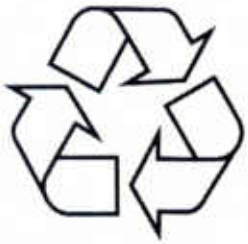
Guidelines for Environmentally Sound Recycling of Hazardous Wastes

(As per Schedule-IV of Hazardous Waste (M, H&TM) Rules, 2008)



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Ministry of Environment and Forests
GOVERNMENT OF INDIA

Central Pollution Control Board, Delhi

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Foreword

There is a need to look at the wastes as potential raw material for resource recovery so as to relieve from the burden of highly polluting landfills and incinerators. Provisions were made in the Hazardous Waste (Management Handling and Transboundary Movement) Rules, 2008 to allow recycling/re-processing of selected group of wastes and thus leaves large opportunities and challenges for setting up new facilities of recycling. An increased cost of natural resources also paves the way for exploring alternate raw material such as wastes or by-products as raw material. National inventory of hazardous waste reveals that more than 40% of the hazardous waste generated in the country is recyclable. However, such wastes listed under schedule-IV of of HW (M, H&TM) Rules 2010 can be re-processed only by registered recyclers for having environmentally sound recycling facilities. The ministry of Environment in its recent notification has transferred the scheme of registrations to State Pollution Control Boards.

The objective of environmentally sound recycling is to achieve optimal recovery of resources from the waste with minimum or no adverse effects to the men and environment. These guidelines describe and illustrate the available and practicable technologies in the country for environmentally sound recycling of hazardous wastes containing Zinc, Lead, Paint sludge, Spent catalysts, electronic wastes and used/waste oils for their recovery after re-processing.

Benefits would be derived by the potential entrepreneurs, the regulatory authorities and the people concerned by way of understanding the sustainable management practices and guidelines given in this document to achieve environmentally sound recycling of hazardous wastes specified in schedule-IV of HW (MHTM) Rules 2008. The contributions made by the members of the Registration Committee of CPCB, HSMD of MoEF and HWMD, CPCB are acknowledged.

1. Introduction

The Recycling of waste is one of the important components in the process of sustainable development. There is an increasing need of viewing all kinds of waste as unutilized resources and all possible efforts are required to be made to reuse, recover and recycle wastes irrespective of their type and the sources of their generation. The recycling of hazardous waste also becomes important as disposal of such waste in TSDF is expensive and leaves a permanent negative environmental footprint. The recycling of hazardous wastes such as used oil, waste oil and non-ferrous metal waste etc is in fact directly linked with the conservation of the resources. Moreover, the recycling of hazardous waste reduces the burden on storage and disposal facilities and also leads to significant reduction of carbon foot print in most cases.

There is a large potential for recycling of hazardous wastes in India. Based on the recent inventory of HW compiled by CPCB, the total quantity of hazardous waste generated in the country is estimated to be 6.2 Million MTA. Out of this, nearly 40% is categorized as recyclable. However, efforts should be made for reducing the quantity of generation of hazardous waste in the first place and to increase the percentage of reuse recovery and recycling.

The processes to be adopted for reuse, recovery and recycling of hazardous wastes are required to use Environmentally Sound Technologies (ESTs) as per the HW (M, H & TM) Rules, 2008. The processes of recycling need to be environmentally sound not only from the point of view of emissions and discharge of pollutants but also from the stand point of the quality of recovered material.

In order to ensure the use of EST by recyclers, the rules provide for registration of recyclers, by the designated regulating authorities for all the hazardous wastes listed in schedule IV of the HW Rules. This document is a guideline for use of the designated regulatory authority and the recyclers. Any EST other than that given in these guidelines may be adopted only with the approval of Central Pollution Control Board (CPCB).

2. Conceptual Framework for assessment of ESTs

The following factors may be considered while assessing the environmental soundness of recycling technologies:

1. Pollution potential of emissions/discharges in to the environment
2. Extent of use of hazardous & toxic chemicals
3. Quantum of use of resources and utilities such as energy, steam, water etc
4. Degree of reuse, recovery and recycling of resources
5. The quality of materials/resources recovered
6. The quantity and quality of residue generation
7. Prevention & control of fugitive emissions
8. Potential exposure of workmen & surrounding community
9. Potential of soil & ground water contamination
10. Degree of manual handling
11. Amenability to prevention, control & mitigation of potential environmental impacts
12. Potential EHS hazards and risks

2.1 Categories of Hazardous Waste for recycling

As per schedule IV of the HW (M, H & TM) Rules, 2008, the hazardous waste for recycling requiring registration may be grouped under the following broad categories:

1. Used Oil & Waste Oil
2. Non Ferrous metal wastes (including Zn, Cu, Ni, Cd, Lead and spent catalysts etc.)
3. Electronic Waste
4. Paint & Ink sludge/residues.

3.0 Procedure for Grant of Registration of recyclers for having Environmentally Sound Technologuies (ESTs)

3.1 Procedure for grant of fresh registration

Every person desirous of recycling or reprocessing the hazardous waste specified in Schedule IV (Annexure I) should submit an application in form 5 (Annexure 3 in triplicate), accompanied with copies of the following documents as per Rule 8 of the said Rules for the grant of the registration.

(i) Consent to establish granted by the State Pollution Control Board under the Water (Prevention and Control of Pollution) Act, 1974 (25 of 1974) and the Air (Prevention and Control of Pollution) Act 1981 (21 of 1981).

(ii) Certificate of registration issued by the District Industry Centre or any other government agency authorized n this regard;

(iii) Proof of installed capacity of plant and machinery issued by the District Industry Centre or any other government agency authorized in this behalf.

(iv) Proposed Membership of common TSDF for final disposal of Hazardous Waste generated in the process

(v) Process flow sheet of recycling or reprocessing of hazardous waste along with the details of equipment installed;

(vi) Details of Air Pollution Control Systems (APCS) installed in the unit along with the diagram;

(vii) Details of Effluent Treatment Plant (ETP) with diagram

(viii) Details of on-site storage facility of hazardous waste generated during the process

After receiving the application, the designated authority should examine it and the shortcomings if any be communicated to the unit. After obtaining the required information/documents from the unit an inspection be carried out. In case needed, views of technical expert may be sought for evaluation. On being satisfied that the applicant is having environmentally sound technology and possesses, requisite technical capabilities, adequate

facilities and equipment, the designated authority may grant registration. The Registration Certificate is issued in the form of a pass book (Annexure 4) wherein the details of hazardous waste procured is entered. The registration issued is valid for a period of five years, unless the operation is discontinued by the unit or the registration is suspended or cancelled for any violation of rules. The terms and conditions of registration should be clearly specified in the Pass Book itself for information and compliance of the registered recyclers and sellers/traders of hazardous waste. The designated authority is expected to dispose applications for registration as stipulated in the HW Rules 2008. The list of the registered recyclers or reprocessors should be regularly updated and placed on the official websites. Statement of registered recyclers in the State may be sent to CPCB half yearly by the SPCBs to maintain a centralized list of such recyclers in the country.

Apart from valid registration, the registered recycling facility can only operate if it has valid 'consent to operate' under the Water (Prevention and Control of Pollution) Act, 1974, Air (Prevention and Control of Pollution) Act 1981 and valid authorization as per HW(HMTM) Rules 2008 for generation, storage, handling and disposal of HW.

3.2 Renewal of Registration

Prior to or on expiry of validity period, the registered recycler should submit application on form-5 for renewal of registration. The designated authority should take decision on renewal of registration based on following criteria;

1. Verify compliance to the conditions specified in the Pass Book
2. Verify the quantity of hazardous waste purchased, re-processed and assess the gaps if any, as well as the quantity of HW generated while recycling, stored and disposed as per the authorization granted.
3. Check the records pertaining to compliance to emission/discharge standards
4. Inspect the facility to assess environmental damages if any to the surrounding environment (effects on soil, vegetation, surface and ground water bodies)
5. Inspect the physical state of facilities used for re-processing and suitability of the same for further period.

4. Sector wise ESTs for the recycling of Hazardous Waste

4.1 Used/Waste Oil Reprocessing / Re-refining

The used oil as defined under H W rules 2008 , 3 (Ze) and meeting the characteristics given in part A of Schedule – V (Annexure – ii) can be reprocessed or re-refined (using environmentally sound technology- EST) to separate lube oil fraction for reuse. In the process of re-refining, water, diluents/ fuel fractions and residues containing decomposed materials, degraded additives, heavy metal particles/ dirt and sediment etc. are also obtained.

The separated water is sent to ETP and fuel fraction is used within the unit as fuel. The residue which carries all the hazardous constituents in concentrated form requires proper handling and disposal for making the reprocessing / re-refining of used oil environmentally sound. The used oil can be re-refined number of times as the lube oil product is reusable after blending it with suitable additives for its better performance during use. Prior to HW (M, H & TM) Rules, 2008 the following ESTs were approved:

I. Vacuum distillation with clay treatment
II. Vacuum distillation with hydrotreating
III. Thin film distillation
IV. Any other technology approved by MoEF

Among these, the largely used technologies in our country for used oil re-refining / reprocessing have been vacuum distillation with clay treatment. Vacuum distillation with hydrotreating process has not been adopted due to high investments. For Vacuum distillation stills, columns including thin film distillation column can be used. AS per HW (M, H & TM) Rules, 2008 any EST approved by CPCB can be adopted..

4.1.1 Vacuum Distillation with Clay Treatment for Used Oils

The basic mechanism of re-refining implicit in above mentioned technologies is that the basestock is obtained as a distillate and the distillate is then subjected to either clay treatment or hydro-treating depending upon the choice of individual industry in regard to obtaining the product quality. The common steps involved in the vacuum distillation / thin

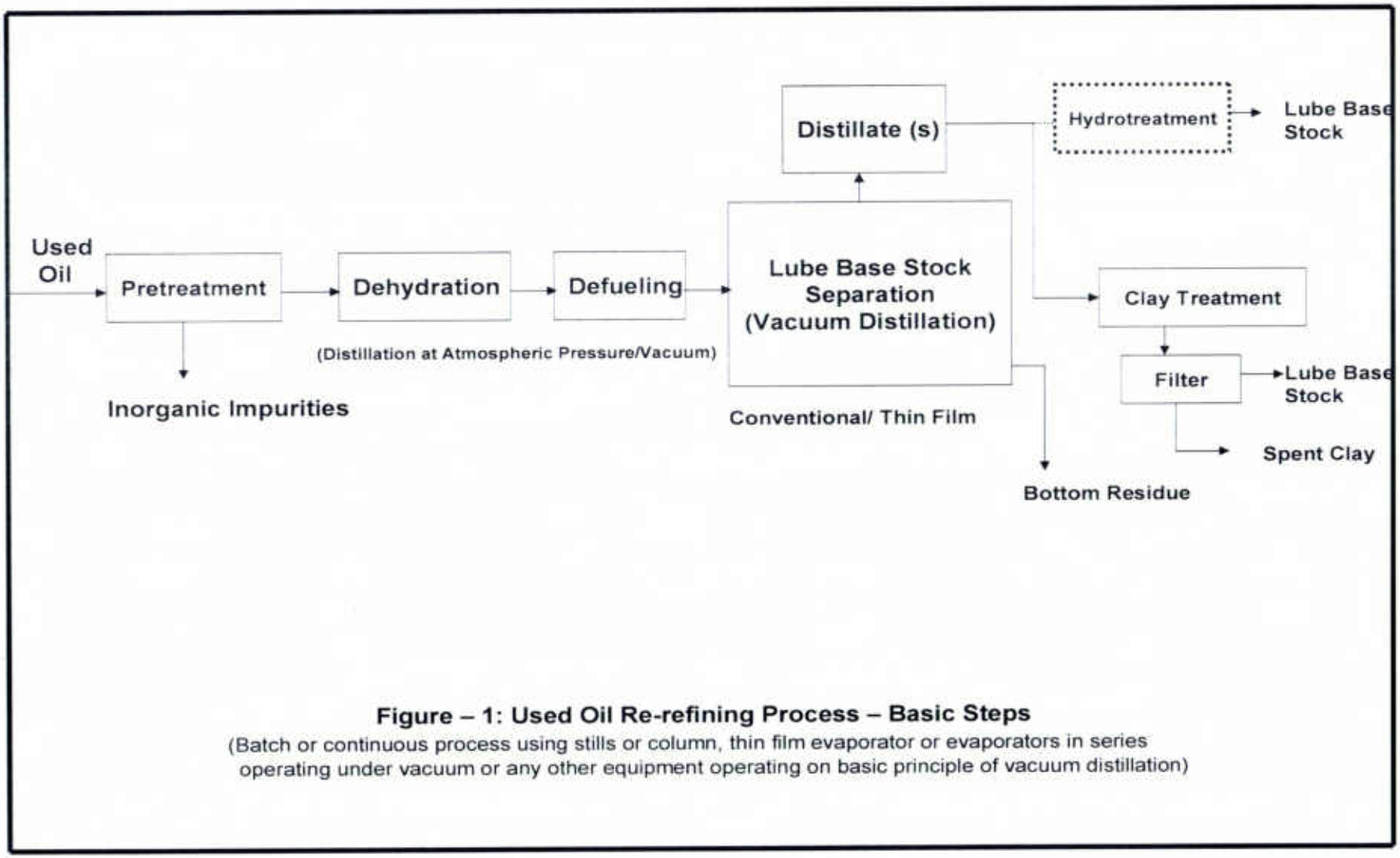

Figure – 1: Used Oil Re-refining Process – Basic Steps

(Batch or continuous process using stills or column, thin film evaporator or evaporators in series operating under vacuum or any other equipment operating on basic principle of vacuum distillation)

film evaporation based used oil re-refining processes are shown in Figure-1 and are described below:-

