Standard Operating Procedure and Checklist of Minimal Requisite Facilities for utilization of hazardous waste under Rule 9 of the Hazardous and Other Wastes (Management and Transboundary movement) Rules, 2016

Utilization of metal and metal bearing wastes (Tin/Tungsten/Cobalt/Vanadium/Tantalum/Niobium Scrap) for recovery of metal salts/alloys

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Central Pollution Control Board
(Ministry of Environment, Forest & Climate Change, Government of India)
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Utilization of metal and metal bearing wastes (Tin/Tungsten/Cobalt/Vanadium/Tantalum/Niobium Scrap)for recovery of metal salts/alloys

Procedure for grant of authorization by SPCBs/PCCs for utilization of Hazardous waste

1) While granting authorisation for utilization of hazardous wastes, SPCBs/PCCs shall ensure that authorisation is given only to those wastes for which SoPs for utilisation have been circulated by CPCB ensuring the following:

   a. The waste (intended for utilization) belongs to similar source of generation as specified in SoP.

   b. The utilization shall be similar to as described in SoP.

   c. End-use/ product produced from the waste shall be same as specified in SoP.

   d. Authorisation shall be granted only after verification of details and minimum requisite facilities as given in SoP.

   e. Issuance of passbooks (similar to passbooks issued for recycling of used oil, waste oil, non-ferrous scraps, etc.) for maintaining records of receipt of hazardous waste for utilization.

2) After issuance of authorization, SPCB shall verify the compliance of checklist and SoP on quarterly basis for initial 2 years; followed by random checks in the subsequent period for atleast once a year.

   In-case of lack of requisite infrastructures with the SPCBs/PCCs, they may engage 3rd party institutions or laboratories having EPA, 1986/NABL/ISO17025 accreditation / recognition for monitoring and analysis of prescribed parameters in SoPs for verification purpose.

3) SPCBs shall provide half yearly updated list of units permitted under Rule 9 of Hazardous & Other Wastes (Management & Transboundary Movement) Rules, 2016 (HOWM Rules, 2016) to CPCB and also upload the same on SPCB website, periodically. Such updated list shall be sent to CPCB on a half yearly basis i.e., by July and January respectively.

4) Authorisation for utilisation shall not be given to the units located in the State/UT where there is no Common TSDF, unless the unit ensures authorised captive disposal of the hazardous waste (generated during utilisation) or its complete utilisation or arrangement of sharing with any other authorised disposal facility.

5) In case of the utilization proposal is not similar with respect to source of generation or utilization process or end-use as outlined in this SoP, the same may be referred to CPCB for clarification /conducting trial utilization studies and developing SoPs.

6) The source and work zone standards suggested in the SoP are based on the E(P)A notified and OSHA standard respectively, however, SPCB/PCC may impose more stringent standards based on the location or process specific conditions.

64.0 Utilization of metal and metal bearing wastes:

S.No.	Type of HW/OW		Source of generation	Recovery/Product
	Name of HW	Category of HW		
1.	Tin scrap	(Basel No. B-1010, Part D of Schedule-III of	Scrap generated during smelting, cutting tools, plating droppings,	Refined Tin metal.

2.	Tungsten Scrap	HOWM Rules, 2016)	melting pots, ordinance factory, scrap traders, etc.	Recovery of sodium tungstate and tungsten carbide powder
3.	Cobalt Scrap			Cobalt Hydroxide
4.	Vanadium, Tantalum and Niobium Scrap			Metal Powder of Vanadium, Tantalum and Niobium

64.1 Source of Waste

Scrap of Tin, Tungsten, Cobalt, Vanadium, Tantalum and Niobium are generated during smelting, cutting tools, plating droppings, melting pots and procured from ordinance factory, scrap traders, etc. are categorized as metal and metal-bearing wastes at Basel No. B-1010, Part D of Schedule-III of HOWM Rules, 2016, that can be utilised as resource in metal salts/alloys recovery.

