Tamil Nadu Pollution Control Board

Standarad Operating Procedures

for Utilization of Hazardous & Other Waste

Volume I

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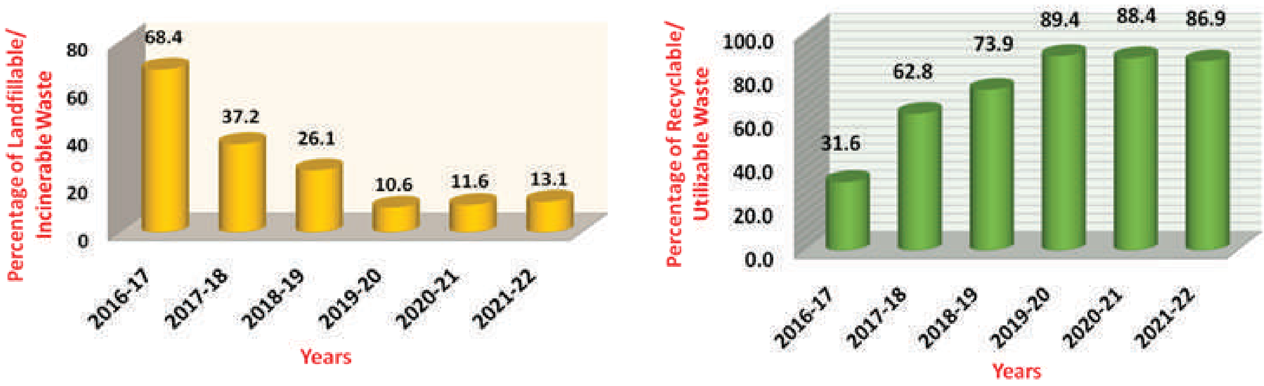
PREFACE

Hazardous waste means "any waste which by reason of characteristics such as physical, chemical, biological, reactive, toxic, flammable, explosive or corrosive, causes danger or is likely to cause danger to health or environment, whether alone or in contact with other wastes or substances". The Ministry of Environment, Forest and Climate Change, Government of India has notified the Hazardous and Other Wastes (Management and Transboundary Movement) Rules in the year 2016. The Rule prescribes various roles and responsibilities of the generators, recyclers, utilisers and treatment, storage and disposal facilities, the Central and the State Pollution Control Boards, and the Central and the State Governments. In Tamil Nadu, the generation, collection, storage, transportation, reception, utilization and disposal of hazardous wastes are monitored by Tamil Nadu Pollution Control Board.

The hazardous waste management hierarchy starts with prevention/minimization, then moves to recycling, utilizing including co-processing in cement industries (as fuel / raw material) and finally with the option for treatment and disposal through incineration or secured landfill. The term “utilizable wastes” has been referred as wastes which do not fall under the “recyclable waste” and are being utilized as resource or for energy recovery. The units utilizing the utilizable wastes have been referred as “utilizers”. The Central Pollution Board along with all the State Pollution Control Board strives hard for the better management of hazardous waste by involving the concept of circular economy, and by minimising the final disposal of the waste into the environment as far as possible and maximizing its recycling/utilization effeciency. It attempts not only to recover valuable resources from the wastes but it also reduce the adverse impacts, the disposal of wastes cause to the environment. On one hand the generators are advised to take all possible efforts to reduce the generation of wastes at the source itself and on the other hand efforts are made to encourage the establishment of more recyclers/utilisers. The number of utilizing / recycling units increased significantly over the years, resulting in steady increase in the quantity of utilized / recycled wastes. The percentage of the waste sent for final disposal as landfill / incinerable and the waste utilized / recycled over the period 2016 to 2022 is given in Figure.



Percentage of landfill/incinerable waste and recyclable /utilizable waste over the years from 2016 to 2022

As per the Rule 9(1), (2) of HOWM Rules, 2016, it is notified that, the utilization of hazardous and other wastes as a resource or either for co-processing or for any other use, including within the premises of the generator (if it is not part of process), shall be carried out only after obtaining authorization from the State Pollution Control Board in respect of waste on the basis of Standard Operating Procedures (SOP)s or guidelines provided by the Central Pollution Control Board. Hence, the Central Pollution Control Board evaluates the proposals received from industries of various states to issue with the Standard Operating Procedures or guidelines for utilization of hazardous and other wastes. After the careful evaluation in the Scientific Expert Committee (SEC) meeting, the SOP's are issued and the same will be sent to all the SPCB's and published in CPCB's website. CPCB has so far issued 101 SOPs for different categories of hazardous wastes.

