Chapter 3

Waste Prevention and Recycling

3. Waste Prevention and Recycling

3.1 Current Conditions

1) Weak Regulatory and Legal Enforcement

In Romania, where the framework for environmental management is still being worked out, management of industrial wastewater, flue gas and waste are not effectively controlled and monitored by the administration. Therefore, Romanian factories in general are not well furnished with so-called end-pipe pollution control equipment. It is assumed that industrial effluents and flue gases contain a significant volume of hazardous wastes

It is also assumed that a large volume of hazardous substances, which are not identified as hazardous wastes, are discharged into the environment along with wastewater and flue gas (Missing HW). The legal enforcement will be strengthened and end-pipe pollution control equipments will be well furnished in a future, above missing wastes will be well collected and be identified as the HW.

Furthermore, there are no standards at this moment for collection, transportation, recycling, treatment, and disposal of hazardous waste. A shortage of facilities is also apparent. Under these conditions, awareness of proper management of hazardous waste is not well recognized by factories generating hazardous waste.

2) Low Level of 3R for HW

Some waste seems to be effectively recycled on-site. However, hazardous waste is generally stored and buried on site in factories, or is disposed of together with non-hazardous waste at off-site landfills. It is also possible that hazardous waste is taken over by non-hazardous waste collection and recycling contractors, such as REMAT, and is illegally treated and disposed of. Elementary volume reduction of HW, such as dewatering of sludge as pre-treatment before on-site storage and landfill, is attempted. However, even segregation of non-hazardous and hazardous waste is not sufficient at present. (Segregation of HW is the first step of 3R activities.) According to OECD report regarding "Progress in achieving basic capacity level for cleaner production in CEEC/NIS"¹, Romania was outdistanced by other central and eastern European countries in terms of basic capacity level for CP².

It can be said that in general the 3Rs (Reduce, Reuse, Recycle) are not frequently employed.

3) Lack of Recycling Facilities for HW

414 recycling companies are registered with the National Commission for Material Recycling (NCMR) of the Ministry of Industry and Resource. Under the socialistic regime, mainly non-HW recyclable waste was recycled off-site under national control. It is assumed that, even after the revolution, recyclable waste recycling has continued, inheriting the procedures of socialistic regime, even though some retraction

¹ Progress in achieving basic capacity level for cleaner production in CEEC/NIS"1 OECD/OCDE 1998 CEEC; Central and Eastern European Countries,

NIS; New Independent States

² Basic capacity level for CP: An active core of CP advisers and trainers, a set of CP case studies,

demonstration projects and model business plans, a functioning CP centre or centres, training materials in the local languages, cleaner production principles, a monitoring framework and quality assurances.

may be observed. However, HW recycling companies registered with the NCMR handle only easy-to-recycle HW or HW that contains comparatively high content of valuable metals. They reclaim waste oil or recycle lead from waste lead acid batteries or non-ferrous metal secondary smelting.

			ategories ano t
Category		No.	Remark
Collection and sorting of	Iron scrap	258	
recyclable wastes	Non-ferrous scrap	131	
	Paper & cardboards	82	
	Glass	29	
	Plastic	63	
	Rubber	35	
	Textile	35	
Waste oil regenerator		3	
Secondary smelter of non-ferrous metals		87	
Acid lead batteries		3	
Total		414	

Table 3.1.1	Numbers	of Recycle	rs by	Category
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(Plural categories allowed)

Source: National Commission for Material Recycling (NCMR), Ministry of Industry and Resources

4) Barriers to Off-Site Recycling

Barriers to the creation of an off-site recycling business are summarised below.

- Establishment of a proper legislative framework is on the way to formulation. A law exits, but formulation of actual regulations, standards and criteria for implementation is in progress.
- The PPP principle is not implemented.