Characteristics of metal scraps are given below:

Table 1- General composition of Tin Scrap/dross/slag

Sl. No.	Tin dross/oxides	Percentage
1.	Tin (Sn)	70
2.	Copper (Cu)	1
3.	Oxygen (O_2)	18
4.	Misc. (Ag, Sb, etc.)	1
	Tin scrap/droppings	
1.	Tin (Sn)	90
2.	Al/Zn	3
3.	SnO_2	7

Table 2- General composition of Tungsten Scrap

Sl. No.	Tungsten Scrap	Percentage
1.	Tungsten (W)	98
2.	Cobalt (Co)	2

Table 3- General composition of Vanadium, Tantalum and Niobium Scrap

Sl. No.	Vanadium/Tantalum/Niobium	Percentage
3.	Vanadium/Tantalum/Niobium	99
4.	Alloy dropping	1

64.2 Utilization Processes

i. **Tin Scrap:** The Tin scrap firstly mixed with binder materials i.e. Borax, Soda Ash and Furnace Oil. The blending of the charging material is carried out in Double Cone Blender–cum-dryer. The charged blended material is then used in each graphite crucibles. Coal is used for heating and melting the metal in pit furnaces. Each batch runs for 2 hours at about 1200 °C temperature. After 2 hours of heating & melting the melted metal is transferred to the crucibles and further refined by Saw dust and diesel. The Tin scrap to refined Tin takes 4 hours in total. The product quantity varies from 30-80% of the raw material.

