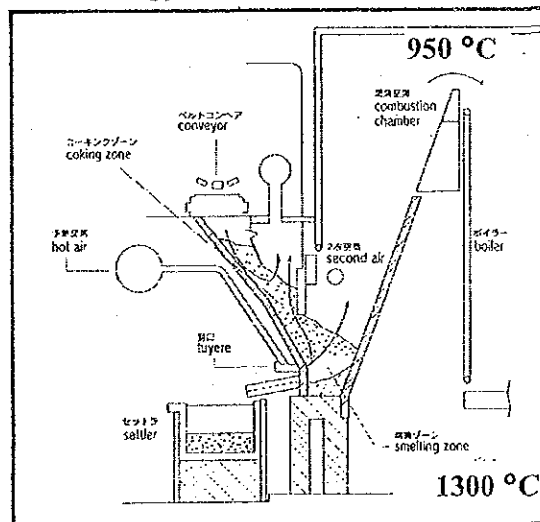
### Business Activities

- Produce zinc oxide 65 % from EAF Dust
- Industrial Waste Treatment by Incineration

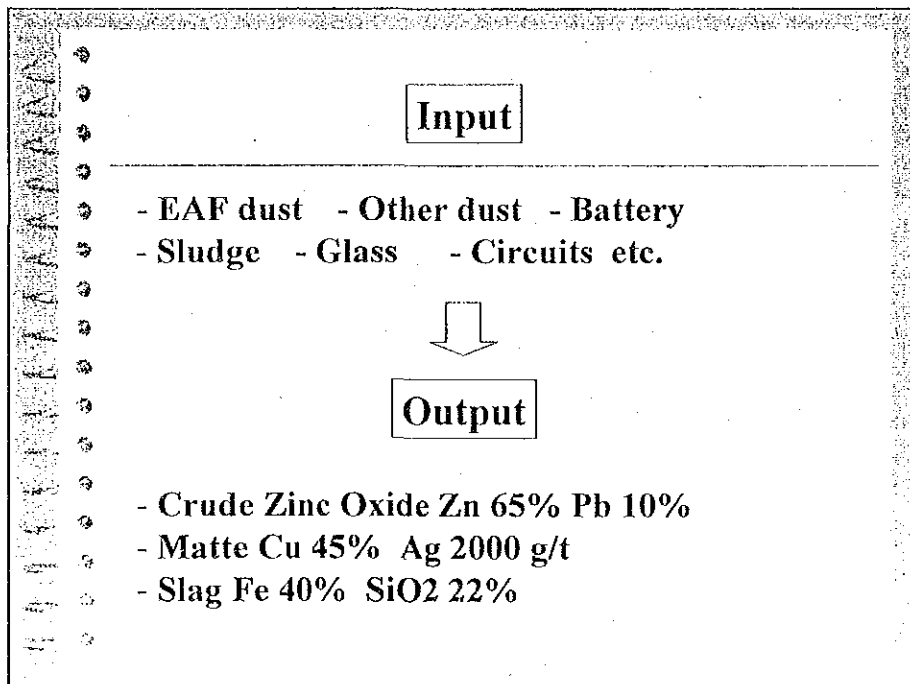
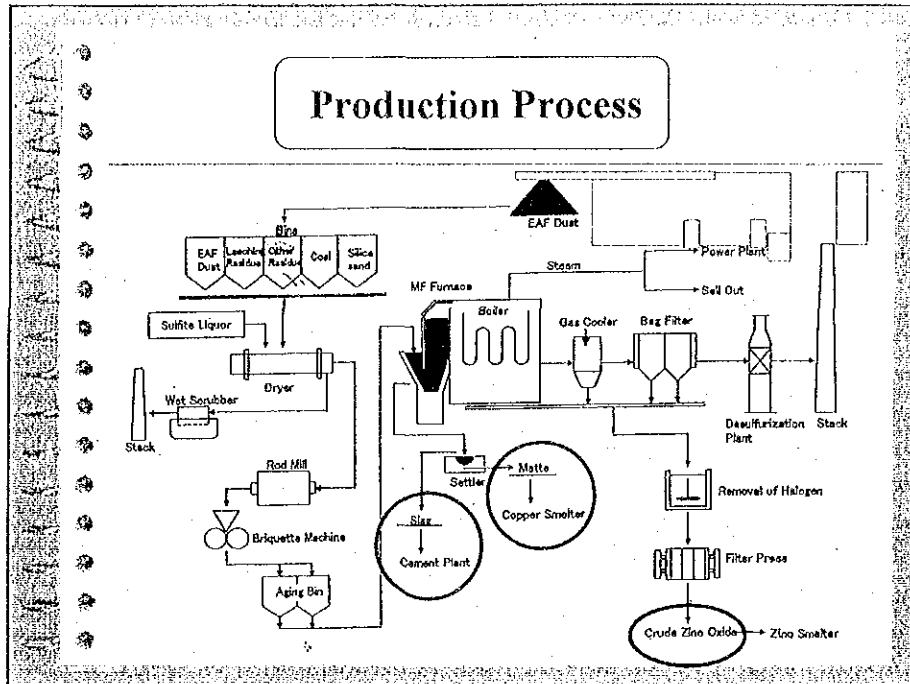
### Special Characteristic