Waste generators' priority is to solve their financial problems, not environmental protection

- Generators of some kinds of waste such as waste oil tend to consider that waste oil is a product, and expect to be paid a high price for the product where as proper disposal of such waste actually involves costs.
- Non-ecological solutions are applied (uncontrolled landfilling or incineration, blending into other products and selling as such, etc)Lack of transparency when reporting generated wastesThe small quantities reported and collected at present do not provide adequate incentives for the cement industry to invest in the measures required to treat and recycle wastesLack of companies specialized in collecting/ transporting/ pre-treating wastes

In short, HW management is controlled in an insufficient manner. The proper flow of HW has not been established. Potential private businesses in this area do not have the required information about the volume of HW that should be properly treated and disposed of, so costs and charges cannot be estimated accurately. The basic legal and regulatory framework for waste recycling and treatment still needs to be established.

3.2 Hazardous Waste Management Hierarchy and Benefit

3.2.1 Waste Management Hierarchy

It is widely recognized that basic policy for waste management should be to give priority to 3R. Final residues should be made harmless and disposed of, and returned to the environment. In particular, priority is generally given to waste reduction at the stage of raw material development and actual production, before generation of the waste. In line with this concept, OECD classifies "reduce" and "reuse" into Strict Avoidance, Reduction at Source and Product re-use, and calls these three types of activities "waste prevention" Figure 3.2.1 shows the OECD's concept of "waste prevention," its relations with 3Rs, and the priority that should be given to each.

Strict Avoidance involves the complete prevention of waste generation by virtual elimination of hazardous substances or by reducing material or energy intensity in production, consumption and distribution.

Reduction at source involves minimizing use of toxic and harmful substances and/or minimizing material or energy consumption.

Product re-use involves the multiple use of a product in its original form, for its original purpose or for an alternative.

Romania aims to join the European Union in 2007. It is noted that Article 3 of the EU Waste Framework Directive (96/350/EC) defines the priorities as mentioned below.

- 1. Reduce
- 2. Reuse, Recycle or Thermal recycle
- 3. Treatment and disposal



Source: JICA Study Team

Figure 3.2.1 Waste Prevention

3.2.2 Benefit of Waste Prevention

Waste prevention not only reduces waste management costs for the companies concerned but also saves resources and energy, which leads to the reduction of production

costs. In particular, it is considered to be an important strategy as environmental protection measures for small and medium-size companies. There is the possibility that some improvements in and changes and modifications to uses of raw material, facilities, and processes can be made without further investment; indeed, actual reduction in investment costs may be possible.

For society also, it is possible to decrease material, energy, and facilities required for collection, storage, treatment and disposal by reducing the volume of HW to be discharged. This is a Win-Win (reduction of costs and hazardous potential) approach that ultimately leads to a decrease in the hazardous load imposed on the environment.

3.3 Objectives

The general objectives with respect to the hazardous waste prevention and recycling are considered as follows:

- To minimize health and environmental impacts
- To increase productivity by increasing rate of utilization of raw materials
- To save costs of production as result of the above activity.
- To preserve natural resources

3.4 Strategy

3.4.1 Approach

Hazardous waste generators must have some incentives for doing prevention and recycling activities for the hazardous waste. Main incentives and practical approaches based on the incentives are presented below.

- Incentive 1 for waste prevention and recycling: High cost of disposal of hazardous waste
 - Generators who pay high costs of disposal have an incentive to reduce generation of hazardous waste to reduce disposal cost, while those who are allowed to apply cheap disposal methods do not.

Strategy: Therefore, enforcement of legal and appropriate disposal of hazardous waste is important for promotion of the prevention and recycling.

- Incentive 2: Shrinkage in illegal recycling market
 - In Romania, there exist a waste oil market where waste oil is illegally traded and reused posing environmental and health problems.
 - Existence of this market provides waste oil generators with disincentives for paying costs for proper disposal or recycling of waste oil, which can be effectively disposed or heat-recovered with cement kilns.

Strategy: Therefore, the legal enforcement and awareness raising for hazardous waste generators is important to stop illegal recycling of waste oil.

Incentive 3: Compliance regulations enforced by the environmental authority
 IPPC directives will be enforced in Romania in a few years time.

Romanian enterprises will have to comply with IPPC directives to obtain environmental permits.