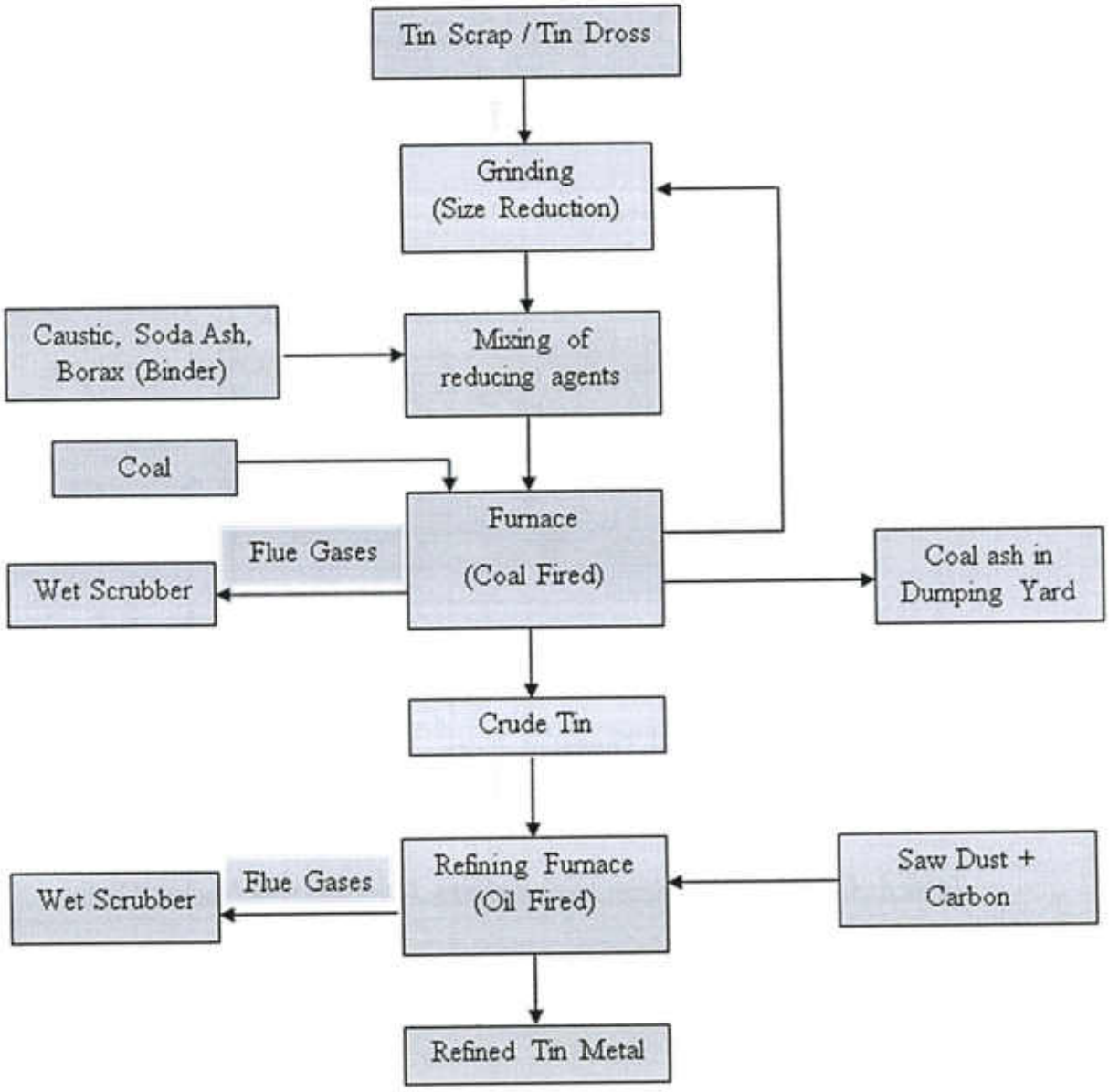

Figure: 1-*Process flow diagram for utilization tin scrap/dross for recovery of Tin metal.*

ii. Tungsten Scrap:

a. Step I: Production of Sodium Tungstate:
Tungsten Metal scrap is fused with sodium nitrate and soda ash at 300 °C in refining furnace. Fused material is leached with water having 2% NaOH. Upon filtration, the filtrate is taken to MS PP tank and HCl added to get sodium tungstate. Sodium Tungstate cake is separated by further filtration.

b. Step II: Production of Tungsten Carbide Powder:
This Sodium Tungstate is leached in ammonia solution and pH adjusted to 6.8 by adding HCl. Slurry formed is filtered and separated and Ammonium Para Tungstate (APT) Cake of yellow color is formed and further dried. APT is fed into oxidation furnace at 600 °C. Oxidized tungsten is reduced to tungsten powder by hydrogen reduction furnace. Tungsten Powder thus formed is mixed with 4% carbon and cobalt. This mixture is sintered in hydrogen reduction furnace. Tungsten Carbide powder is formed.