Pre-treatment

Pre treatment step refers to the separation of suspended or fibrous material using screens, gravity settling etc., for removal of settlable material with or without using flocculent. The used oil storage itself is expected to be equipped with screen before the procured used oil is transported from barrels / tankers to the storage tanks. The tanks are also expected to have provision for removal of the sediments as and when required. The material remaining on the screens as well as sediments are to be disposed off as hazardous waste as per authorization granted by SPCBs/PCCs under HW Rules, 2008.

Dehydration

Dehydration is to remove the water contained in the used oil. A temperature of about 100-120 °C at atmospheric pressure or under reduced pressure is adequate to remove most of the water contained in the used oil. The water vapours resulting from dehydration process are required to be condensed, treated and disposed off as per the consent issued under the water and air act by SPCBs/ PCCs.

De-Fueling

The main purpose of the step is to remove the fuel fraction from the used oil and depending upon choice and the facilities existing in the individual industries, defueling and dehydration can be done in the same vessel. A temperature of about 120 -300° C and a Pressure of about 200 mm Hg absolute may be adequate for removal of fuel fraction. This fraction is also expected to contain traces of water depending upon the initial water contained in the used oil and the efficiency of dehydration step. The fuel fraction can be used as fuel in furnaces / boilers.

Lube oil basestock separation

The used oil after removal of water and fuel fractions is subjected to distillation under vacuum to distill out lube basestock fraction. A temperature of about 350 ° C and a pressure of 40-50 mm Hg is generally required for distilling out the lube base oils from used oil feed, using still, conventional packed / plate vacuum distillation columns. However, at lower

pressure i.e. below 40 mm of Hg, the distillation can be carried out at still lower temperature. When thin film distillation column (jacketed hollow column) is used the temperature may be of the order of 300 ° C with vaccum less than 1 mm of Hg.

The residue generated (up to 10% of used oil) from the distillation process is required to be disposed off. This oil residue will have to be disposed of either for co-processing in cement kilns or incineration at TSDF or any other way of energy/resource recovery as approved by CPCB and authorization, granted by SPCBs/PCCs. For obtaining high vaccum (of the order of 1mm of Hg or below) a combination of steam ejector/water-ring vacuum pumps and oil sealed booster pumps is required to be used.

Clay Treatment

The lube basestock distillate is treated with hydrogen or clay for improving its colour and colour stability. The hydrogen using process, being quite capital intensive, is likely to be adopted for the larger capacity re-refining units (minimum size typically above 10,000 KLA). Clay based process relatively is less capital intensive, with product quality also being reasonably good, hence is more favoured. A 2 to 3 % clay may be found sufficient for the desired improvement in product quality with operating temperatures being around 250°C. Spent / used clay is separated from lube oil basestock using a plate and frame filter press. Spent clay is to be disposed off as per the authorization granted by SPCBs / PCCs. Spent clay may be utilized for co-processing in cement kilns and/or as fuel in brick kilns.

It is to be noted that the entire re-refining process, described above, can be batch or continuous process using stills or columns, thin film evaporators or evaporators in series operating under vacuum or any other equipment operating on basic principle of vacuum distillation.

4.1.2 Re- refining of Used Transformer Oils

Depending upon the condition of used Transformer Oil, re-refining may not require distillation. It could be re- refined by following steps:

1. Neutralisation with alkali solution
2. Dehydration
3. Filtration either directly or after clay treatment

The residue may be utilized for co-processing in cement kilns.

4.1.3 Generation and Recycling of Waste oil

The waste oil as defined under the HW rules includes spills of crude oils, emulsions, tank bottom sludge(s) and slop oil generated from petroleum refineries / installations or ships and can be used as fuel in furnaces for energy recovery if it meets the specifications laid down in Part B of Schedule – V, either as such or after reprocessing.

The major source of waste oil generation is from ships calling at the ports to avail the port facilities under MARPOL convention and allowed to offload periodically the accumulated fuel tank bottom sludge / waste oil stream at the port. This waste oil stream invariably remains mixed with lot of water. The ports then auction it to the registered waste oil recyclers. The other source of waste oil is oil refineries and bulk users of furnace oil. The refineries sometimes dispose off their crude oil tank bottom sludge to the registered recyclers but it is quite uncommon as most of the refineries have their own processes to recover oil out of it to the extent possible. The remaining oily sludge will have to be disposed of either for incineration at TSDF or for co-processing in cement kilns or any other way of energy/resource recovery as approved by CPCB.

Environmentally Sound Technology for Waste oil Recycling

The waste oil streams need to be processed / recycled in such a way so as to produce fuel for furnaces meeting specification laid down in Part B of Schedule-V. The basic concept involved in such processing / treatment is the removal or reduction of water and sediments to the specified level, given in Part B; Schedule-V of HW Rules, 2008. The other constituents e.g. metals (Pb, As, Cd, Cr& Ni), PAH, Halogens, PCBs and Sulphur should also conform to the limits specified in Part B of schedule V.

The environmentally sound recycling technology for waste oil processing therefore essentially includes centrifuging and dehydration for water and reducing the sediment to the desired level as shown in Figure -2. Depending on sediment content of the dehydrated fuel oil another stage of centrifugation may be necessary to meet the sediment level of less than 0.25% by weight. It is also to be noted that the recycling process, described above, can be batch or continuous.

The separated water from recycling / reprocessing step need to be processed through Effluent Treatment Plant (ETP) and the separated sediment/sludge need to be

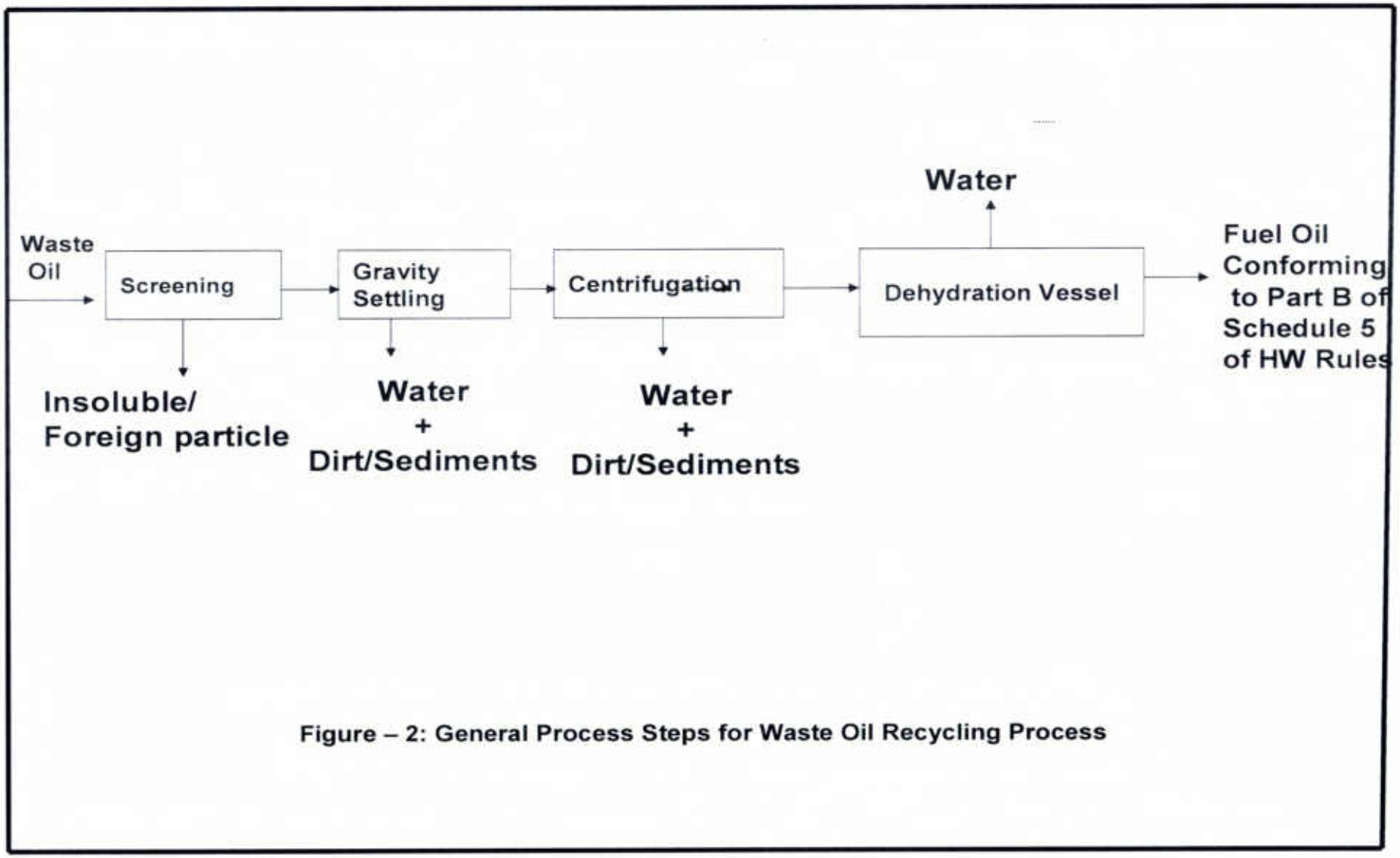

Figure – 2: General Process Steps for Waste Oil Recycling Process

handled/disposed off in environmentally sound way. The disposal has to be as per the consent issued by SPCBs / PCCs.

4.2 Non – Ferrous Metal Wastes

Lead Bearing Wastes

The sources of generation of the lead bearing wastes are used lead acid batteries, battery manufacturing industries, lead oxide manufacturers, cable companies, slag from smelters and other lead bearing scrap materials such as used lead electrodes from primary and secondary zinc producing units using electrolytic methods, lead scrap from printing press, lead pipes, etc.

Zinc & Copper Bearing Wastes

Zinc wastes are generated from the industrial processes like galvanizing, die casting, smelting and refining such as zinc scrap, zinc dross, top dross and bottom dross, zinc ash. Skimming, other zinc residues, spent catalyst containing zinc, etc.

The main copper wastes are copper dross, copper oxide mill scales, reverts, cakes, residues, copper alloys, slag, insulated copper wires/druids, jelly filled copper cables.

The various processes/technologies involved in recycling of lead, zinc and copper wastes depend upon the levels of the zinc or copper in the raw material and the products (metal or metal compound) to be manufactured.

Spent Catalyst

Spent Catalyst containing Ni, Cd, Zn, Cu, As, V and Co are generated from various industries. The processes used for recovery of metal values from the spent catalyst are hydro metallurgical or pyro-metallurgical.

4.2.1 Environmentally Sound Recycling of Lead Bearing Wastes

The lead bearing wastes as specified in schedule IV are used for production of lead ingots, lead alloy, lead oxides, etc. The main steps involved in the process are smelting of the lead bearing wastes after addition of reductant and Flux (charcoal/ lime and silica), cooling and casting of the molten lead to lead ingots. The production of lead alloy ingots involves further refining after mixing with antimony depending upon the type of alloy ingots needed.