The Handbook on Standard Operating Procedure for Utilizing Hazardous Waste in India is the overall compilation of the SOPs released by CPCB. The Handbook is intended to serve as a quick reference for the generators, recyclers, pre-processers, co-processers, utilisers of hazardous and other waste, for the officials of TNPCB. This handbook outlines the procedures to be adopted for the safe utilization of hazardous and other waste. The SOP's released by CPCB are categorized as solid and liquid wastes and in this handbook of Vol I, the solid waste categories are compiled. The liquid waste category will be released in the Vol II.

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Procedure for Processing the Proposals for Utilization of Hazardous Waste under Rule 9 of the Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016

Background:

The Rule 9 of the Hazardous and Other Wastes (Management and Transboundary Movement) (HOWM) Rules, 2016 and amendments thereof stipulates that;

1) The utilization of hazardous waste as a resource or after pre-processing either for co-processing or for any other use, including within the premises of the generator (if it is not part of process), shall be carried out only after obtaining authorization from the State Pollution Control Board in respect of wastes on the basis of standard operating procedures or guidelines issued by the Central Pollution Control Board from time to time.

2) Where standard operating procedures are not available for specific utilization of hazardous waste, the approval has to be sought from the Central Pollution Control Board which shall be granting approval on the basis of trial runs and thereafter, standard operating procedures shall be prepared by the Central Pollution Control Board.

   Provided, if trial run has been conducted for particular waste with respect to particular utilization and compliance to the environmental standards has been demonstrated, authorization may be granted by the State Pollution Control Board with respect to the same waste and utilization, without need of separate trial run by Central Pollution Control Board under such cases of successful trial run, Central Pollution Control shall intimate all the State Pollution Control Board regarding the same.

3) No trial runs shall be required for co-processing of waste in cement plants for which guidelines by the Central Pollution Control Board are already available, however, the actual users shall ensure compliance to the standards notified under the Environment (Protection) Act, 1986 (29 of 1986), for cement plant with respect to co-processing of waste, provided that till the time the standards are notified, the procedure as applicable to other kind of utilization of hazardous and other waste, as enumerated above shall be followed

   As per the aforesaid provisions of utilization of hazardous wastes as a resource or after pre- processing either for co-processing or for any other use, including within the premises of the generator (if it is not part of process), shall be carried out onlyafter taking approval from CPCB and/or obtaining authorization from the SPCB in respect of wastes on the basis of SoPs or guidelines for various proposed utilization ofwaste is given below procedure for processing applications received at online portal CPCB for grant of approval and development of SoPs or guidelines for various proposed utilization of hazardous waste is given below:

A. Application for Utilization of Hazardous Waste under Rule 9:

The applicant willing to utilize hazardous waste should submit an application through CPCB portal Online application for utilization of hazardous wastes under Rule 9 available at - *https://egovernancecpcb.co.in/hazardous/* (Instructions for online application at **Annexure I)**

Hard copy of application shall not be accepted for processing at CPCB.

B. Processing of applications:

B-I In case the proposal is for utilization of hazardous wastes, for which CPCB has already prepared SOPs or guidelines, applicant after complying with such SoPs shall apply to concerned SPCB/PCC for authorization. If required, applicant will be informed accordingly with a copy to concerned SPCB/PCC (preferably by email).

B-II In case the proposal to utilize hazardous waste(s), for which SoPs or guidelines are not in existence, then the application shall be processed according to the following procedure:

1. Upon receipt of the online application, CPCB shall examine and evaluate it in 10 working days (02 weeks).
2. If, application found incomplete w.r.t. necessary information required to process the application, the applicant shall be communicated to provide the desired information within 30 days.
3. In case of no response within 30 days from the applicant, the application shall be treated as withdrawn.
4. CPCB shall further examine the additional information provided by the applicant.
5. The case along with protocool for trial utilization study shall be put up before Technical Expert Committee (TEC) within 02 weeks upon receipt of complete information from the unit. The protocol shall include the duration, quantity of hazardous waste required for trial, the parameters for measurement in air / water / waste-streams/soil/work-zone etc., tentative standards for identified parameters. sampling duration, tentative number or samples process conditions: load variation, waste mix proportions, duration, etc.
6. After recommendation of TEC & approval of Competent authority in CPCB, trial run protocol shall be communicated to the unit. A formal letter with protocol shall be issued by CPCB to the unit for conducting trial run study with copy to concerned SPCB/PCC and CPCB (Regional Directorate/HO Team) within 5 working days (01 week) of approval from Competent Authority of CPCB.