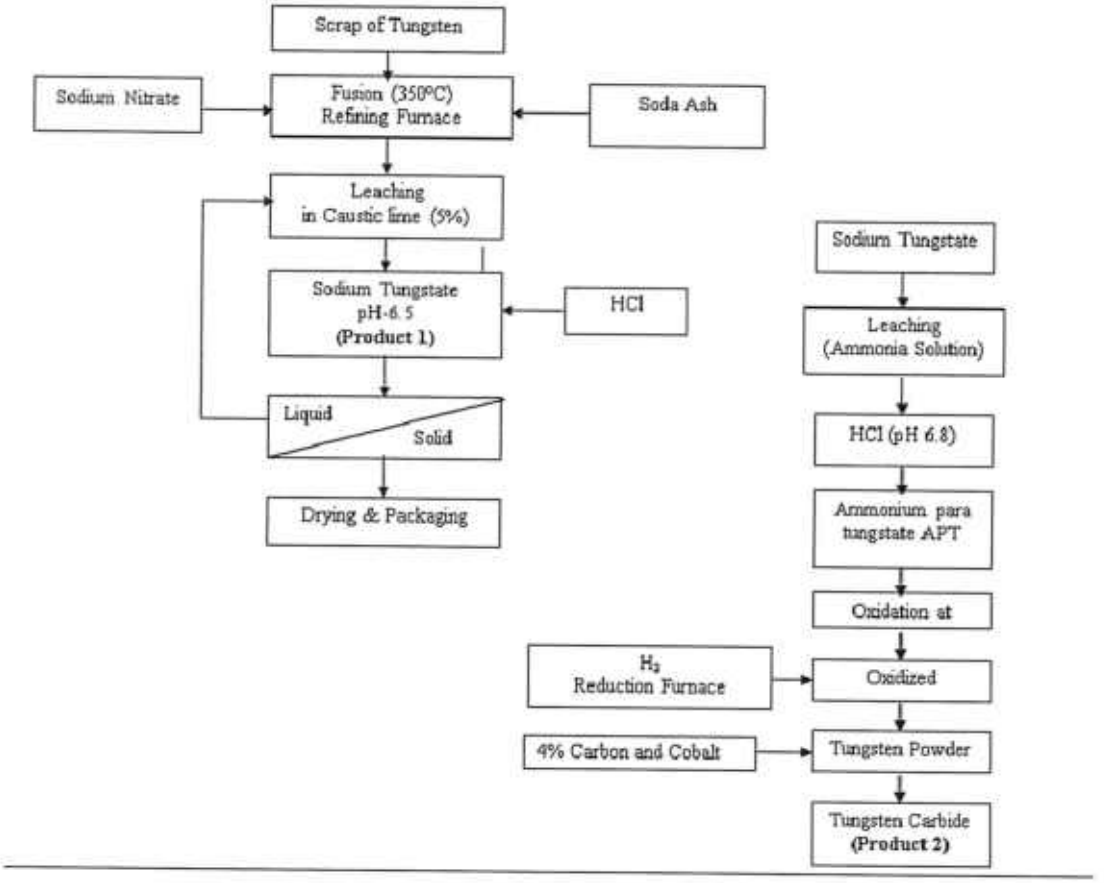

Figure: 2-*Process flow diagram for utilization tungsten scrap for recovery of Tungsten Carbide Powder.*

iii. Cobalt Scrap: Cobalt scrap undergoes leaching in water with sodium carbonate (soda ash) at 600 °C. The fused leach solution undergoes solid-liquid separation and sodium hydroxide is added into leached liquid. Solid separation goes back to leaching with soda ash again. After reaction with NaOH, Cobalt hydroxide is formed which is washed with water and dried.