Strategy: Therefore, EPIs' determined enforcement by MWEP and EPIs is important.

- Incentive 4: Possible increases in productivity and associated reduction of production costs
 - Waste prevention and recycling contribute to productivity increases and resulting cost reduction.
 - Enterprises need to have the above awareness.

Strategy: Therefore, awareness increases for waste generators is important.

- Incentive 5: Possible increases in level of safety and health of employees and local residents
 - Waste prevention and recycling contribute to the above
 - Enterprises need to have the above awareness.

Strategy: Therefore, awareness increases for waste generators is important.

- Incentive 6: Better corporate image
 - Corporate image perceived by public and business will improve if the company obtain IPPC compliance certificate or ISO 14001
 - Improved corporate image and status will help the enterprises to increase opportunity of export and market expansion.

Strategy: Creation of good examples (success story of an enterprise with IPPC compliance and improved corporate image and better business chance) and its diffusion is important.

3.4.2 Policy Instruments for Waste Prevention and Recycling for three Prioritized Industry Sectors

The strategy for HW prevention and minimization should be integrated into various policies, such as environment, industrial, resources pricing, trade and educational policies. In order to promote such policies, there are several instruments categorized in following three areas.

Instrument category	Example
Regulatory instrument that mandate specific behavior	 Specified and negotiated compliance Negotiated agreement Reporting requirement (such as PRTR) Auditable Environmental Management System (EMS) (such as ISO 14000) Public voluntary program Industry Codes of Practice (such as Responsible Care)
Market-based instrument that act as incentive for particular activities	 Taxes, charges and fees Liability rules Subsidies
Information-based instrument that seek to change behavior through the provision of information	 Promotion of high-profile demonstration project such as cost-saving by waste minimization Encouraging educational institute for preventive management Public disclosure of environmental performance Eco-labeling schemes Training of waste minimization

 Table 3.4.1 Policy Instruments for HW Prevention and Recycling

Source: JICA Study Team

An effective HW waste prevention and minimization strategy should have the right mix of these instruments. As discussed in the hazardous waste generation section, the priority fields/industries for hazardous waste generation in Romania are the non-ferrous metal smelting industry, the chemical industry and the electroplating and surface treatment industry/process. Following is a brief review of the position of each industry.

1) Non-Ferrous Metal Smelting Industry

Once it was known as the most serious polluting industry and it still generates large quantities of hazardous waste. Historically, the industry processed the concentrate obtained in domestic mines such as Baia Mare. However recently they process imported ore, because of the closure of domestic mines. This situation induced the industry to consider and initiate the processing of recycled material in place of concentrate. From a waste prevention and minimization viewpoint, this is a substitution of the raw material by a cleaner material. From a technological viewpoint, non-ferrous metal smelting facilities are most comprehensive treatment system for recycling of hazardous waste which includes heavy metals, such as waste lead batteries. From this aspect, promotion of the transition from non-ferrous metal smelting industry to resources recycling industry is appropriate strategy.

2) Chemical Industry

The chemical industry is one of the most active industries in Romania, and is a typical plant-based industry. However, in general, many facilities have out-dated technologies and processes compared to their competitors in other countries. For the chemical industry to have better waste prevention and minimization, processes and facilities have to be modernized. Simple good practice and management at the operational level may be unable to achieve much. On the other hand, modernization of the facilities requires large investment. As many industries are still state-owned, such investment is very much dependent on the government's chemical sector policy. A simple enforcement approach is not appropriate to control the hazardous waste situation in the chemical industry. There must be a good mix of promotional measures for good practice through self-regulating activity like Responsible Care combined with development of an industrial policy with funding for modernization.

3) Electroplating & Surface Treatment

Electroplating and surface treatment is a common process in various manufacturing and assembling industries. This type of process and industry will be increasing in the future as more investment takes place in Romania. Compared with the chemical industry, waste prevention and minimization can be achieved without major investment. Furthermore, such waste prevention and minimization is often also cost saving to the factories, i.e. a WIN-WIN case. Proper enforcement and resource pricing policy such as for water consumption may increase the opportunity for WIN-WIN investment. The right mix of enforcement, market-based and information-based instruments can promote waste prevention and minimization in this sector.