7. The maximum duration to conduct trial run in a stretch shall be restricted to 30 days. Trial run monitoring shall be conducted at weak load or to capture the possible maximum emission/discharges to the environment.

8. The validity of trial run study shall be for period of 03 months from the date of issue of trial run permission letter. In case, applicant is unable to conduct trial run in the specified period, the application shall be treated as withdrawn. CPCB may however extend the validity trial run period on case to case basis, upon request of the applicant, citing reasons and valid grounds.

9. It shall be responsibility of the applicant to obtain one-time authorization for trial run study based on the permission granted by CPCB.

10. The unit shall engage an environmental laboratory recognized under EPA 1986 or NABL accredited laboratory for carrying out the monitoring of trial utilization as per the protocol issued by CPCB. The laboratory shall have accreditation (EPA/NABL/ISO17025) for the parameters specified for the trial run protocol. In case the unit is unable to engage any laboratory having the said accreditation for any parameters, international labs accredited under ISO 17025 may be engaged for analysis of such parameters.

11. Based on trial run permission, the unit shall procure the required quantity of hazardous waste for trial run front the generating industry as declared by the unit.

12. The unit shall inform CPCB and the concerned SPCB/PCC about their preparedness of carrying out trial run at least 15 days in advance so as to enable CPCB and the SPCB/PCC to participate in the trial utilization study and monitoring.

13. Regional Directorate (RD), CPCB shall schedule trial run jointly with SPCB within 30 days from date of receipt of communication fro applicant.

14. It shall be responsibility of the industry to take all safeguards while handling, transportation, storage, utilization etc. of the hazardous is waste so as to avoid accidents, environmental damages etc. In the event of such accidents/damages, the industry shall have sole responsibility and liability of the same.

15. NOC for inter-state transport of hazardous waste meant for utilization is not required from SPCB/PCC. However, the sender of hazardous wastes shall intimate both the SPCBs before handing over the waste to the transporter in accordance to the provisions laid down under the Rule 18(4) of HOWM Rules, 2016.

16. Trial run performance shall be monitored by laboratory in presence of the CPCB & SPCB/PCC officials. CPCB/SPCB shall collect few random samples for cross-verification during the trial run period.

17. The laboratory engaged shall submit data and analysis results within 15 days after completion of trial utilization monitoring and other information as prescribed in the monitoring protocol only to the concerned RD, CPCB with copy to Head Office CPCB, Delhi.

18. Inspecting team of CPCB (RD) shall submit inspection report along with analysis results and information within 30 days after completion of trial runs. The report shall be very specific with observations, shortcomings and recommendations. Deviations in analysis reports of CPCB and laboratory hired shall be indicated in the report with likely reasons.

19. In case of major deviation between the results of samples collected by CPCB and laboratory engaged and non-compliance, the monitoring shall be repeated. One time repeat trial run may be permitted. However, the said repeat trial run shall be permitted only after taking corrective measures by the unit. The permission for repeated trial run shall be obtained from Head Office, CPCB Delhi.

20. The monitored data of identified parameters shall be comparted with notified standards under Environment (Protection) Act, 1986. CPCB may propose international practices/standards. in the absence of notified standards,

21. Based on the trial study report individual case shall be examined for compliance to monitored parameters and requisite infrastructure as per trial run protocol. CPCB shall develop draft SoP and place before TEC for discussion within 10 working days (2 weeks) from date of receipt of the trial run report from RD, CPCB.

22. The recommendation of TEC shall be placed before Competent Authority of CPCB for granting approval / conditional approval / refusal, as the case may be.

23. CPCB shall develop Final SoPs for utilization of similar hazardous waste adopting similar process which has been assessed through inspection and trial run and upload on CPCB website.

24. CPCB shall issue a letter to applicant with copy to concerned SPCB/PCC regarding granting approval/conditional approval/refusal of utilization proposal within 5 working days (01 week) of approval from Competent Authority of CPCB.