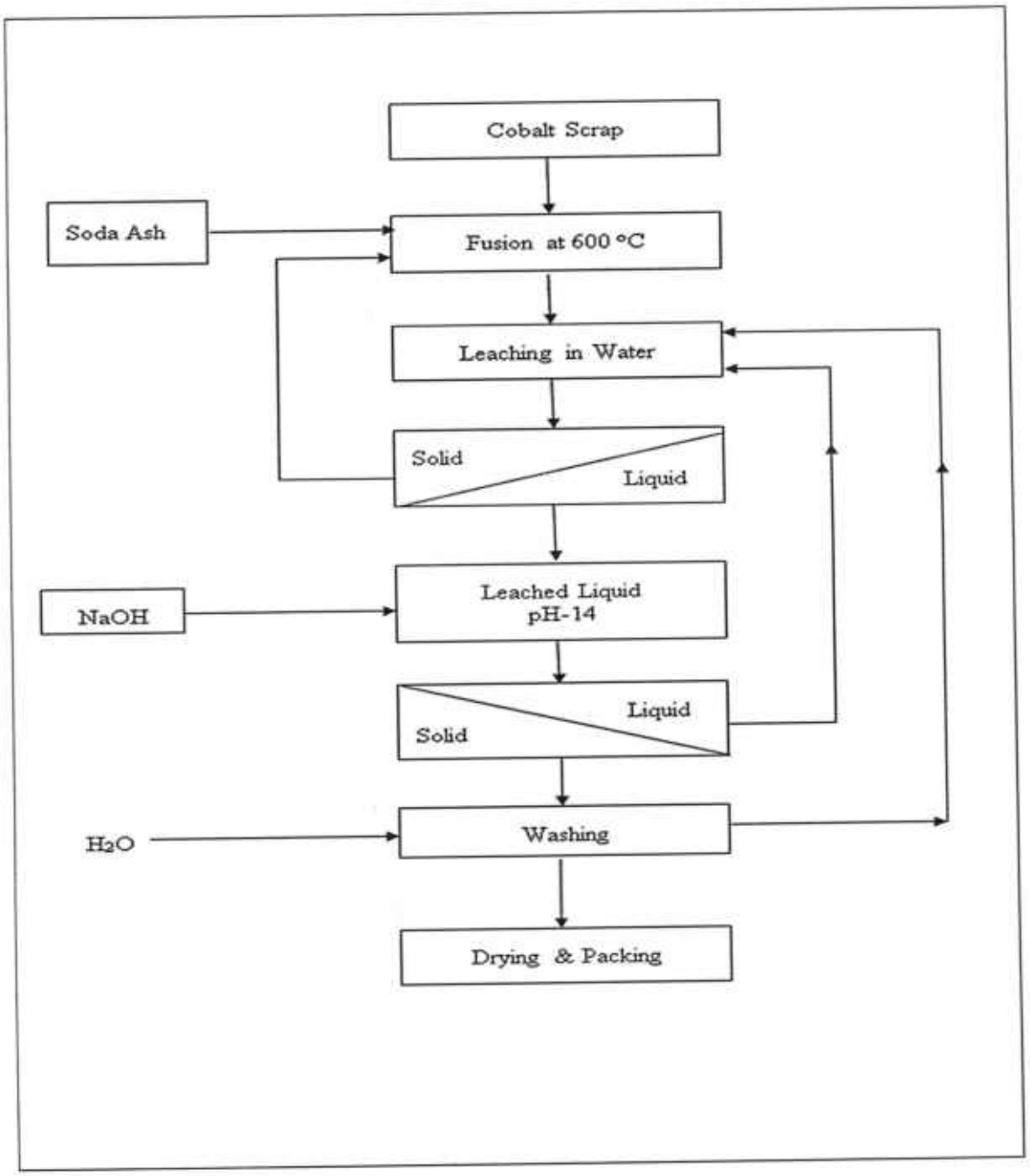

Figure: 3-*Process flow diagram for utilization cobalt scrap for recovery of cobalt hydroxide.*

iv. Vanadium, Tantalum and Niobium Scrap: Vanadium, Tantalum and Niobium alloy scrap undergoes oxidation in oxidation furnace at 350 °C, 650 °C and 1000 °C respectively. At different gauss, the metal powder of desired product obtained at their respective magnetic flux density.