Lead bearing waste could comprise of used Lead Acid Battery Plates, Lead Scrap, Process residues containing Lead, Lead Sheathing on Cable, etc.

The various steps involved in recycling of Lead bearing Wastes are as follows:

1. Battery-Breaking Processes: After draining the acid there are two modes of dismantling/breaking of batteries before battery plates are processed for smelting. The first mode is manual where the battery is cut from the top, plates are removed and left over acid is drained. The second mode is where the battery is mechanically broken along with the casing.
    a. The facilities required for manual dismantling include suction hood, connected to the pollution control device, arrangement for washing of the plastic components before being sent for recycling and acidic water neutralization facility. The capacity for manual breaking of batteries should be restricted to 5000 MTA.
    b. Facilities required for mechanical breaking include arrangements for noise control and dust and fume extraction system and acidic collection / neutralization facilities.
2. Lead-Smelting Processes: The smelting process to recycle lead scrap requires the use of Mandir Bhattis and Rotary furnaces, sweat furnace etc. The pollution control system required for both types of furnaces include cooling chambers, cyclone separators, bag filter, alkaline scrubber followed by exhaust blower and chimney of 30m height(minimum) figure 3.
3. Lead Sweat Furnaces: Small amounts of lead are recycled using lead sweat furnaces. Some major materials that are recycled in sweat furnaces are lead-coated power and communications cable, lead sheet and pipe, and other products, which contain lead as a coating or as part of a complex part. The process is executed at relatively lower temperatures and produces both metal for refining and dross; the dross is recycled to smelters.

The overall process including the streams that are required to be connected to the requisite Air Pollution Control Devices (APCD), are shown in figure – 3, which is self explanatory. Waste slag should be stored in impervious pit under a shed and disposed at common HW disposal facilities at regular intervals as per HW(HMTM) Rules 2008.

Standard for Emission/Discharge for Lead

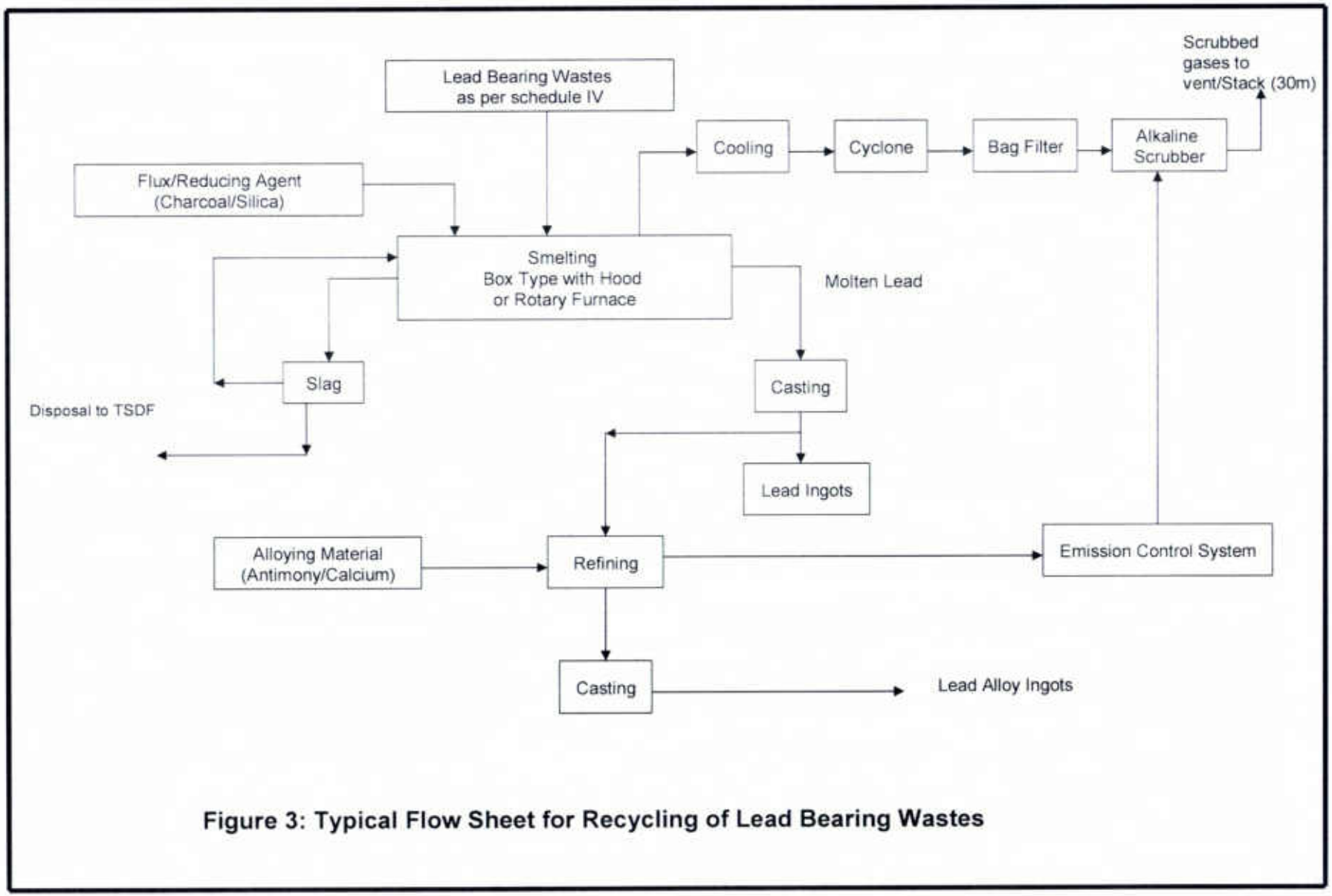

Figure 3: Typical Flow Sheet for Recycling of Lead Bearing Wastes

The parameters and control limits, which are in force in the country, are as follows:

Lead in work area, NIOSH 8-hr avg (mg/m^3) : 0.05

Lead in emission through stack (mg/Nm^3) * :10.0

Lead in effluents (mg/l) :0.10

Lead in ambient air 24-hr avg ($\mu g/m^3$) :1.0

(* Nm^3 – normal cubic meter)

Steps to minimize fugitive emissions of Lead

i. The design of hood/fume collection system from the smelting/refining operations (from metal tapping point, charging doors, furnace joints etc.) should be capable of collecting lead emissions and transfer to the air pollution control system.

ii. The storage and handling of all the raw materials, intermediates and products should be in covered area/shed having concrete floors and mechanized equipment should be used to handle these materials as far as possible.

iii. The floors in the loading area should be kept wet through sprinklers to reduce the chances of lead particles/dust getting airborne.

iv. Any water used for washing, rain water etc, should be collected through separate pits (to delink this from the regular drain) for removing metallic lead etc and the pit should have fine screens for passage of clear water.

v. The movement of vehicles to the administrative/working/production areas should ensure that only the trucks/vehicles involved in the material handling/transportation reach the work areas, and their tyres are washed before they leave these areas.

Steps to minimize Lead Exposure

The precautions/measures to be taken for minimization of exposure to the workers involved in handling/processing of the lead and lead bearing material. These are given in Annexure 5

Monitoring of Blood Lead (Pb) Levels

As a practice, all lead related units should periodically examine their workers at least once in year for lead level in blood as well as urine. Persons with higher lead levels (greater than 42 Ug/dl) should be shifted immediately to non-lead activity areas and given special medical treatment till the lead levels come back to acceptable level (10-Ug/dl).

4.2.2 Environmentally Sound Recycling of Zinc Bearing Wastes

General Processes and Products

The recycling processes for zinc bearing wastes are mainly of two types namely (i) Pyrometallurgical Processes and (ii) Hydrometallurgical Processes. The Pyrometallurgical Process is adopted for manufacturing of Zinc ingots containing about 98.5% Zinc, and the Hydrometallurgical Process involves electrolytic methods and produce Electrolytic Grade Zinc (EZ) containing 99.9% Zinc. In addition to this, another process involving solvent extraction techniques is adopted to get Zinc, but the solvent extraction processes are mainly used for treatment of Brass Wastes for recovery of not only Zinc but also Copper.

Zinc bearing wastes can also be used for manufacturing of chemicals such as Zinc Sulphate ($ZnS0_4$), Zinc Chloride ($ZnCl_2$), Zinc Oxide (ZnO.

The processes that are exclusively meant for production of zinc and its compounds are described in this section, and the solvent extraction method which is used primarily for recovery of copper and zinc from brass bearing wastes has been described separately in the subsequent paragraphs.

Production of Zinc (Pyrometallurgical Processes)

Zinc Dross, Dross from Hot dip Galvanizing and die casting operation, Zinc Ash/Skimming arising from galvanizing and die casting operations, other zinc bearing waste arising from smelting and refining are manually transferred to the pulverizer where it is crushed by rotating hammers. The fine fraction that is Zinc Ash is separated from Zinc Metal by pneumatic suction and is collected in cyclone and bag filter/scrubber. The metallic zinc portion which is separated from zinc ash by screening is charged into a crucible type furnace maintained at about 500°C for melting into ingots. The scum formed on the surface of the molten metal is removed and sent for pulverization. The molten metal is poured into moulds and allowed to cool to form zinc ingots. A typical process flow sheet is shown in Figure – 4. The fine pulverized scum can be further processed by wet processing to prepare Zinc Salts or for making electrolytic grade Zinc. It could be done in house or through another registered recycler.

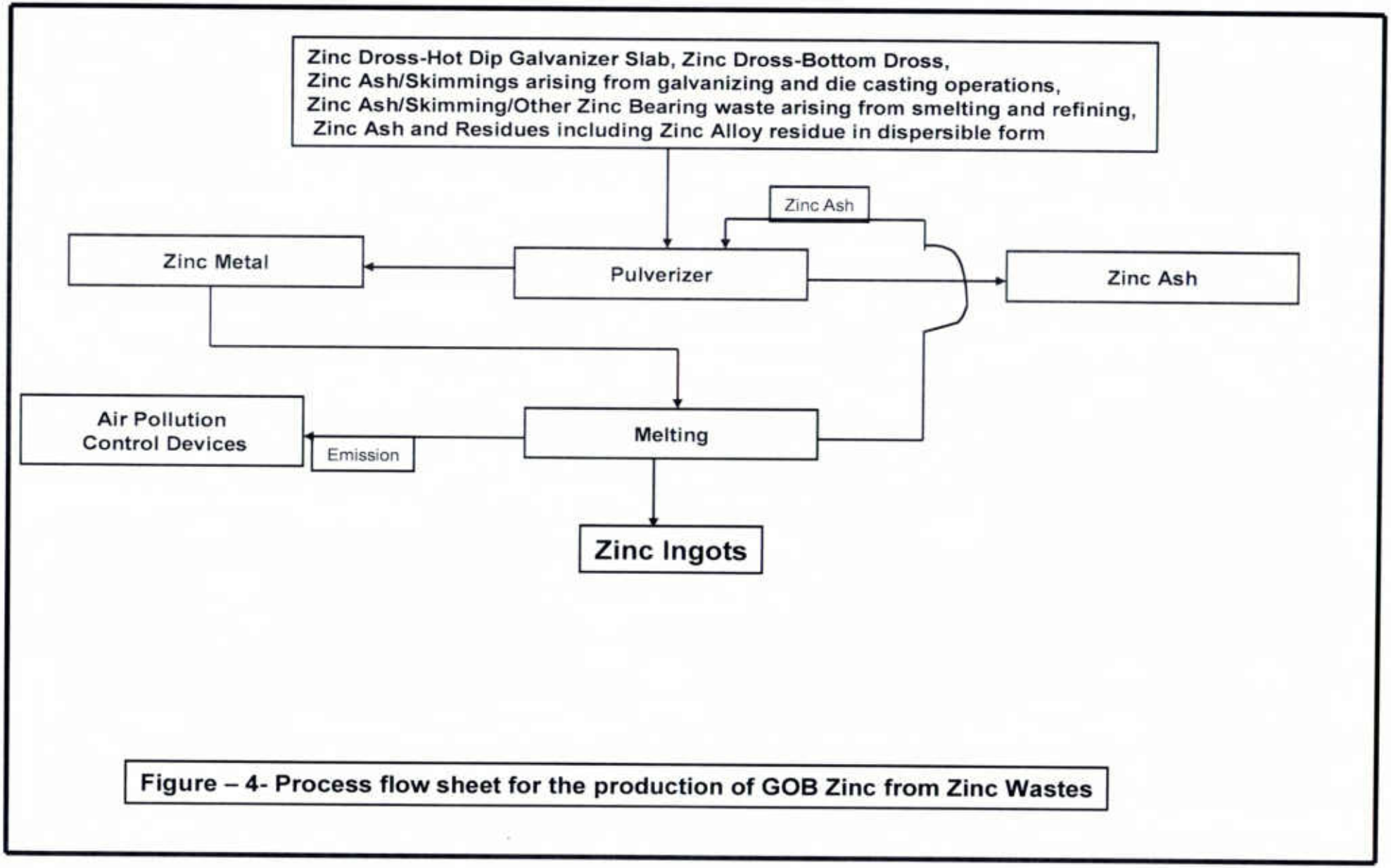

Figure – 4- Process flow sheet for the production of GOB Zinc from Zinc Wastes

It is required to install suitable cyclone and bag-filter for pulverizer and screening operations. Melting crucible emissions should be collected in suitable enclosure with fume hood and routed to cyclone and bag-filter/wet-scrubber, ID Fan and chimney. Process area should be paved and covered under shed. The runoff water from plant area to be routed to settling ponds. Good housekeeping practices are key to minimizing losses and preventing fugitive emissions.