The following table summarizes the appropriate strategy for waste prevention and minimization in general and for priority industries/sectors based on the three categories of instrument

	Regulatory	Market-based	Information-based
General for waste prevention and minimization	 Strengthening of enforcement by EPI Strengthening of hazardous chemical management and restriction 	 Establishment of CP fund Provision for CP consulting services Utilizing exiting facilities in terms of HW management 	 Formation of CP information network Implementation of demonstration project CP information seminar, workshop Strengthening of national CP center CP training
Priority to Non-ferrous smelting industry	 Restrict improper recycling of waste battery Enforcement of dust emission from furnace facility 	• Increase economic feasibility of heavy metal recycling by charges/fee and subsidies provision	Ĩ
Priority to Chemical industry	Promote self -regulated Industry Code practice such as "Responsible Care"	Provision of modernization fund	
Priority to Electroplating & surface treatment	• Strengthening of waste water monitoring and regulation	Adequate resource pricing policy for water consumption	

Table 3.4.2 Strategy for HW Prevention and Recycling for Three Industrial Sectors

Source: JICA Study Team

Detail strategies are mentioned chapter 3.4.2 and chapter 3.4.3.

3.4.3 On-Site

1) Dissemination and Development of Cleaner Production Technology

As concrete means of HW prevention and recycling, it goes without saying that the dissemination and development of Cleaner Production Technology is important. This is, however, not necessarily successful in many countries (developing countries, in particular). In addition to administrative legal enforcement and CP promotion measures, an increase in awareness about environmental management by HW generators is essential.

Table 3.4.3 shows Cleaner Production promotion measures to be taken by an administrative body.

Bottleneck	Measures for encouragement
Information, Technology Consulting Education	 Formulation of CP information network among government organizations, industries, universities and research institutes. Implementation of demonstration projects Provision of CP information (Seminar, workshop, exhibition etc) Establishment of organization in charge of CP promotion Establishment of national/regional CP centre Provision of CP training Fostering and licensing of CP consultant
Fund	 Establishment of CP fund (Provision of special loan for introduction of CP process, equipment, facility and improvement to CP process, equipment, facility) Provision of subsidy or grant for CP consulting service

 Table 3.4.3 Measures for Encouragement of Cleaner Production

Source: JICA Report of Cleaner Production, 2001 May

Survey and planning of promotional measures for Cleaner Production is a large-scale project and cannot be covered by the master plan survey this time. The team proposes the following two Action Plans related to the present master plan survey among the CP promotion measures.

In a specific industrial sector, factories use the same or similar raw material, facilities, process, and technology. Therefore, it is often more effective to formulate CP promotion measures and implement them on an industrial sector basis than on a factory basis. Particularly, in Romania, factories with metal plating or metal surface treatment processes generate hazardous waste such as sludge in large quantities and this constitutes a big problem. Therefore, Action Plan E1, a CP promotion plan for the metal plating and metal surface treatment industries is proposed. This Action Plan should be carried out in making the best of outcome and experience of pilot project No.2.

As a complementary activity, Action Plan K1 proposes creation of a funding mechanism to facilitate investment in improved HW management.

2) Introduction of HW Audits

In order to promote proper management of hazardous waste on-site, inclusion of

HW as a part of environmental management systems is necessary. Introduction of HW audits would be effective part of HW management. Table 3.4.4 shows an example of HW audits checklist. In order to introduce HW auditing, MEWP should prepare appropriate guidelines.