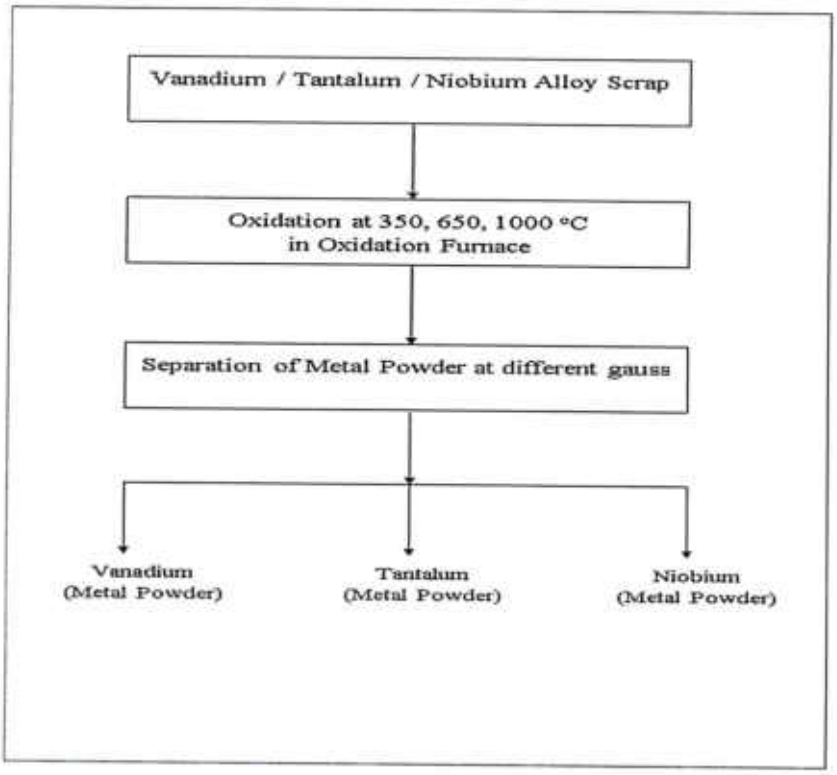

Figure: 4-*Process flow diagram for utilization of Vanadium, Tantalum and Niobium scrap for recovery of their metal alloys*

64.3 Product Usage / Utilization

The tin scrap/dross shall be used as resource in recovery of refined Tin metal, which may be reused in further manufacturing of various Tin alloys.

Cobalt Scrap shall be used as resource for recovery of cobalt hydroxide.

Tungsten scrap shall be used as resource for recovery of sodium tungstate and Tungsten Carbide powder.

Vanadium, Tantalum and Niobium scrap shall be used as resource for recovery of their metal powder, to be further used for manufacturing metal alloys.

64.4 Standard Operating Procedure for utilization

This SoP is applicable only for utilization of metal and metal bearing wastes containing scrap of Tin, Tungsten, Cobalt, Vanadium, Tantalum and Niobium are generated during smelting, cutting tools, plating droppings, melting pots and procured from ordinance factory, scrap traders, etc. for recovery of metal salts/alloys.

Utilization of metal and metal bearing wastes (Tin/Tungsten/Cobalt/Vanadium/Tantalum/Niobium Scrap)for recovery of metal salts/alloys

1) The other wastes i.e. scraps (dross in drums) shall be stored in well ventilated, covered storage shed(s) within premises, as authorized by the concerned SPCB/ PCC under Hazardous and Other Wastes (Management & Transboundary Movement) Rules, 2016, so as to eliminate rain water intrusion.

   Further, the storage area floor is of concrete with impervious base shall have adequate slope to collect spillage, if any, in a designated pit.

2) The handling of hazardous and other wastes i.e. scraps shall be carried out using mechanical means with minimal manual intervention.

3) The handling and storage of raw materials (scraps) or additional materials such as coal, reducing agents (borax, soda ash, saw dust), acids, etc. shall be done in separate storage sheds or atleast properly demarcated/partitioned area in case of one shed.

4) Chemicals and additives shall be procured in non-reactive containers/drums and stored under cool, dry, well ventilated and covered storage shed.

5) Acid (such as HCL) used in production of sodium tungstate shall be stored under shed and should have leak-proof floor tiles with adequate slope to collect spillage, if any, into a collection pit. The spillage from collection pit shall be transferred to reaction tanker or ETP, as the cases may be, through chemical process pump.

6) Transfer of hazardous and other wastes i.e. scraps from storage shed to furnaces (pit/reduction/tilting) and fused scraps to leaching reactors shall be transferred through mechanised claw/conveyer system with minimal manual intervention.

7) The chemicals, additives, leachate and filtrate of the utilization processes shall be transferred to the appropriate reaction/storage tanks using chemical process pumps.