Production of Electrolytic Grade Zinc (Hydrometallurgical Processes)

The main steps involved are (i) Calcination, (ii) Leaching and Purification, (iii) Electrolytic section and (iv) Melting section. A general process flow sheet is shown in figure - 5

(i)Calcination

The zinc ash which is in fact the fine fraction of the pulverized Zinc Ash/Skimming is fed to rotary kiln for calcination. The rotary kiln is heated by an oil/gas fired burner. The temperature of about 900^0 C is maintained in the kiln to enable calcination for removal of chloride from zinc ash.

The emissions from the rotary kiln are treated in cyclone, bag-filter and wet scrubber prior to venting through chimney. Calcination converts zinc ash into clinkers. The calcined zinc ash in clinker form is discharged at the firing end of the kiln. The clinker is then transferred to pulverizer with bag-dust collector, where it is ground into fine powder. The fine powder is sent to leaching section.

(ii)Leaching

The calcined zinc ash in a fine powder form is transferred to the leaching tank. Sulfuric Acid, Ferrous Sulphate and Manganese Dioxide are added to the tank. A proper mixing is achieved through continuous agitation. Leaching is carried out for about two hours. The zinc sulfate solution formed at the end of leaching is pumped to a thickener. The clear zinc sulfate solution is transferred to purification tank for removal of copper, nickel and organic impurities.

The sludge formed is filtered in a drum filter and the filtered solution is taken to the process. The cake generated from drum filter is neutralized and dried and then sent for disposal to Secure Landfill at TSDF. Zinc dust is added to the zinc sulfate solution and mixed for one

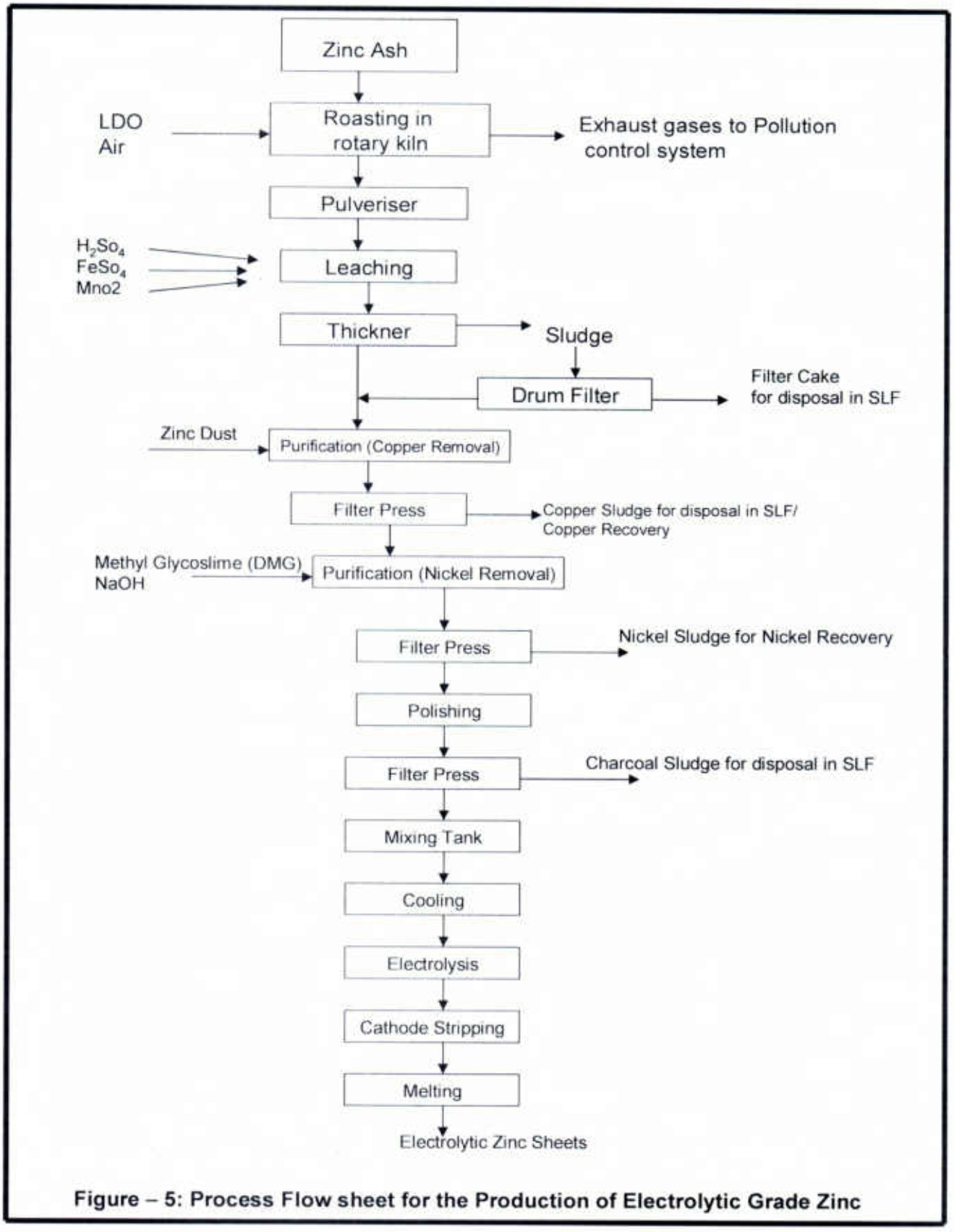

Figure – 5: Process Flow sheet for the Production of Electrolytic Grade Zinc

hour for removal of copper. The solution is then transferred to the filter press for separating copper sludge. The copper sludge formed in the filter press is removed and sent for disposal or copper recovery. The filtrate is then transferred into another tank for nickel removal. Di Methyl Glyoxime (DMG) and Sodium Hydroxide are added to the filtrate in another tank and mixed for two hours. The solution is transferred into filter press for nickel sludge removal. The Nickel free zinc sulfate solution is sent to polishing tank. The nickel sludge is sent for Ni recovery. In the polishing tank charcoal is added to the zinc sulfate solution and mixed thoroughly. The addition of charcoal removes organic impurities and colour. The solution is sent to filter press for final filtration. The pure zinc sulfate solution is then transferred to storage tank and allowed to cool. The cooled zinc sulfate solution is then sent to cell house for electrolysis.

It is required to collect the fumes/emissions from leaching tank in suction hood and treat in alkali scrubber prior to venting through a suitable chimney. The process area should be lined with acid proof flooring and covered under shed. There should be spillage collection pits within process area for recovery of solutions. Any effluent discharges from process area should be routed through equalization, neutralization and settling tanks/ filters prior to final disposal. The sludge from filter drum should be neutralized, dried, collected in HDPE bags and stored on-site in separate room prior to disposal to secure landfill at TSDF. On-site storage can also be made in HDPE lined storage pits under a shed.

(iii) Electrolytic Section

The Electrolytic Section consists of several cells containing aluminium cathode and lead anode plates. The purified zinc sulfate solution is transferred to cells by pumps. Pure zinc gets deposited on the surface of the aluminum cathode. When the process is over the cathodes are removed from the cells and the zinc deposited on them in the form of sheets is removed. The zinc sheets are then sent to melting section for converting into ingots.

The solution after Zinc deposition should be recycled back for leaching. The process area should be lined and any spillage and discharge should be treated by equalization, neutralization and settling tanks/filters prior to final disposal.

(iv)Melting Section

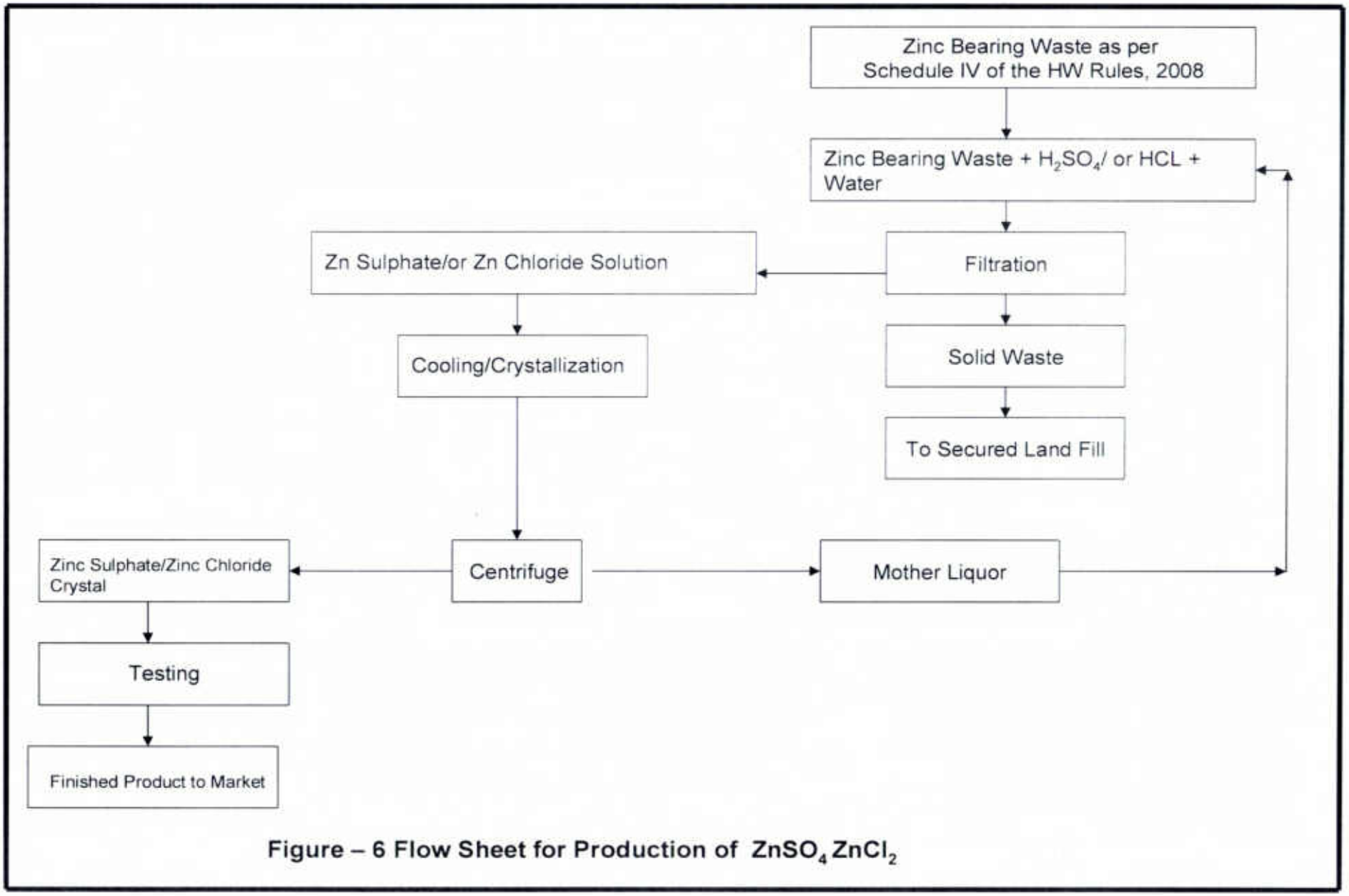

Figure – 6 Flow Sheet for Production of $ZnSO_4$ $ZnCl_2$

The zinc sheets are fed to a crucible type furnace for melting. The furnace is heated by light diesel oil. The molten metal from the furnace is moulded into marketable zinc ingots. The resulting product after moulding is called Electro-grade/Electrolytic zinc, which is 99.9% pure.