 To grasp present situation of HW generation, type and amount of To grasp present situation of treatment and disposal of HW To grasp present situation of HW prevention and recycling 			HW generation, type and amount of HW reatment and disposal of HW HW prevention and recycling	
Scope		All the HWs generated from factory concerned		
		Management system	Usual, Unusual, Emergency	
		• Segregation	Types, Place	
Genera	General	 Annual treatment and disposal cost 	On-site & Off-site	
	_	• Treatment and disposal flow	On-site & Off-site	
		Management contractors	Amount & type	
Check		• Annual generation amount	Amount, Situation of prevention & recycling	
Points		• Legal and regulation	Situation of legal compliance	
	HW type	Treatment & recycling	Treatment, dispose and recycling method	
	51	• Cost	Treatment, dispose and recycling cost	
		Pollution prevention equipment	Operation & Maintenance	
		 Monitoring equipment 	Operation & Maintenance	

Table 3.4.4 Checklist for HW Audits

Source: M. Tanaka, 1999

3) Diffuse "Responsible Care" and "Voluntary Environmental Management"

As mentioned earlier, a simple enforcement approach is not appropriate to control hazardous waste situation for the chemical industry. In order to promote HW prevention and recycling in the sector, the team proposes a self-regulating activity like Responsible Care. (See Action Plan E3 "Diffuse Responsible Care and Voluntary Environmental Management to chemical industry and petro-chemical industry").

3.4.4 Off-Site

1) Promotion of HW Recycling and Disposal by Utilizing Cement Plants

Table3.4.5 shows the quantity of HW in Romania that generally can be treated and

recycled in cement kilns. In this table, the amount of generally acceptable HW in Romania amounts to around 790 thousand tons per year, which equals approximately two thirds of total HW generation nationwide. In particular, HW categorised in waste oils amounts to around 582 thousand tons annually. It is almost 49 percent of all HW.

In Romania, there are four cement clinker and cement product manufacturers with nine plants. All the four companies have already been privatised. Total clinker production capacity is 11 million tons per year. Actual production in 2000 was approximately 6 million tons, the rate of operation remaining at about 50%. Figure 3.1.1 illustrates the location of cement plants, oil refineries and non-ferrous metal smelters in Romania. The cement plants are distributed widely all over the country. The cement industry in Romania intends to participate in recycling and treatment of alternative raw materials and fuel in the cement kilns. In October 2002, a seminar on waste recycling and treatment for the cement industry was held by CIROM¹ and its four members Romanian cement companies.

¹ CIROM; Cement Industry and Other Mineral Products for Constructions Owner's Association

Waste Type	Waste Name	Quantity (ton/year 2002)	
Acid	Acid	40	
Asbestos	Asbestos	25,463	
Chemical	Sludge containing chemicals	22,467	
	Waste water containing chemicals	18,471	
Cyanidic	Cyanide containg heavy metals other than	47	
Waste	Cyanide	9	
Explosive	Explosive	40	
Halogens	halogen wastewater	4	
-	Halogenated sludge	2,591	В
	Sludge (Halogenated sludge)	4,385	В
	Sludge containing halogenated solvents	64	В
Cr6+	Cyanide-free liquid waste containing chromium	18,363	
Infectious	Infectious	16,75204	
Lead	Lead battery	12,777	
Metal	Al dross	6,239	
	Al dust	30,400	
	Boiler dust	52	
	Copper dust	304	
	Copper slag	164,766	А
	Lead	13	
	Lead dross	14,573	
	Lead dust	9,375	
	Lead slag	107,045	А
	Metal sludge	13,160	
	Other non-ferrous dross	13	
	Sludge (Metal sludge)	834	
	Zn dross	3,729	
	Zn dust	308	
	Zn slag	2,517	А
	Sum	353,328	
Oil	Acid tar	1,797	В
	Emulsion	44,903	В
	Machine oil	256	А
	Oil	30,421	А
	Oil (Engine or gear oil)	453,507	А
	Oil (Engine or gear oil) chlorinated	16	В
	Oil (Hydraulic oil)	6,085	А
	Oil (Hydraulic oil) chlorinated	1	В
	Oil medium	1,295	
	Oil sludge	27	А
	Oily water	140	
	Still bottoms	7,417	В
	Tank bottom sludge	26,341	А
	Tar	10,564	
Organic	Organic solvents	1,693	Α
0	Paint without halogen solvent	32	В
Other	Casting sand	19,932	В
inorganic	Catalyst	39	
-	Filter clays (waste activated clay)	502	А
	Photo fix	10	
	Scale	32	
Other	Machine emulsion	331	
organic	Organic chemicals	2	
-	Pesticide packageing	25	
PCB	Transformer containing PCB	513	
Sludge	Sludge	105,576	В
WWT	Sludge (Waste water treatement)	18.523	В
	Total	1.288.078	