*** Complete applications are evaluated by CPCB considering environmentally soundness of the utilization proposal, pollution potential for emissions/discharges; potential for ground/soil contamination ; adequacy of the proposed facility for control of pollution; quantity of residue/waste generated; potential exposure to the workers and nearby community ; etc. If utilization proposal found satisfactory, trial run monitoring protocol shall be recommended along with emission/discharge/work zone standards. Further, upon satisfactory verification during trial run, CPCB shall grant approval and prepare standard operating procedure thereof.*

C. **Validity of Approvals:**

a. No validity period for the approvals issued under the Rule-9 shall be specified as long as there is no change in utilization process, raw material and product use, wherever applicable. The conditions specified as part of approval shall be enforced by the concerned SPCB/PCC.

b. In cases where violations are observed by CPCB or the concerned SPCB/PCC, or in case the approved utilization process proves to be non-compliant in real time conditions over a period, the approval under Rule-9 as well as the SoPs shall be cancelled by CPCB or SPCB/PCC, as the case may be.

It shall be the endeavour of CPCB to continuously improve upon the utilization process based on the technology improvements, implementation and experience gained on larger scale. Therefore, the conditions specified in SoPs and Check-list is subjected to change from time to time.

Format & Checklist for obtaining approval from the Central Pollution Control Board under the Rule 9 of the Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016*

1.0	GENERAL INFORMATION
1.1	Name & Address of the Unit:
1.2	Contact Person and phone number with Email Id:
1.3	Products to be manufactured and quantity (MT/Day}):
1.4	Pleas attach the copy or air consent, water consent and authorization:

2.0	DETAILS OF HAZARDOUS WASTE TO BE UTILIZED
2.1	Name, category & address of hazardous waste generating industry:
2.2	Name/Type of the hazardous wastes waste including category (as per the Schedule I or II or III) intended for utilization:
2.3	Detailed characteristics of hazardous waste proposed for utilization (including individual concentration of all raw materials/products and by- products/possible organic compounds utilized during hazardous waste generation process):
2.4	Complete process details from which such hazardous waste is

3.0	**DETAILS OF UTILIZATION OF HAZARDOUS WASTES IN PRODUCT MANUFACTURING**
3.1	Proposed quantity (in MTA) of hazardous waste to be utilized:
3.2	Process details of hazardous waste utilization *(including working principle of each of the plant & machinery and flow diagram of the utilization process along with complete mass balance and write-up about the process)*:
3.3	Chemical reactions involved at various stages of the utilization process along with material balance:
3.4	Detailed characteristics of product manufactured by using above hazardous waste *(including individual concentration of all raw materials/ products and by-products/possible organic compounds utilized during hazardous waste generation process: TCLP/STLC/Total concentration analysis, as applicable)*:
3.5	Base line data including characteristics pertaining to air emissions, waste water generation and other solid wastes including hazardous or other waste expected to be generated in the proposed utilization process:
3.6	Material Balance with and without utilizing hazardous wastes, in case the waste is proposed for utilization/co-processing in an already existing process:
3.7	Details of hazardous or other waste storage facility and process area facility:
3.8	Quantity of fuel and/or raw material that are expected to be conserved (in % of raw material replaced) from the proposed Utilization:
3.9	Details of findings of laboratory/ pilot scale study, international practice etc.
3.10	End use process details of the product (s) manufactured by using the above waste and its environmental impacts thereof:
3.11	Specifications of product derived with and without utilization of the aforesaid hazardous waste {Please also provide BIS or other specifications of the product as applicable):

4.0	**ADDITIONAL DETAILS OF UTILIZATION OF HAZARDOUS WASTE IN ETP/CETP**
4.1	Name of chemical being currently used as neutralizing/coagulating agent/others
4.2	Consumption of quantity of chemical being currently used as neutralizer/coagulating agent/others in terms of per MLD
4.3	Proposed dosing of hazardous waste in terms of per MLD

***To be filled by the unit who desires to utilize hazardous waste as a resource or after pre-processing either for co-processing or for any other use, including within the premises of the generator (if it is not part of process)*

Checklist for evaluation of applications under Rule 9 of HOWM Rules, 2016 (to be submitted along with application)