- Incineration by Half Shaft Blast Furnace (Mitsui Furnace)

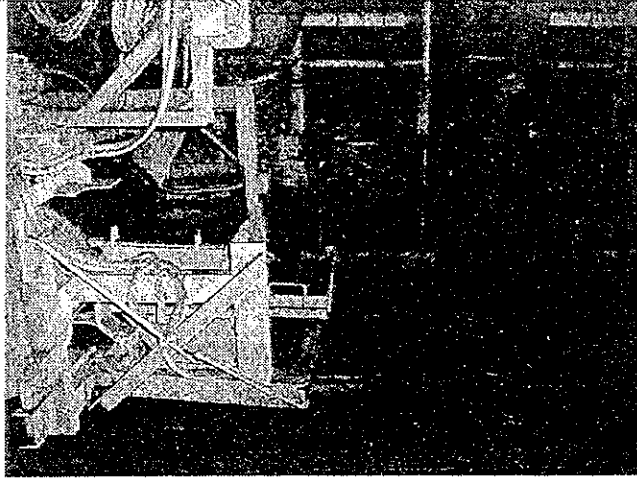
### Technology of Half Shaft Blast Furnace







### Furnace Charging Hopper



### Zinc Oxide 65%





# Annex 2

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## *Environmental Fund*

## **Annex 2: Environmental Fund**

### **Project Qualification**

It is industrial private project or other public services which activities and process that may cause pollutant problems. The fund aims at small and medium enterprises which investment in fixed assets of up to 400 million Baht and being the project with one of the following purposes

1. Construct and install of air pollution control or water treatment, waste treatment or facilities to control, treat or dispose pollutants that occurs from activities or process.
2. Demolish or move industrial establishment in unsuitable area to locate in industrial estate, industrial zone or suitable area that has waste water treatment or waste treatment
3. Central Pollution Treatment Project which licensed of waste water treatment services or waste dispose in accordance with Enhancement and Conservation of National Environmental Quality Act 1992. In this case the project cost is not limited.
4. Invest in order to solve environmental problems such as clean technology or as consideration of Environmental Fund.

### **Terms of Loan**

1. Loans available in Baht
2. Maximum loan amount is not exceed 20% of investment in project fixed assets and it must not exceed investment cost of pollution treatment system in item 1.
3. Maximum loan amount is not exceed 60% of investment in project fixed assets for item 2 and 3.
4. Environmental Fund will take loan consideration case by case for project in item 4.

**Loan Interest** : Average MLR\* -3.00 to -1.50%

(\*Average MLR is the average interest rate quoted by 5 commercial banks, namely Bangkok Bank, Krung Thai Bank, Thai Farmers Bank, Siam Commercial Bank and Bank of Ayutthaya.

**Loan Period** : not over 7 years (including grace period not more than 2 years)

JICA