 Table 3.4.5 Applicable HW Treated and Recycled in Cement Kilns

A;Applicable,B;Possible

Source: JICA Study Team



Source: JICA Study Team

Figure 3.4.1 Distribution of Cement Plants, Oil Refineries and Non-Ferrous Metal Smelters

Private contractors for HW recycling are limited in waste type and number. It will not be easy to enforce strengthened HW laws and regulations until adequate treatment and disposal facilities can be equipped. In this situation, it is thought that utilizing the cement industry which can recycle and treat a wide variety of wastes and has almost no waste generation, should be given priority for the promotion of off-site recycling of HW.

As shown in Volume 1 Annex1.2, the Japanese cement industry uses around 300 kg of waste to produce a ton of cement. The industry is trying to increase the amount of waste to be used to 400 kg per ton of cement in 2010. Applying this figure, the Romanian cement companies have the possibility of recycling and disposing more than 3 million tons of waste a year including HW.

In Romania, two cement products manufacturing companies (Holcim and Larfarge Romcim) have begun the operation of utilization of wastes in the pilot plant scale. However, the business is still small. In order to promote waste recycling business utilizing cement kiln beginning with waste oils, the team proposes Action Plan G1, in which the main objective is to raise the awareness of waste oils generators and general public.

2) Promotion of Recycling of Heavy Metals Contained in HW by Utilizing Non-Ferrous Metal Smelters

In Romania, non-ferrous metal metals smelters are major HW generators. On the other hand, they use the recycle-oriented smelting and refining processes such as Imperial Smelting Process (ISP) and the Chloride Vaporization Process (KOWA Process). They are recognized as the potential recycler for HW containing heavy metals.

Consequently measures are required to involve these companies the HW recycling business, while at the same time strengthening legal controls over illegal recyclers that have insufficient pollution control measures or have no license by NCMR.

	SOMTRA	ROMPLUMB	PHOENIX	UVCP
Location	Copsa Mica	Baia Mare	Baia Mare	Turunu Megrere
County	Sibiu	Maramures	Maramures	Teleorman
Ownership	Private	Government	Private	Government
Operation	Pb • Zn ISP process	Pb Blast Furnace	Cu Outokump Flushing Furnace	Pyrite treatment (Chloride vaporization process), (Producing raw material for steel industry) Recovery of Cu, Au, Ag etc.
Raw material	Pb & Zn Concentrate.;135 thousand ton/year Internal Wastes;44 thousand ton/year Zn Scrap;11 ton/year	Pb concentrate; 28 thousand ton/year Internal Wastes External Wastes;2 ~ 2.5 thousand ton/year Ratio: Conc.: Internal Waste: External Wastes= 60%: 2 ~ 6%: 10 ~ 15%	Blister Cu from another Cu smelter (Ampellum smelter) Recyclable Cu scraps	Pyrite ash;160 thousand ton/year

 Table 3.4.6 Situation of Primary Non-Ferrous Metal Smelters

	SOMTRA	ROMPLUMB	PHOENIX	UVCP
Product	Capacity Refined Pb; 38 thousand ton/year Refined Zn; 57 thousand ton/year	Capacity Pb bullion;20 thousand ton/year	Capacity Electrolysis Cu; 40 thousand ton/year	Iron oxide pellet;130 thousand ton/year Cement Cu; 50 ton/month Au & Ag Gypsum;50 ~ 60 ton/month
Internal Wastes	Blue powder Zn-Pb Dross Dust Pb Slime Cu matte Cu-Pb Dross Slag	Dross Dust Slag	N/A	N/A

Source: JICA Study Team

(1) HW Prevention of Smelter Internal HW Generation and Improvement of Facilities

The HW generation survey result reveals that the total amount of waste lead acid battery and HW containing metal that is generated is approximately 366 thousand tons per year. Of this figure, copper, lead and zinc slag accounts for 274 thousand tons. The rest, 92 thousand tons, consists of sludge dross, dust and so on. Regarding the slag, following measures are recommendable.