S. No	Details of information required	Provided (Yes/No)	Remarks
1.	Name & complete address of the hazardous waste (HW) utilizing unit		
2.	Role & Designation of authorized person with contact number & email ID		
3.	Copy of CTE / CTO / Authorization		
4.	Name & Category; or HW proposed to utilize		
5.	Name & Address of HW generating industries (attach list)		
6.	HW generation process details, attach process flow diagram (PFD)		
7.	Proposed quantity of HW to be utilized		
8.	Analysis report of HW		
9.	Proximate and ultimate analysis of HW (if utilized for energy recovery)		
10.	Detail HW utilization process description		
11.	PFD of HW utilization process		
12.	Mass balance of utilization process with and without using HW		
13.	Chemical reaction involved in utilization process		
14.	Operation details of unit involved in HW utilization (like operational parameters, capacity, working principle of machinery)		
15.	HW Storage and process area facility details		
16.	Quantity and details of fuel and/or raw material that are expected to be conserved/replaced through HW utilization.		
17.	Details of any laboratory/ pilot scale study		
18.	End use details of the product (s) manufactured by using HW along with other standard specification (like BIS)		

Aluminium Dross

Captive Utilization of Aluminium Dross generated from refining and casting house of Aluminium smelter units to recover Aluminium Metal

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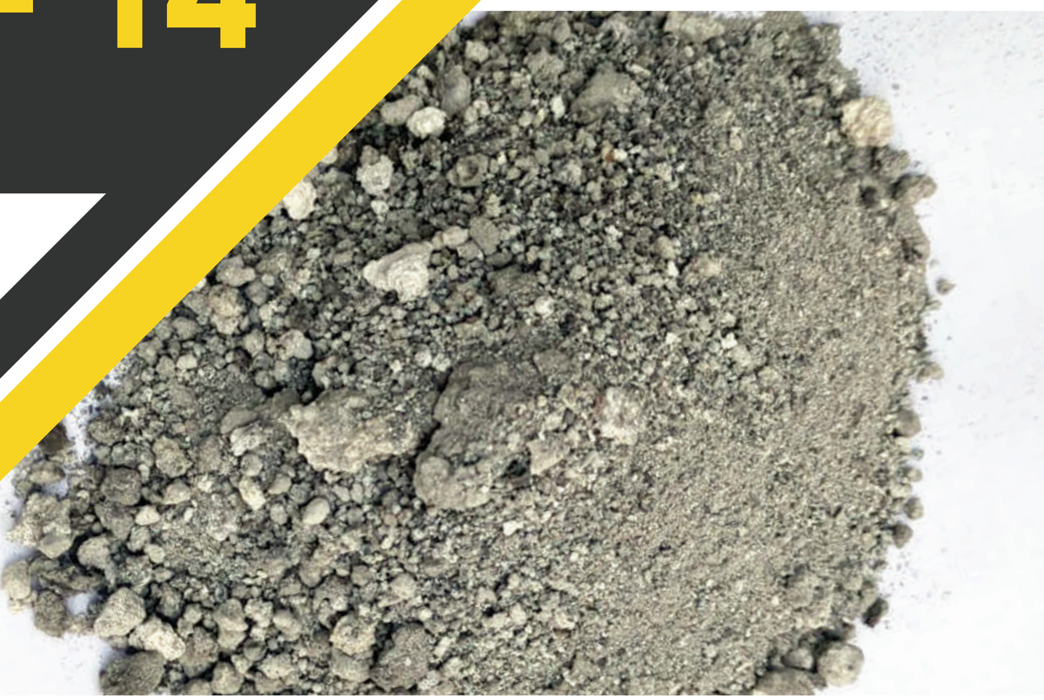

Aluminium Dross from refining and casting house of Aluminium smelter units

(Category: 11.5 of Schedule I of HOWM Rules, 2016)

1.0 Utilization of Aluminium Dross (Captive)

This SoP is applicable only for utilization of Aluminium Dross as described below:

Type of HW	Source of generation	Recovery/Product
Aluminium Dross	Refining and casting house of Aluminium smelter units	To recover aluminium metal (captive use)

The utilization process shall involve crushing of aluminium dross in a crusher followed by screening to recover > 1mm and < 20mm size metal rich granules. These rich granules are melted in a crucible furnace to recover molten metal.

1.1 Standard Operating Procedure

1) In-house transportation & handling of Aluminium dross shall be carried out using covered truck.

2) The material shall be collected and stored under covered shed.