8) If not recycled/recovered, filtered residues from reactors shall be disposed in authorized TSDF in accordance with the provisions stipulated in HOWM Rules, 2016.

9) There shall be a closed system of operations such as leaching. The reaction vessel shall be connected with suction hood above the feeding point (of fused scraps) to control acid/alkali fumes/vapours liberated form the reaction vessel. The suction hood shall be connected with scrubber and stack of adequate height or as prescribed by SPCB/PCC.

10) The fume hoods of furnaces ((pit/reduction/tilting)) shall be connected to bag filters and stack of adequate height or as prescribed by SPCB/PCC.

11) All vapour lines of reactors shall be connected with condenser for reflux back to reactor to minimize acid requirements and finally to receiver for recovery vapour line from receiver will be connected to suitable APCD (i.e. scrubber).

12) The unit shall maintain proper ventilation in the work zone and process areas. All personnel involved in the plant operation shall wear proper personal protective equipment (PPE) specific to the process operations involved and type of chemicals handled as per Material Safety Data Sheet (MSDS). The safety precautions of the worker shall be in accordance with the Factory Act, 1948, as amended from time to time.

13) The treated effluent shall be discharged in accordance with the conditions stipulated in the Consent to Operate issued by respective SPCB/PCC under the Water (Prevention and Control of Pollution) Act, 1974.

14) Prior to utilization of hazardous and other wastes i.e. scraps, the unit shall obtain authorisation for generation, storage and utilization of such hazardous and other wastes from the concerned State Pollution Control Board under Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016.

15) In case of environmental damages arising due to improper handling of hazardous wastes including accidental spillage during generation, storage, processing, transportation and disposal, the occupier (sender or receiver, as the case may be) shall be liable to implement immediate response measures, environmental site assessment and remediation of contaminated soil/ groundwater/ sediment etc. as per the "*Guidelines on Implementing Liabilities for Environmental Damages due to Handling & Disposal of Hazardous Wastes and Penalty*" published by CPCB.

16) The unit shall provide suitable fire safety arrangements and flame proof electrical fittings.

17) During the process of utilization and handling of hazardous waste the unit shall comply with requirement in accordance with the Public Liability Insurance Act, 1991 as amended, wherever applicable.

64.5 Record/Returns Filing

1) A log book with information on source, quantity, date wise utilisation of hazardous and other wastes and its generation and disposal, etc. shall be maintained including analysis report of fugitive emission monitoring & effluent discharged, as applicable.

2) The unit shall maintain record of hazardous and other wastes utilised, generated and disposed as per Form 3 & shall file annual returns in Form 4 as per Rule 20 (1) and (2) of the Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016, to concerned SPCB/PCC.

3) The unit shall submit quarterly and annual information on hazardous and other wastes consumed, its source, products generated or resources conserved (specifying the details like, type and quantity of resources conserved) to the concerned SPCB.

64.6 Standards

1) Source emissions from the stack connected to Air Pollution Control Device (APCD) of boiler furnace shall comply with the following standards or as prescribed by the concerned SPCB/PCC, whichever is stringent;

   i. For utilization of Tin scrap (at stack of pit furnace):

Parameters	Standard
PM	50 mg/Nm^3
SO_x	200 mg/Nm^3

ii. For utilization of Tungsten scrap (at stack of hydrogen reduction furnace and oxidation furnace) :

Parameters	Standard
PM	50 mg/Nm^3
HCl vapour & mist	35 mg/Nm^3
NH_3	30 mg/Nm^3

2) Fugitive emission in the storage area shall comply with the following standards:

i. For Utilization of Tin scrap:

Parameter	Standards
PM_{10}	5 mg/m^3 TWA*
Tin (Sn)	2 mg/m^3 TWA*
NaOH	2 mg/m^3 TWA*

ii. For utilization of Tungsten scrap:

Parameter	Standards
PM_{10}	5 mg/m^3 TWA*
HCl	7 mg/m^3 TWA*
Acetic Acid (CH_3COOH)	25 mg/m^3 TWA*
Oxalic Acid	1 mg/m^3 TWA*
NH_3	35 mg/m^3 TWA*
Tungsten (as W) Insoluble compounds	5 mg/m^3 TWA*
Tungsten (as W) Soluble compounds	1 mg/m^3 TWA*
Tungsten carbide containing cobalt as binder	0.1 mg/m^3 TWA*

iii. For utilization of cobalt scrap:

Parameter	Standards
PM_{10}	5 mg/m^3 TWA*
Cobalt as (Co)	0.1 mg/m^3 TWA*
Chromium (as Cr)	1 mg/m^3 TWA*
NaOH	2 mg/m^3 TWA*

iv. For utilization of Vanadium/Tantalum/Niobium alloy scrap:

Parameter	Standards
PM_{10}	5 mg/m^3 TWA*
Vanadium (Respirable dust as V_2O_5)	0.5 mg/m^3 (#C)
Vanadium (Fume as V_2O_5)	0.1 mg/m^3 (#C)
Tantalum, metal and oxide dust	5 mg/m^3 TWA*
Titanium Dioxide (Total Dust)	15 mg/m^3 TWA*
Hafnium	0.5 mg/m^3 TWA*

 # Ceiling Limit
**time-weighted average (TWA): measured over a period of 8 hours of operation of process.*

3) Monitoring of the above specified parameters for source emission shall be carried out quarterly for first year followed by at least annually in the subsequent year of utilization. Fugitive emission for specified parameters shall be carried out quarterly. The monitoring shall be carried out by NABL or EPA approved laboratories and the results shall be submitted to the concerned SPCB/PCC on a quarterly basis.

4) Standard for wastewater discharge: Treated effluent shall be discharged in accordance with the conditions stipulated in Consent to Operate issued by respective SPCB/PCC under the Water (Prevention and Control of Pollution) Act, 1974. In case of zero discharge or no discharge condition stipulated in the said consent or non-availability of the Common Effluent Treatment Plant (CETP), zero discharge shall be met.

64.7 Siting of Industry

This SoP is applicable only for utilization of metal and metal bearing hazardous and other wastes namely Tin, Tungsten, Cobalt, Vanadium, Tantalum and Niobium scraps and facilities for their utilization shall be located in a notified industrial area or industrial park/estate/cluster and in accordance with Consent to Establish issued by the concerned SPCB/PCC.

64.8 On-line detectors / Alarms / Analysers

In case of continuous process operations, online emission analysers for PM and SO_x in the stack of pit furnace (for Tin scrap utilization) & PM and HCl vapour & mist in the stack of hydrogen reduction & oxidation furnace (for Tungsten scrap utilization) shall be installed and the online data be connected to the server of the concerned SPCB/PCC and CPCB.

64.9 Checklist of Minimal Requisite Facilities

Sl. No.	Particulars
1	Covered storage shed of adequate capacity to store hazardous and other wastes for at least two weeks requirement but preferably for 30 days.
2	Cool, dry well-ventilated covered storage shed(s) for hazardous and other wastes, other raw materials/chemical storage and process activities within premises.
3	Enclosed pumping/mechanized conveyer system for handling and transfer of hazardous and other wastes from storage area to reactors and/or furnaces.
4	Rotary Drier, Pulverizer, Non-reactive Storage tanks
5	Centrifuge, Transfer Pumps, Filter Press & Evaporators.
6	Furnaces (Hydrogen Reduction, Oil Fired Tilting), Refining Pots, Leaching Reactors.
7	Wet Scrubbers and Bag Filters (APCD).
8	Stack of proper height as prescribed by SPCB with sampling port, platform, access to the platform etc. as per the guidelines on methodologies for source emission monitoring published by CPCB under Laboratory Analysis Techniques LATS/80/2013-14.

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