It is required to control emissions from pot furnace with air pollution control devices as specified above for pyrometallurgical process.

Production of Zinc Sulphate / Zinc chloride

The fine zinc ash is reacted with sulfuric acid/hydrochloric acid in a reactor for 4 hours and the slurry from the reactor is filtered in filter press and the filtrate is transferred to the crystallisers, where the solution is cooled to form crystals. The filter cake from the filter (named as 'mud') which is a hazardous waste is sent for disposal to TSDF. The crystals are centrifuged and the mother liquor is recycled to the reactor. The general steps in the production of Zinc Sulfate are shown in figure – 6, which is self explanatory.

All the reaction vessels should be adequately covered and connected to an exhaust system through alkaline scrubber and vented through stack. The process area should be covered and the flooring should be lined with acid proof liners. Spillage and discharge should be treated by equalization, neutralization and settling tanks/filters prior to final disposal. The acidic filter cake should be neutralized, dried and stored for disposal as specified above in leaching section.

Production of Zinc Oxide

The Zinc bearing waste like dross, skimming's etc can also be used for making Zinc oxide. The metallic part after pulverization is put in a furnace which is heated to more than 900^{0}C. The Zinc is converted to vapours which are oxidized by air to form Zinc Oxide. The Zinc Oxide is collected in cyclone and bag-filters. The residue from the furnace can be used for recovery of Zinc as a compound by chemical leaching and may be sent to another recycler. The overall steps involved in the production of zinc oxide from zinc dross are shown in Figure-7.

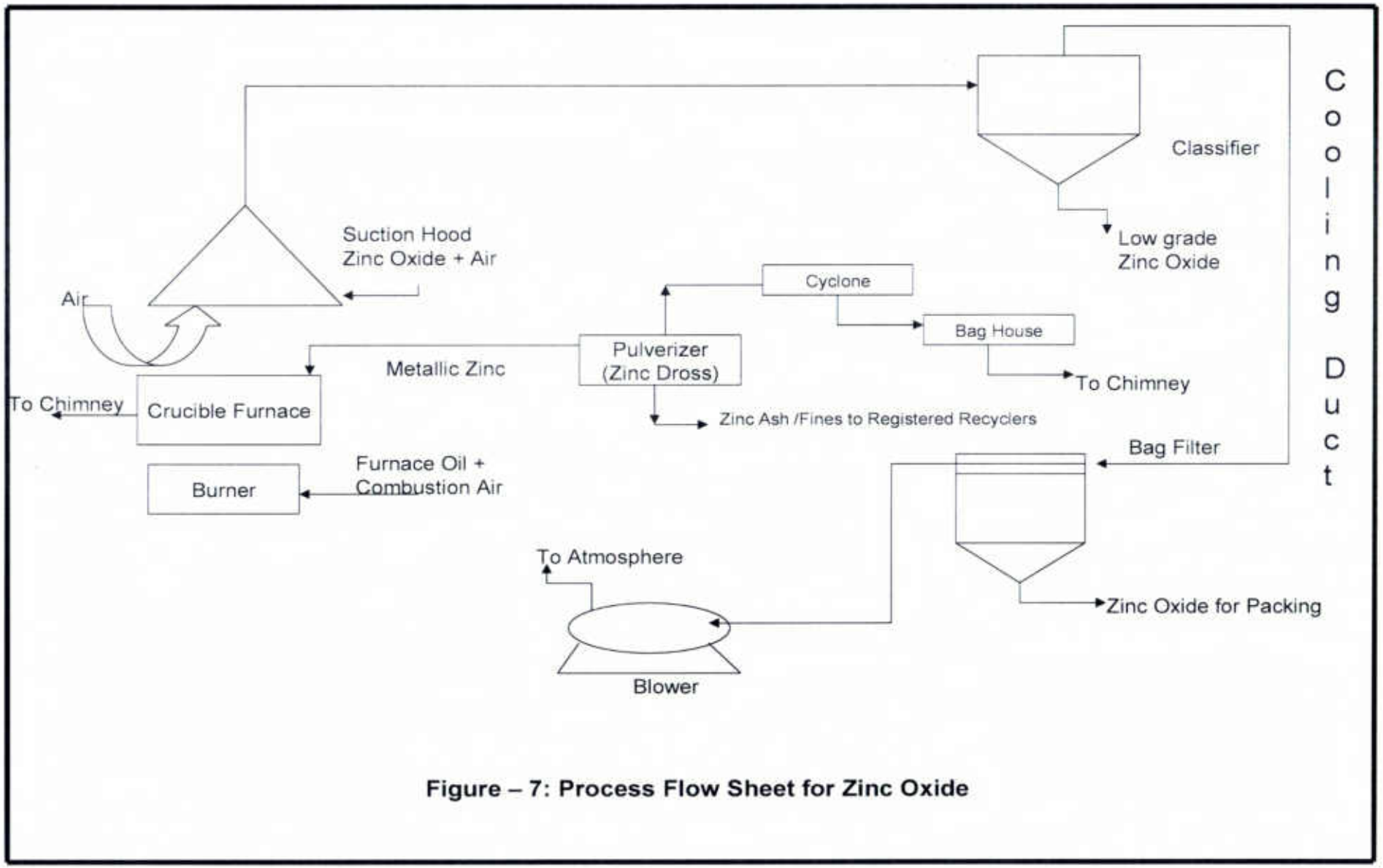

Figure – 7: Process Flow Sheet for Zinc Oxide

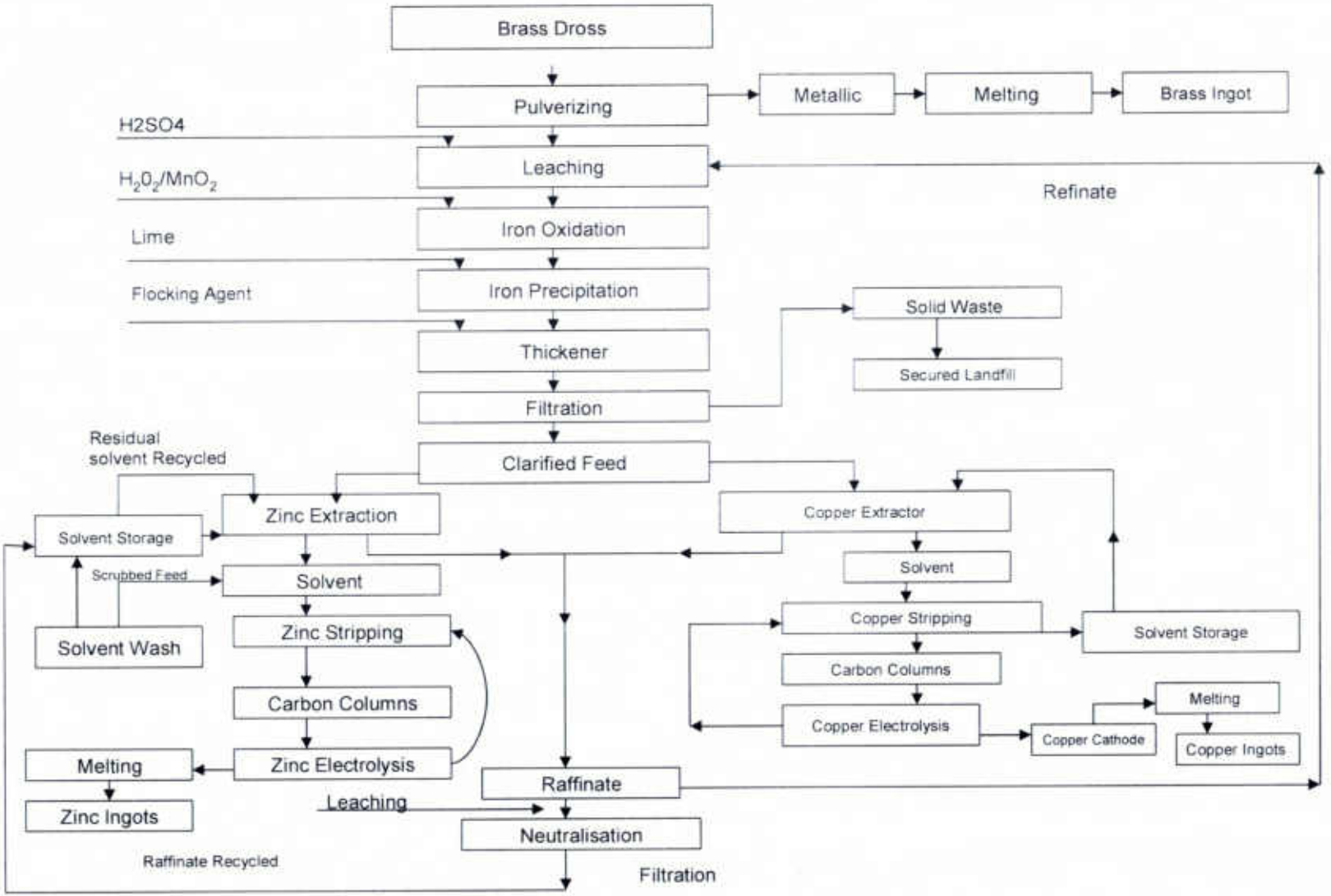

Figure- 8 : Flow sheet for recovery of Copper & Zinc from Brass Dross by Solvent Extraction

The bag-filter houses should be enclosed and the filtered gases have to be vented through suitable stack.

Production of Copper and Zinc from Brass Dross by Solvent Extraction

The overall steps involved in the recovery of Copper and Zinc from Brass Dross by solvent extraction technique are shown in Figure-8. The brass dross is first pulverized to separate the metallic part from the dispersible ash. The separated metallic lumps/part is taken to furnace for melting and brass metal ingots are obtained. The left-out brass dross/residues are subjected to leaching process with sulphuric acid. Then the liquid is subjected to Iron Oxidation (with catalysts) process followed by the lime treatment process to remove iron. After thickener and filtration the zinc and copper containing liquor is subjected to solvent extraction whereby $ZnSO_4$ solution & $CuSO_4$ are separately obtained. They can be recovered in the form of metals by electrolysis.

House keeping and disposal of wastes (water, air emissions and hazardous wastes) should be done in accordance with the measures specified above for leaching and pyrometallurgical processes

4.2.3 Recovery of metals from spent catalysts

Spent catalysts have been defined as hazardous wastes under Schedule-I of HW(HMTM) Rules 2008. and specifies the following processes generating spent catalysts:

Petrochemical processes & pyrolytic operations (Sr.no 1)
Petroleum Refining (Sr.no 4)
Production of nitrogenous and complex fertilizers(Sr.no 18)
Production and formulations of drugs and pharmaceuticals and health care products (Sr.no 28)
Purification process for organic compounds and solvents (Sr.no 35)

Several thousands of tonnes of spent catalysts are being generated every year from chemical, petrochemical, food, fertilizer, catalytic converter of automobiles and other industries containing various high value metals. They are stored by the generators, sent back to catalyst manufacturers or given to recyclers for recovery of metals. Catalyst containing different metals or a combination of metals are used in different sectors.

Catalysts used in petroleum and petrochemical industry are mainly supported catalysts. Supports consist of alumina, silica, zirconia, clay or hybrid of these, impregnated with Ni, Mo, Co, Pt, Pd, and W. Some unsupported catalysts such as MoS_2 and NiS in finely divided form and Zn for H_2S removal are also used.

Catalysts get deactivated and need regeneration or rejuvenation. After several regeneration-reuse cycles, catalyst activity may not justify further regeneration of spent catalysts. Other options for utilization of this non-regenerable catalyst include metal reclamation and other utilizations such as construction material, sorbents etc .