- Promotion of utilization in the cement plant as the alternative raw material (Lowering the content of valuable metals, and making fine grain for handling convenience)
- Development of utilization as construction material like roadbed and aggregate making the most of physical and chemical stabilization due to high specific gravity.

It is necessary to for non-ferrous metal smelters to establish and strengthen the foundations of recycling factories while improving and modernizing facilities and promoting HW prevention inside the smelters. In terms of the improvement in HW management for each smelter, the team notes in the report of pilot project No.1. Table 3.4.7 summarize the recommendations for HW management.

	Issues	Recommendation	Cost	Remarks
			(Million US\$)	
S.C. ROMPLUMB S.A.	Slag management & utilization	Slag management Check the elution in compliance with EU standards Slag utilization Raw material for steel and cement Substitute material for sand blasting Construction material Filling of caisson		Amount of generation in 2001;Approximately 30,000 ton Slag is inert glass substance. There are several utilization applications shown in left column. However social barrier and cost competitiveness exists for utilization. If official organization cooperates with non-ferrous metal smelters for technology development and so on, it can be step forward.
RBG PHOENIX S.A.	Wastewater treatment sludge storage	Check the elution in compliance with EU standards Improvement of storage facility Reduction of sludge generation in case of re-start of the smelting process Introduction of heavy metals fixing by roasting the sludge	_	It is not generated yet.(Historical wastes),Storage quantity;Approximately 4,000 Roof, wall and pit of storage pond 1st stage neutralization pH;3 (1st stage; Gypsum, 2nd stage; Sludge) Roasting condition;>900 ,>10 min
S.C. SOMETRA S.A.	Reduction of Zn-Pb dross	Improvement of ISF operation Check below items Cokes strength Charging height of ISF Proper size of sinter lump	_	Amount of generation in 2001;12,200 ton
	Reduction of blue powder	Proper rotor immersion depth Flow gas modification	0.4	Amount of generation in 2001;11,343 ton
	Reduction of Pb-Cu dross	Shortening the de-copperization time Elemental sulpher copperization Treatment of speiss	0.1	Amount of generation in 2000;6,100 ton
	Improvement of powder product handling	Mixing of dxry and wet powder Moisture content adjustment improvement	1.5	
	Slag management & utilization	See S.C.ROMPLUMB S.A.	—	
	SO ₂ emission improvement (Sulphric acid production)	Cosntruction of sulphuric acid plant	32	Rough estimation of initial cost;32 Mill.US\$ Modification of sintering machine;1.5 Dry electric precipitator;3.5 Sulphuric acid plant;24 Cooling facility;1 Waste acid treatment;2

Table 3.4.7 Recommendation of 3 R in the Non-Ferrous Metal Smelters

Source: JICA Study Team

(2) Recycling of External HW

a. Waste Lead Acid Battery

Problems related to the waste lead acid battery recycling in Romania are mentioned below.

- Illegal dumping of sulphuric acid solution

Sulphuric acid solution in the waste acid batteries is illegally dumped in the course of collection. The waste acid lead batteries are brought dried to the REMAT companies or other collectors. There is concern about water and soil contamination by the illegal dumping.