3) Crushing and screening units shall be enclosed in a chamber connected to air pollution control devices comprising of cyclone dust collector and bag filter. The treated gases are routed to main flue gas duct of smelter pot-lines or anode baking units leading to FTP for control of fluoride emissions.

4) The furnace shall be enclosed completely with shutters at the front side to enable charging and material retrieval operations. It shall be ensured that fume extractions systems are operated continuously during firing, charging and retrieval operations of the furnace.

5) The flue gases containing combustion emission along with gases from furnace shall be extracted through ID fan and mixed with main duct carrying flue gases from smelters pot-line or anode baking unit for treatment in Fume Treatment Plant (FTP).

6) If required, the furnace shall be fitted with a blower fan to supply the combustion air.

7) A mechanical mixer shall be installed, to mix the molten material in crucible remotely while the firing in progress.

8) There should be a provision for inspection window with glass lenses to inspect the interior portion of the furnace during firing and mixing operations.

9) The furnace should be operated at a temperature of around 700°C.

10) Coke / Pet coke / hard coke or any other conventional fuels may be used for heating the furnace.

11) The storage and handling material shall be done under a shed and over lined impervious flooring.

12) The handling of hazardous waste shall be carried out using mechanical means with minimal manual intervention.

13) The reject from screens, flue dust from cyclone & bag filters, and residue/dross from furnace shall be packed and temporarily stored in dedicated hazardous waste storage pit with cover and disposed in common hazardous waste treatment, storage and disposal facility within 90 days.

14 The unit shall ensure that all personnel involved in the plant operation shall wear proper personal protective equipment such as masks, safety gloves, goggles, safety shoes etc.

15) The unit shall comply with following standards:

Source Emission Standards:

(i) Total Fluoride, in the vent of Bag filters attached to crusher & screening unit shall not exceed 25 mg/Nm^3 or as stipulated by concerned SPCB, whichever is low.

(ii) Particulate Matter, in the vent of Bag filters attached to crusher & screening unit shall not exceed 150 mg/Nm^3 or as stipulated by concerned SPCB, whichever is low.

(iii) The emission in stack connected with FTP unit shall comply with the notified emission standards for anode baking unit or smelter units.

Work Zone standards (OSHA) —

PM_{10} - 5000 µg /m^3 TWA*

Ammonia - 25 ppm (18 mg/m^3) TWA*

Fluoride - 2.5 mg/m^3 TWA*

Cyanide - 5 mg/m^3 TWA*

**8 hour Time-weighted average (TWA)*

16) Monitoring of the specified parameters for source and work zone emissions shall be carried out by NABL/EPA accredited laboratories quarterly and the results shall be submitted to the concerned SPCB quarterly.

17) The unit shall obtain authorization from the concerned State Pollution Control Board under the Hazardous and Other Wastes (Management & Transboundary Movement) Rules, 2016, for generation, storage and processing of aluminium dross.

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

19) The unit shall maintain record of hazardous waste utilised, residues 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 SPCB.

20) A log book with information on date of generation of aluminium dross, quantity, date wise utilization of the same, quantity of products manufactured, hazardous waste generation and its disposal etc. shall be maintained including analysis report of emission monitoring & effluent discharged, as applicable.

21) In case of environmental damages arising due to improper handling of hazardous wastes including accidental spillage during generation, storage, processing, transportation and disposal, the unit 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.

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

1.2 Checklist of Minimal Requisite Facilities

S. No	Requisite Facilities
1.	Covered storage shed(s), of adequate capacity shall be provided to store aluminium dross as well as hazardous waste. Size of said sheds shall be adequate to store a quantity equivalent to one month's utilization of aluminium dross and 90 days of generation hazardous wastes respectively.
2.	Covered sheds for process operations including material handling.
3.	Crucible furnace made of cast iron or any other suitable material to operate at a temperature around 700°C.

4.	A blower unit may be installed for supplying combustion air to the furnace.
5.	Use of Coke / hard coke / pet coke or any other conventional fuels for heating the furnace.
6.	There should an enclosure around the furnace with suction hood at the top connected to air pollution control devices. A provision of shutters shall be made at front side to enable charging, material retrieval and other operations.
7.	May install mechanical stirrer with provision for remote operation.
8.	The Pulveriser, crusher and screening units shall be connected to air pollution control devices comprising of cyclone dust collector and bag filter with pulse jet cleaning.
9.	The cleaned gases from Pulveriser, crusher and screening units shall be sent to FTP unit of anode baking or smelter units for treatment of fluoride emissions.
10.	The flue gases generated form crucible furnace including the combustion emissions shall be sent to FTP unit of anode baking unit or smelter unit for treatment of fluoride emissions.
11.	Dumpers, loaders, feeders and other equipment for mechanical handling of aluminium dross and its residues.