Spent catalysts from hydro-processing of distillation residues are contaminated with coke besides metals from the feed. Metal reclamation needs to be carried out when metal contents of these catalysts exceed 5% by weight. In addition to metal reclamation support material can also be recovered. In case of petroleum industries, spent catalysts contain up to 10% molybdenum and/or vanadium, 3% nickel or cobalt with alumina (as support).

Metal Reclamation

The methods for metal reclamation involve a combination of hydro and pyrometallurgical operations However, before carrying out leaching some pretreatment like roasting is carried out if necessary to remove coke or sulphur etc, Leaching is done by acid/alkali. Separation of the metals (from mixed metals catalyst) is carried out by selective precipitation or solvent extraction. Typically, all valuable components of the catalysts are converted into four major marketable products viz. Vanadium oxide, Molybdenum trioxide, Aluminium trihydrate and a nickel-cobalt concentrate or nickel sulphate, cobalt oxide separately. Other metals typically found in these wastes may be present in lesser concentrations.

The metal leaching process for spent catalysts, has a recovery of more than 95% for the metals. The undissolved residue containing mainly Al_2O_3 and SiO_2, has to be disposed in secure land fills at TSDF or can be used in cement kiln.

In some cases, pyrometallurgical processes can be employed to recover the valuable metals as alloy/ master-alloy with iron.

Pollution Control Systems required to be adopted in spent catalysts processing include:

1. Dust Control using cyclone, bag filter and alkali scrubber for acidic gases in the roasting step.
2. Suitable enclosure with fume collection hood and scrubber to absorb acidic fumes in leaching
3. Control of solvent vapours in case of separation of metals by solvent extraction.
4. Covering of process area, provision of acid proof liners and spillage collection pits.
5. Proper ventilation in process areas.
6. Physico-chemical treatment of effluent to remove heavy metals i.e. by equalization, precipitation, neutralization and settling/filtering before discharge.

4.2.4 E-waste

Composition of E-Waste

E-waste composition is very diverse and has "hazardous" and "non-hazardous" substances. It consists of ferrous and non-ferrous metals, plastics, glass, wood & plywood, printed circuit boards, concrete and ceramics, rubber and other items. Iron and steel constitutes about 50% of the e-waste followed by plastics (21%), non ferrous metals (13%), glass (14%) and other constituents. Non-ferrous metals consist of metals like copper, aluminium and precious metals viz. silver, gold, platinum, palladium etc. The hazardous substances in e-waste are lead, mercury, cadmium, selenium, hexavalent chromium, arsenic, asbestos and halogenated substances (e.g. CFCs), polychlorinated biphenyls and brominated flame retardants (BFRs) etc.

Environmentally Sound E-waste recycling/re-processing

Environmentally sound E-waste recycling/re-processing can be carried out at three levels. Each level of recycling consists of unit operations, where e-waste is recycled/re-processed and out put of 1st level recycling serves as input to 2nd level recycling. After the third level of recycling, the residues generated are disposed of either in TSDF or incinerated. The efficiency of operations at first and second level determines the quantity of residues going to TSDF or incineration.

EST for 1st Level recycling/re-processing

The following three unit operations are of first level for E-waste recycling/re-processing

1. Decontamination : Removal of all liquids and Gases
2. Dismantling -manual/mechanized breaking
3. Segregation

All the three unit operations are dry processes

Decontamination

The first step is to decontaminate E-waste and render it non-hazardous. This involves removal of all types of liquids and gases (if any) under negative pressure work space and their recovery and storage.

Dismantling

The decontaminated e-waste or the E-waste requiring no decontamination are dismantled to remove the components from the used equipments. The dismantling process could be manual or mechanized requiring adequate safety measures to be followed in the operations.

Segregation

After dismantling the components are segregated into hazardous and non-hazardous components of E-waste fractions to be sent for 2nd level recycling/re-processing.

Dismantling and segregation operations should be carried out on working bench tops having space de-dusting system connected to cyclone, bag-filters and ID fan connected to chimney, so as to maintain desirable workzone air quality as per the factory act 1948.

The output of first level recycling/re-processing would be segregated recyclables like mild steel, aluminium, Hg Switches, batteries, capacitors, plastic components, CRT, printed circuit board, cables etc

EST for 2nd Level Treatment

Decontaminated & segregated recyclables like CRT, printed circuit board, cables etc are taken for 2nd level of operations as below:

1. Hammering
2. Shredding
3. Separation processes comprising of
   - (i) CRT cutting into funnel and panel including removal of phosphor coating from the panel as well as lead paste binding the panel with the funnel .
   - (ii) Electromagnetic separation
   - (iii) Eddy current separation
   - (iv) Density separation using water

The major objective of hammering and shredding operations is size reduction The separation of material can be done by electromagnetic, eddy current and density separation technique. The separation techniques utilize properties of different elements like electrical

conductivity, magnetic properties and density to separate ferrous, non ferrous metal and precious metal fractions.

Fractions such as plastic, ferrous and non ferrous material, glass are sent for recycling and the remaining fraction are sent for third level of treatment to recover precious and other metals.

CRT splitting

CRT is manually removed from plastic/ wooden casing. The CRT is split into leaded funnel and unleaded panel glass using different splitting technology in a closed chamber under low vacuum environment and the funnel section is then lifted off from the panel glass section and the internal metal gasket is removed for facilitating the removal of internal phosphor coating. The CRT can be split adopting the following methods:

- Ni-Chrome hot wire cutting

  A Ni-Chrome wire or ribbon is wrapped round a CRT in a closed low vacuum chamber and electrically heated for at least 30 seconds to causes a thermal differential across the thickness of the glass. The area is then cooled (e.g. with a water-soaked sponge) to create thermal stress which results in a crack. When this is lightly tapped, the screen separates from the funnel section.

- Diamond wire method

  In this method, a wire with a very small diameter, which is embedded with industrial diamond, is used to cut the glass as the CRT is passed through the cutting plane in a closed low vacuum chamber.

- Diamond saw separation

  Diamond saw separation uses either wet or dry process. Wet saw separation involves rotating the CRT in a closed low vacuum chamber while one or more saw blades cut through the CRT around its entire circumference. Coolant is sprayed on to the surface of the saw blades as they cut. This is to control temperature and prevent warping.

The vacuum chambers where the CRT handled for splitting and separation of material is

required to be connected to cyclone and bag filters, ID fan and a suitable chimney. The operators should use gloves fixed to the walls of the vacuum chamber while handling CRTs as shown in the figure below

The internal phosphor coating from the inner side of panel glass is removed by using an abrasive wire brush and a strong vacuum system to clean and recover the coating. The extracted air is cleaned through high efficiency bag-filter system to collect the phosphor dust. The phosphor dust so collected in the filter bags should be sent to TSDF.

3rd Level E-waste recycling/re-processing

The 3rd level E-waste recycling/re-processing is carried out mainly to process and recover ferrous, non-ferrous metals, plastics, glass, precious metal and other items of economic value as shown below:.

The unit operations for 3rd level recycling/re-processing of e-waste

Input (Out put from 2nd level recycling/re-processing)	**Unit Operation/ Disposal/ Recycling Technique**	**Output**
Sorted Plastic	Recycling	Plastic Product
Mixed Plastic	Energy Recovery/ Incineration	Energy Recovery
CRT	Breaking/ Recycling	Glass Cullet
Lead scrap	Secondary Lead Smelter	Lead
Ferrous metal scrap	Secondary steel production (foundries/DRI furnaces)	Iron
Non Ferrous metal Scrap	Secondary copper and aluminum smelting	Copper/ Aluminum
Precious Metals	Au/ Ag separation (refining), melting and hydro-metallurgical processes	Gold/ Silver/ Platinum and Palladium
Batteries (Lead Acid/NiMH and Li ION)	Lead recovery and smelting	Lead, Ni and Li

Input (Out put from 2nd level recycling/re-processing)	Unit Operation/ Disposal/ Recycling Technique	Output
	Remelting and separation	
Capacitors	Incineration	Energy recovery
Mercury	Separation and Distillation	Mercury

4.2. 5 Paint and Ink Sludges

Paint and ink sludges are generated during manufacture as well as during industrial use of Paints and Ink. During manufacture they are generated during cleaning and washing of process vessels, spills or due to production of off-specification products. Paint sludges and residues are generated while spray painting in industries like automobile sector,. Similarly ink sludge is generated during printing process. Paint and ink sludges can be recycled/re-processed to obtain paints of lower grade to be used as primer or constituents of paints.

Processes for recycling

These sludges are usually paint residues (solid/semi-solid/Viscous liquid) mixed with water and other extraneous materials. The normal constituents of paint are resin, oil, pigments, additive like drying agents, modifiers and solvents (in case of solvent based paints). The hazardous nature of the paint residue is due to the likely presence of toxic chemicals used in the resin, heavy metals like Co, Cd, Ti in pigments, Pb and Co in drying agents and solvent which would be flammable and could be harmful due to release of VOCs.

The recycling of paint does not involve any chemical processing. The process will depend upon the nature of the paint whether solvent based or water based (emulsions). Solvent based paint sludge, apart from having some residual solvent will need fresh solvent during the process. Therefore, adequate systems need to be provided to control emissions of solvent vapours and also to guard against fire hazard.

The steps involved in the recycling of solvent based paint sludges are:

i) Washing with water;
ii) Drying to remove moisture
iii) Mixing by stirring with some solvent
iv) Homogenization in a ball mill
v) Coarse filtration to remove extraneous material

vi) Soaking with solvent, mixing, blending and milling.

vii) Filtration & packing

Special Precaution:

All electrical fittings and motors used in the recycling facility should be in flame-proof construction.

For water based paint sludges, the steps involved are:

i) Milling the waste paint along with some additives.

ii) Stirring in a vessel with high speed stirrer after addition of water, emulsifier and other additives.

iii) Packing, after coarse filtration.

For ink sludges, the processes may be similar, or they could be converted to granular product by drying, milling, sieving for use as paint constituents.

Emissions/discharges and their control

Air Emissions

Solvent vapours are the main pollutant released in the recycling of solvent based paint sludges during the various process operations. All vessels used for mixing, blending, milling etc. should be closed to the extent feasible. Vents and openings in the vessels should be provided with hoods connected to an exhaust system through chilled water/ brine cooled condensers and followed by activated carbon adsorption. It is required to minimize emission of particulate matter in air during handling of dry powders and operations like milling, sieving of dry powder or their additives should be carried out under hoods connected to an exhaust system through bag filters and chimney.

Liquid Effluent:

Wastewater may be generated as process wash water or from floor washing. Such wastewater should be collected and treated before discharge and should be recycled/reused to the extent possible. The treatment will include pH adjustment, if required, removal of oily material and coagulant aided flocculation and settling/filtration to remove suspended or colloidal solids. Additional treatment may be necessary to meet discharge standards.

Solid Waste:

Solid waste from process (i.e. residues from filters), vessel cleaning, dust from dust collection system and sludge from effluent treatment should be collected in containers and kept in separate areas with adequate ventilation and can be sent to cement kilns for co-processing or for incineration at TSDF.

5.0 Criteria for permitting quantities of recyclables:

The quantity of the hazardous waste to be granted registration depends upon the type of the waste contents the products manufactured, technologies and their respective installed capacities. The basis for calculating permissible quantities in respect of the various recyclable wastes are as follows:

(i) For lead recycling units, quantity of lead acid battery plates/lead scrap/ ashes/residues permissible shall be 1.7 times the installed capacity for lead production.

(ii) For zinc metal recovery units with melting furnace, the permitted raw material quantity shall be 1.5 times the installed capacity for zinc. Where as for zinc oxide production, the quantity permitted shall be 1.2 times the installed capacity for zinc oxide

(iii) For zinc Sulphate manufacturing units, the quantity of Zinc Ash/skimming permitted shall be 0.33 times the installed capacity for Zinc Sulphate.

(iv) For Copper Cables, it shall be equal to 1.1 times the installed capacity of Copper production.

(v) For Used Oil, it shall be equal to 1.25 times of installed capacity for the re-refining of Used Oil.

(vi) For Waste Oils, it shall be equal to 1.25 times of the installed capacity for the recycling of Waste Oils.