- Existence of illegal secondary lead smelters.
- Low level of pollution and waste management by secondary lead smelters and lead acid battery manufacturers

Countermeasures should be to put emphasis on legal control of illegal recyclers and establishment of a collection and transportation system. Now, recycled lead recovered by Romania recycler is not-refined lead but lead-antimony alloy. This lead-antimony alloy can be used only for lead acid batteries. If primary lead smelters are involved in waste acid lead batteries recycling, they can produce refined lead, of which the price of lead is much higher than un-refined lead. As MF batteries become more popular in the future in Romania and as it becomes necessary to produce new recycled lead. It will become important for primary lead smelters to participate in the recycling business. Since most primary lead smelters have wastewater treatment facilities, they will be able to neutralize waste sulphuric acid solution without installation of new neutralization plants.

b. HW Containing Other Heavy Metals

If collection and transportation system exists, relatively the high-grade wastes can be recycled under the business condition. The problem is the grade wastes in which contain low content of usable component. Followings are the barriers for recycling of low-grade wastes like electro-plating sludge.

- High content of water Needs to dry the sludge High cost
- Generation amount of each factory is very small. Collection and transportation of the sludge takes a great deal of time.
- Fluctuation of metal content by generator and by lot Difficulty of constant operation of recycler and smelterNeeds to analyze, blend and harmonize the composition
- Shortage of awareness of natural resources crisis

From the point of environmental conservation view, promotion of recycling of such low grade HM wastes like sludge is important. For this purpose, collection system should be established and awareness raising and cooperation with generators, collectors, recyclers and non-ferrous smelters is necessary. Following figure illustrates the collection and reverse distribution system that was successful in Japan. Factory with electroplating process needs chemicals for electroplating. When dealer of the chemicals delivers the chemicals, they collect sludge in reverse distribution way. Then sludge store to some extent, recycler or smelter collect the sludge. REMAT companies can be put in this system. Role of non-ferrous smelter is important for recycling of the low-grade waste, e.g. sludge, dust.



Source: JICA Study Team

Figure 3.4.2 Reverse Logistics of Electroplating Sludge

(3) Future Development

a. Low-Grade Wastes Recycling System

Technically, some kind of low-grade non-ferrous metal wastes can be recycled by blending them with raw materials, internal wastes and/or external wastes in the non-ferrous metal smelters. However, following items should be examined to promote the recycling of low-grade non-ferrous metal wastes.

- Reverse logistics system
- Awareness raising of generators
- Incentives of wastes recycling for non-ferrous smelters
- Fostering of mediator, blender or collector
- Intermediate storage

b. Potential Recyclable Non-Ferrous Metal Wastes

Following table shows an example of electric arc furnace dust analysis in Japan. Electric arc furnace is commonly used in the waste iron recycling. Because steel materials are galvanized electroplated in many cases, the dust from waste iron recycling process contains more than 20 % of zinc. Since composition of electric arc furnace is not so complex and amount of this dust is large, this dust is one of the big sources for secondary zinc. As mentioned before, this dust may be not captured and scattered in Romania at this moment. It is desirable that market study of these potential recyclable wastes should be carried out.

Element	Content	Element	Content
	(%)		(%)
Zn	22.5	Fe	32.0
С	3.6	Cr	0.36
Cu	0.2	Pb	2.2
Ca	2.6	Cl	3.1
Cd	0.02	F	0.25
Si	1.6	0	24.9

Table 3.4.8 Electric Arc Furnace Dust Analysis in Japan

Source: JICA Study Team

c. Sustainability of Non-Ferrous Smelting Industry

Without primary source (concentrates), non-ferrous metal smelter cannot continue the operation. This means they cannot recycle external wastes in the smelter. In order to promote HM containing wastes by using existing non-ferrous smelting facilities, their sustainability is important. In this sense, promotion and revitalization of non-ferrous metal industry in Romania is also necessary.

3) Government Support for Developing Recycling Facilities

Waste acids, waste alkali and organic solvents are usually recycled off-site. If the industrial structure changes in Romania; from heavy and chemical industries to machine and electrical assembling industries, these HWs will increase in the future. The Romanian government should take promotional measures to encourage the private sector to develop recycling facilities in order to promote Recycling.

Reference

M. Tanaka etl., 1999, Outline of Waste Management, Japan Environmental Measurement and Chemical Analysis Association

Japan International Cooperation Agency, 2001, Report of Cleaner Production