Schedule IV

[(See rules), 8 (1) and 9]

List of Hazardous Wastes requiring Registration for Recycling/Reprocessing

Sl.No.	Wastes
1.	Brass Dross
2.	Copper Dross
3.	Copper Oxide mill scale
4.	Copper reverts, cake and residue
5.	Waste Copper and copper alloys in dispersible from.
6.	Slags from copper processing for further processing or refining
7.	Insulated Copper Wire Scrap/copper with PVC sheathing including ISRI-code material namely "Druid"
8.	Jelly filled Copper cables
9.	Spent cleared metal catalyst containing copper
10.	Spent catalyst containing nickel, cadmium, Zinc, copper, arsenic, vanadium and cobalt
11.	Zinc Dross-Hot dip Galvanizers SLAB
12.	Zinc Dross-Bottom Dross
13.	Zinc ash/Skimmings arising from galvanizing and die casting operations
14.	Zinc ash/Skimming/other zinc bearing wastes arising from smelting and refining
15.	Zinc ash and residues including zinc alloy residues in dispersible from
16.	Spent cleared metal catalyst containing zinc
17.	Lead acid battery plates and other lead scrap/ashes/residues not covered under Batteries (Management and Handling) Rules, 2001. [* Battery scrap, namely: Lead battery plates covered by ISRI, Code word "Rails" Battery lugs covered by ISRI, Code word "Rakes". Scrap drained/dry while intact, lead batteries covered by ISRI, Code word "rains".
18.	Components of waste electrical and electronic assembles comprising accumulators and other batteries included on list A, mercury-switches, activated glass cullets from cathode-ray tubes and other activated glass and PCB-capacitors, or any other component contaminated with Schedule 2 constituents (e.g. cadmium, mercury, lead, polychlorinated biphenyl) to an extent that they exhibit hazard characteristics indicated in part C of this Schedule.
19.	Paint and ink Sludge/residues
20.	Used Oil and Waste Oil – As per specifications prescribed from time to time.

Schedule V

[See rule 3 (ze) and (zf)]

PART A

Specifications of Used Oil Suitable for reprocessing / recycling

S.No.	Parameter	Maximum permissible Limits
(1)	(2)	(3)
1.	Polychlorinated biphenyls (PCBs)	< 2ppm *
2.	Lead	100 ppm
3.	Arsenic	5 ppm
4.	Cdmium+Chromium+Nickel	500 ppm
5.	Polyaromatic hydrocarbons (PAH)	6%

PART B

Specification of fuel derived from Waste Oil

S.No.	Parameter	Maximum permissible Limits
(1)	(2)	(3)
1.	Sediment	0.25%
2.	Lead	100 ppm
3.	Arsenic	5 ppm
4.	Cadmium+Chromium+Nickel	500 ppm
5.	Polyaromatic hydrocarbons (PAH)	6%
6.	Total halogents	4000 ppm
7.	Polychlorinated biphenyls (PCBs)	<2 ppm *
8.	Sulfur	4.5%
9.	Water Content	1%

The detection limit is 2 ppm by gas Liquid Chromatography (GLC) using Electron Capture detector (ECD)

FORM 5

[See rule 8(1)]

FORM OF APPLICATION FOR GRANT/RENEWAL OF REGISTRATION OF INDUSTRIAL UNITS POSSESSING ENVIRONMENTALLY SOUND MANAGEMENT FACILITIES FOR REPROCESSING/RECYCLING

{To be submitted to the Central Pollution Control Board in triplicate by the Reprocessor/Recycler}

1	Name and Address of the unit :	
2	Name of the occupier or owner of the unit with designation, Tel / Fax:	
3	Date of commissioning of the unit :	
4.	No. of workers (including contract labourers) :	
5	Consent Validity	a) Water (Prevention & Control of Pollution) Act, 1974 valid up to..... b) Air (Prevention & Control of Pollution) Act, 1981 valid up to.....
6.	Product Manufactured during the last three years (Tonnes / Year)	**Year** | **Name of the Product** | **Quantity in Metric Tonnes or KL** a) b) c)
7.	Raw material consumption during last three years (Tonnes/ year)	**Year** | **Name of the Raw Material consumed** | **Quantity in Metric Tonnes or KL** a) b) c)
8.	Manufacturing Process	Please attach manufacturing process flow diagram for each product (s)
9.	Water Consumption	Industrial .....m^3/ day Domestic.....m^3/day
10	Water Cess paid up to (date)	.....
11	Waste water generation as per consent.....m^3/day	Industrial/Domestic Actual.....m^3/day (avg. of last 3 months)
12	Waste water treatment (provide flow diagram of the treatment scheme)	Industrial Domestic

<table>
<tr><td>13</td><td>Waste water discharge</td><td>Quantity..... m3/day
Location.....
Analysis of treated waste water for parameters such as pH, BOD, COD, SS, O&G and any other as stipulated by the SPCB/PCC (attach details)</td></tr>
<tr><td>14.</td><td>Air Pollution Control</td><td></td></tr>
<tr><td></td><td>a. Flow diagram for emission control system (s) installed for each process unit, utilities etc.</td><td></td></tr>
<tr><td></td><td>b. Details of facilities provided control of fugitive emission due to material handling, process, utilities etc.</td><td></td></tr>
<tr><td></td><td>c. Fuel consumption</td><td><table><tr><td>Name of fuel</td><td>Quantity per Day/Month :</td></tr><tr><td>a)</td><td></td></tr><tr><td>b)</td><td></td></tr></table></td></tr>
<tr><td></td><td>d. Stack emission monitoring results</td><td><table><tr><td>Stack attached to:</td><td>Emissions (for SPM, SO2, NOx and Metals (like Pb etc.) in particulates in mg/Nm3</td></tr><tr><td></td><td></td></tr><tr><td></td><td></td></tr></table></td></tr>
<tr><td></td><td>e. Ambient air quality</td><td><table><tr><td>Ambient air quality location:</td><td>Parameters (SPM, SO2, NOx, Pb, any other) in µg/ m3</td></tr><tr><td></td><td></td></tr><tr><td></td><td></td></tr></table></td></tr>
<tr><td>15.</td><td>Hazardous waste management :</td><td></td></tr>
<tr><td></td><td>a. Waste generation :</td><td><table><tr><td>S. No.</td><td>Name</td><td>Category</td><td>Quantity (last 3 years)</td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr></table></td></tr>
<tr><td></td><td>b. Details on collection , treatment and transport :</td><td></td></tr>
<tr><td></td><td>c. Disposal</td><td></td></tr>
<tr><td></td><td>(i) Please attach Details of the disposal facilities</td><td></td></tr>
<tr><td></td><td>(ii) Please attach analysis report of characterisation of hazardous waste generated (including leachate test if applicable)</td><td></td></tr>
<tr><td>16.</td><td>Details of hazardous wastes proposed to be acquired through sale/negotiation/ contract or import as the case may be for use as raw material.</td><td>1. Name
2. Quantity required per year
3. Waste listing & No. in Annex VIII (List A)/ Annex IX (List B) of Basel Convention (BC)
4. Hazard Characteristic as per Annex III of BC</td></tr>
</table>

17	Occupational safety and Health aspects	Please provide details of facilities provided
18	Remarks	
	(i) Whether industry has provided adequate pollution control system/ equipment to meet the standards of emission/effluent.	Yes / No
	(ii) Whether HW collection and Treatment, Storage and Disposal Facility (TSDF) are operating satisfactorily.	Yes / No
	(iii)Whether conditions exists or likely to exists of the hazardous waste being handled /processed of posing immediate or delayed adverse impacts on the Environment.	Yes / No
	(iv) Whether conditions exists or is likely to exists of the wastes being handled / processed by any means capable of yielding another material eg , leachate which may possess eco-toxicity.	Yes / No
19	Any other Information i) ii) iii)	
20	List of enclosures as per rule	

Signature :
Designation :

Date:.....
Place:.....

Registration Certificate- cum- Pass Book for Re-refining/Recycling of Hazardous Wastes

Name and Address : .....
of the Industry .....
.....
.....

Telephone/ Fax No. : .....
E-mail Address : .....
Registration No. : .....
Date of Issue : .....
Validity Period : .....To.....

Type & quantity of the Hazardous Waste(s) permitted for procurement and recycling :

S. No.	Hazardous Wastes (Lead Bearing) Type	Quantity (Tons Per Annum)

Authorised Signatory &
Seal

Conditions of the Registration:

1. The registration shall cease to be valid in case of expiry of the validity or suspension or cancellation of any of the existing consents under Water (Prevention & Control of Pollution) Act, 1974 and Air (Prevention & Control of Pollution) Act, 1981 and Authorization under Hazardous Waste (Management, Handling and Transboundary Movement) Rules, 2008 and as amended issued by the_____ State Pollution Control Board (SPCB)/_____ Pollution Control Committee (PCC), and shall remain invalid till consent(s)/ authorization are obtained.

2. The Recycler shall submit copies of the valid consents and authorization also to the auctioneer/seller at the time of each procurement.

3. The Recycler shall be responsible to ensure that the quantity of the waste(s) procured each time is endorsed in this Pass-Book by the authorised seller/auctioneer.

4. The registered recycler shall maintain the records of above mentioned Recyclable Wastes procured for recycling and submit the Annual Returns regarding utilisation of such wastes to the ..... SPCB/.....PCC as per Form-13 of the Hazardous Waste (Management, Handling and Transboundary Movement) Rules, 2008 by 31st January of every year.

5. This registration certificate shall be produced at the time of inspection upon request of an officer authorised by the Ministry of Environment & Forests (MoEF) / Central Pollution Control Board (CPCB) or SPCB/PCC.

6. The Recycler shall not rent/ lend/sell/transfer this registration certificate.

7. Any change in the recycling technology, disposal facility and equipment as given in the application shall only be carried out with prior permission of CPCB.

8. Transportation, processing, treatment and disposal of wastes shall be carried out strictly as per the Guidelines on "Management & Handling of Hazardous Wastes, 1991" issued by MoEF and in accordance with the Hazardous Waste (Management, Handling and Transboundary Movement) Rules, 2008.

9. The hazardous wastes generated from the recycling process shall be disposed off as per the Hazardous Waste (Management, Handling and Transboundary Movement) Rules, 2008.

10. The unit should take appropriate and adequate measures to control fugitive emissions such that the Work Zone standards with respect to lead content in particulate and other parameters are met.

11. The stack emission and ambient air quality for lead content in particulate should not be more than 10 mg/Nm^3 & 1.5g/m^3 respectively and the unit should carryout Stack emission and Ambient Air Quality (AAQ) monitoring for lead in particulate, SPM, RSPM, SO_2 , NO_x and monitoring reports should be submitted by the unit to the ..... SPCB/ .....PCC, as per the consent conditions.

12. Soil and ground water from within the industry promises should be analysed for lead at least once a year through a laboratory recognized under the Environment (Protection) Act, 1986 as amended, and the analysis results should be submitted by the unit to CPCB.

13. Application (in triplicate) for renewal of registration shall be made well in advance, at least **two months** before expiry, in Form 5 alongwith each of the documents as per requirement of Rule 8 (1) of Hazardous Waste (Management, Handling and Transboundary Movement) Rules, 2008

14. At the time of submission of the application for renewal of registration, the unit should submit a copy of the "Registration-cum-Pass Book", alongwith details of the quantity of product (s) manufactured, process wastes generated, mode of final disposal during the validity period of registration, and a statement showing pointwise compliance status of the above conditions. This information should be supported with Central Excise/Sales tax details.

15. The registration may be cancelled or suspended by CPCB as per Rule 8(5) of the HW Rules, in case the recycler fails to comply with any of the conditions of the registration or with any of the provisions of the Environment (Protection) Act, 1986 as amended or Rules made there under.

16. In addition to above, CPCB may stipulate further conditions, if so required, in the interest of environment protection.

17. Additional Conditions :

Date :
Place :

Authorised Signatory
Seal

Endorsement by the Auctioneer/Seller (except column No. 6 & 7)
[Condition No. 3 of the Registration]

Registration No. : ..... Date : .....

Waste(s) Type : ..... Permitted Quantity : .....

S. No.	Date	Address of the Auctioneer / Seller	Type & Quantity of HW sold/ Auctioned	Signature & Seal of the Auctioneer/ Seller with date	Date of arrival in the Recyclers premises & Challan No.	Balance Quantity (Registered-Procured till date)
(1)	(2)	(3)	(4)	(5)	(6)*	(7)*

* To be filled by the Recycler

Registration Certificate- cum- Pass Book for Re-refining/Recycling of Hazardous Wastes

Name and Address : .....

of the Industry .....

.....

.....

Telephone/ Fax No. : .....

E-mail Address : .....

Registration No. : .....

Date of Issue : .....

Validity Period : .....To.....

Type & quantity of the Hazardous Waste(s) permitted for procurement and recycling :

S. No.	Hazardous Wastes (Non-Ferrous other than Lead) Type	Quantity (Tons Per Annum)

Authorised Signatory &
Seal

Conditions of the Registration:

1. The registration shall cease to be valid in case of expiry of the validity or suspension or cancellation of any of the existing consents under Water (Prevention & Control of Pollution) Act, 1974 and Air (Prevention & Control of Pollution) Act, 1981 and Authorization under Hazardous Waste (Management, Handling and Transboundary Movement) Rules, 2008 and as amended issued by the_____ State Pollution Control Board (SPCB)/_____ Pollution Control Committee (PCC), and shall remain invalid till consent(s)/ authorization are obtained.

2. The Recycler shall submit copies of the valid consents and authorization also to the auctioneer/seller at the time of each procurement.

3. The Recycler shall be responsible to ensure that the quantity of the waste(s) procured each time is endorsed in this Pass-Book by the authorized seller/auctioneer. In case of import this endorsement should be obtained from the Customs Authorities.

4. In case of imports [where permitted as per Hazardous Waste (Management, Handling and Transboundary Movement) Rules, 2008]

   (i) The recyder should submit the analysis report received from the exporter to the CPCB and SPCB/PCC each time the consignments of recyclable waste are received.

   (ii) Copper content in the consignment of Copper dross should be equal or more than 65% of recoverable Copper, Lead and Cadmium content in it shall not exceed 1.25% and 0.1% respectively.

   (iii) Lead & Cadmium content in the consignment of spent cleaned metal catalyst containing copper and copper reverts, cake & residues should be equal or less than 1.25% and 0.1% respectively.

   (iv) Zinc content in the consignment of Zinc ash should be equal or more than 65 % of recoverable Zinc, Lead and Cadmium content shall not exceed 1.25% and 0.1 % respectively.

   (v) Lead content in the consignment of Brass dross should be equal to or less than 1.25%.

5. The registered recycler shall maintain the records of above mentioned Recyclable Wastes procured for recycling and submit the Annual Returns regarding utilisation of such wastes to the ..... SPCB/.....PCC as per Form-13 of the Hazardous Waste (Management, Handling and Transboundary Movement) Rules, 2008 by 31st January of every year.

6. This registration certificate shall be produced at the time of inspection upon request of an officer authorised by the Ministry of Environment & Forests (MoEF) / Central Pollution Control Board (CPCB) or SPCB/PCC.

7. The Recycler shall not rent / lend / sell / transfer this registration certificate.

8. Any change in the recycling technology, disposal facility and equipment as given in the application shall only be carried out with prior permission of CPCB.

9. Transportation, processing, treatment and disposal of wastes shall be carried out strictly as per the Guidelines on "Management & Handling of Hazardous Wastes, 1991" Issued by MoEF and in accordance with the Hazardous Waste (Management, Handling and Transboundary Movement) Rules, 2008.

10. The hazardous wastes generated from the recycling process shall be disposed off as per the Hazardous Waste (Management, Handling and Transboundary Movement) Rules, 2008.

11. The unit should take appropriate and adequate measures to control fugitive emissions such that the Work Zone standards are met.

12. The unit should carryout Stack emission and Ambient Air Quality (AAQ) monitoring for SPM, RSPM, SO_2 , NO_x and monitoring reports should be submitted by the unit to the ..... SPCB/..... PCC, as per the consent conditions.

13. Application (in triplicate) for renewal of registration shall be made well in advance, at least **two months** before expiry, in Form 5 alongwith each of the documents as per requirement of Rule 8 (1) of Hazardous Waste (Management, Handling and Transboundary Movement) Rules, 2008.

14. At the time of submission of the application for renewal of registration, the unit should submit a copy of the "Registration-cum-Pass Book", alongwith details of the quantity of product (s) manufactured, process wastes

generated, mode of final disposal during the validity period of registration, and a statement showing pointwise compliance status of the above conditions. This information should be supported with Central Excise/Sales tax details.

15. The registration may be cancelled or suspended by CPCB as per Rule 8(5) of the HW Rules, in case the recycler fails to comply with any of the conditions of the registration or with any of the provisions of the Environment (Protection) Act, 1986 as amended or Rules made there under.

16. In addition to above. CPCB may stipulate further conditions, if so required, in the interest of environment protection.

17. Additional Conditions :

Date :
Place :

Authorised Signatory
Seal

Endorsement by the Auctioneer/Seller (except column No. 6 & 7)
[Condition No. 3 of the Registration]

Registration No. : ..... Date : .....

Waste(s) Type : ..... Permitted Quantity : .....

S. No.	Date	Address of the Auctioneer / Seller	Type & Quantity of HW sold/ Auctioned	Signature & Seal of the Auctioneer/ Seller with date	Date of arrival in the Recyclers premises & Challan No.	Balance Quantity (Registered-Procured till date)
(1)	(2)	(3)	(4)	(5)	(6)*	(7)*

* To be filled by the Recycler

Registration Certificate- cum- Pass Book for Re-refining/Recycling of Hazardous Wastes

Name and Address : .....

of the Industry .....

.....

.....

Telephone/ Fax No. : .....

E-mail Address : .....

Registration No. : .....

Date of Issue : .....

Validity Period : .....To.....

Type & quantity of the Hazardous Waste(s) permitted for procurement and recycling :

S. No.	Hazardous Wastes (Used / Waste Oil) Type	Quantity (Kilolitres Per Annum)

Authorised Signatory & Seal

Conditions of the Registration:

1. The registration shall cease to be valid in case of expiry of the validity or suspension or cancellation of any of the existing consents under Water (Prevention & Control of Pollution) Act, 1974 and Air (Prevention & Control of Pollution) Act, 1981 and Authorization under Hazardous Waste (Management, Handling and Transboundary Movement) Rules, 2008 and as amended issued by the_____ State Pollution Control Board (SPCB)/_____ Pollution Control Committee (PCC), and shall remain invalid till consent(s)/ authorization are obtained.

2. The Re-refiner/Recycler shall submit copies of the valid consents and authorization also to the auctioneer/seller at the time of each procurement.

3. The Re-refiner/Recycler shall be responsible to ensure that the quantity of the waste(s) procured each time is endorsed in this Pass-Book by the authorised seller/auctioneer.

4. The Re-refiner/Recycler shall obtain a copy of the analysis report of the used oil/waste oil from the generator at the time of each procurement and submit the same to CPCB.

5. The registered Re-refiner/Recycler shall maintain the records of above mentioned Recyclable Wastes procured for re-refining/recycling and submit the Annual Returns regarding utilisation of such wastes to the ..... SPCB/..... PCC as per Form-13 of the Hazardous Waste (Management, Handling and Transboundary Movement) Rules, 2008 by 31st January of every year.

6. This registration certificate shall be produced at the time of inspection upon request of an officer authorised by the Ministry of Environment & Forests (MoEF) / Central Pollution Control Board (CPCB) or SPCB/PCC.

7. The Re-refiner/Recycler shall not rent / lend / sell / transfer this registration certificate.

8. Any change in the re-refining/recycling technology, disposal facility and equipment as given in the application shall only be carried out with prior permission of CPCB.

9. Transportation, processing, treatment and disposal of wastes shall be carried out strictly as per the Guidelines on "Management & Handling of Hazardous Wastes, 1991" issued by MoEF and in accordance with the Hazardous Waste (Management, Handling and Transboundary Movement) Rules, 2008.

10. The hazardous wastes generated from the recycling process including the residue generated in re-refining of used oil shall be disposed off as per the Hazardous Waste (Management, Handling and Transboundary Movement) Rules, 2008.

11. The unit shall submit quarterly reports giving details of used oil/waste oil procured, quantity of the products manufactured and sold (supported with Central Excise/Sales Tax details), quantity of waste generation and its mode of disposal, to CPCB.

12. The unit should take appropriate and adequate measures to control fugitive emissions such that the Work zone standards are met.

13. The unit should carryout Stack emission and Ambient Air Quality (AAQ) monitoring for SPM, RSPM, SO_2 , NO_x and monitoring reports should be submitted by the unit to the ..... SPCB/..... PCC, as per the consent conditions.

14. Application (in triplicate) for renewal of registration shall be made well in advance, at least **two months** before expiry, in Form 5 alongwith each of the documents as per requirement of Rule 8 (1) of Hazardous Waste (Management, Handling and Transboundary Movement) Rules, 2008.

15. At the time of submission of the application for renewal of registration, the unit should submit a copy of the "Registration-cum-Pass Book", alongwith a statement showing pointwise compliance status of the above conditions. This information should be supported with Central Excise/Sales Tax details.

16. The registration may be cancelled or suspended by CPCB as per Rule 8 (5) of the HW Rules, in case the Re-refiner/Recycler fails to comply with any of the conditions of the registration or with any of the provisions of the Environment (Protection) Act, 1986 as amended or Rules made there under.

17. In addition to above, CPCB may stipulate further conditions, if so required, in the interest of environment protection.

18. Additional Conditions :

Date :
Place :

Authorised Signatory
Seal

Endorsement by the Auctioneer/Seller (except column No. 6 & 7)
[Condition No. 3 of the Registration]

Registration No. : ..... Date : .....

Waste(s) Type : ..... Permitted Quantity : .....

S. No.	Date	Address of the Auctioneer / Seller	Type & Quantity of HW sold/ Auctioned	Signature & Seal of the Auctioneer/ Seller with date	Date of arrival in the Recyclers premises & Challan No.	Balance Quantity (Registered-Procured till date)
(1)	(2)	(3)	(4)	(5)	(6)*	(7)*

* To be filled by the Recycler

Appendix-1

Precautions/measures to be taken for minimization of the exposure involved in handling/processing of the lead bearing materials.

Instructions for Lead based industrial workers:

(1) Prior to entering the work premises you need to change over to the work uniform including shoe, socks, head gear etc. preferably in a lead free chamber.

(2) Your changed dress material (which should be preferably made of cotton and not any synthetic material) should be packed in a polythene cover and stored away from coming into contact with any lead dust.

(3) You need to cover your head with airtight shower cap either made up of disposable papers or thin cotton material. The floor in your work area needs to be kept wet sprinkles at work place help in reducing the dust level.

(4) Your face mask provided has to be used all through the working hours however uncomfortable they are.

(5) Make sure that the inner portion of the gum boots and the thick gloves used is free from dust. (This can be achieved using leadazol solvent to clean from time to time)

(6) Goggles used by you need to be cleaned for any dust accumulated from time to time.

(7) You should use the disposable cotton ear plugs to prevent any lead dust getting into inner ear and also for noise control.

(8) Nails need to be trimmed and cleaned more frequently to ensure that no lead dust gets under your nail bed.

(9) You must have a shower before going home for the day. Prior to the shower at the end of the working day you need to keep away the working dress material in a day place. The (dress material- that is uniform) should be periodically dry cleaned.

(10) The above precautions will ensure that you are free from lead dust prior to leaving the work place.

Under any circumstances:

1. Do not consume water or food at work place/eating place with your working dress on.

2. Do not walk over any dusted area or against the wind direction as far as possible in a dusted environment in spite of having protecting gears.
3. Do not smoke, or consume alcoholic beverages as they are found to increase the risk for lead absorption.
4. Do not used printed papers for packing food as the printing inks do contain some amount of lead.
5. Do no enter the canteen/eating place with the uniform provided for the working purpose.
6. Exhaust at ground level helps in bringing down the lead dust in the environment.
7. Do not leave the work area without the body shower and after adequately drying up.
8. Do not handle as far as possible any other material such as mobiles, phones, registers, pens or pads, other that the work tools at the shop floor.
9. Do not get into any other area other than the one specified to your nature of work partitioning is of utmost importance.
10. Do not use the floor for resting purpose, as the level of dust is high below the knee level.
11. Do not take any traditional medicines unless you are well informed about its constituents as many of the traditional medicines contain lead.
12. Do not ignore even a small physical discomfort or the health problem. Please go for medical check up immediately.

Remember that paints could be alternative sources of lead if they are not lead free paints.