Utilization of Aluminium Dross generated from refining and casting house of Aluminium smelter units to recover Aluminium Metal

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Aluminium Dross generated from refining and casting house of Aluminium smelter units

(Category: 11.5 of Schedule I of HOWM Rules, 2016)

1.0 Utilization of Aluminium Dross

This SoP is applicable only for utilization of Aluminium Dross as described below:

Type of HW	Source of generation	Recovery/Product
Aluminium Dross	Refining and casting house of Aluminium smelter units	To recover aluminium metal

The utilization process shall involve pulverising aluminium dross using crushers, pulverisers and mechanical screens to recover > 0.5mm and <20mm size metal rich granules. These rich granules are melted in a crucible furnace to recover molten metal.

1.1 Standard Operating Procedure

1) Aluminium dross shall be procured in trucks and un-loaded in covered sheds to avoid contact with any moisture.
2) The storage and handling material should be done under a shed and over lined impervious flooring.
3) The handling of hazardous waste such as unloading, storage and transfer shall be carried out using mechanical means with minimal manual intervention.
4) Crushing, pulverising and screening units shall be enclosed and connected to air pollution control devices comprising of cyclone dust collector, bag filter and alkali scrubber and attached to stack. A combination of crusher, pulveriser and screening units with common air pollution control devices may be used.
5) The furnace shall be enclosed completely with shutters at the front side to enable charging and material retrieval operations. It shall be ensured that fume extractions systems are operated continuously during firing, charging and retrieval operations of the furnace.
6) The flue gases containing combustion emission and gases from furnace shall be extracted through ID fan and routed to wet alkali scrubber connected to a stack of height atleast 06 meter above the roof level of the process shed or the adjoining structure or as prescribed by SPCB whichever is higher.
7) If required, the furnace shall be fitted with a blower fan to supply the combustion air.

8) A mechanical mixer may be installed, to mix the molten material in crucible.

9) The furnace should be operated at a temperature of around 700°C.

10) Coke / hard coke or any other conventional fuels may be used for heating the furnace.

11) The reject from screens, flue dust from cyclone & bag filters, sludge from scrubber and residue/dross from furnace shall be packed and temporarily stored in dedicated hazardous waste storage pit with cover and disposed in common hazardous waste treatment, storage and disposal facility within 90 days.

12) The unit shall ensure that all personnel involved in the plant operation shall wear proper personal protective equipment such as masks, safety gloves, goggles, safety shoes etc.

13) The unit shall comply with following standards:

Source Emission Standards:

Total Fluoride, in stacks attached to the Crushing, pulverising and screening units and crucible furnace shall not exceed 25 mgINm^3 or as stipulated by concerned SPCB, whichever is low.

Particulate Matter, in stack attached to Crushing, pulverising and screening units and crucible furnace shall not exceed 150 mg/Nm^3 or as stipulated by concerned SPCB, whichever is low.

Work Zone standards (OSHA) —

PM_{10} - 5000 µg/m^3 TWA*

Ammonia - 25 ppm (18 mg/m^3) TWA*

Fluoride - 2.5 mg/m^3 TWA*

Cyanide - 5 mg/m^3 TWA*

**8 hour Time-weighted average (TWA)*

14) Monitoring of the specified parameters for source and work zone emissions shall be carried out by NABL/EPA accredited laboratories quarterly and the results shall be submitted to the concerned SPCB quarterly.

(15) The unit shall maintain a passbook issued by concerned SPCB wherein the following details of each procurement of aluminium dross shall be entered:

- Address of the sender
- Date of dispatch
- Quantity procured

- Seal and signature of the sender
- Date of receipt in the premises

16) Transportation of the hazardous wastes (i.e. Aluminium dross) and residues generated during utilisation process shall be carried out by sender or receiver (utilizer/TSDF operator) as per authorisation issued by the concerned SPCB under the Hazardous and Other Wastes (Management & Transboundary Movement) Rules, 2016.

17) It shall be ensured that the aforesaid hazardous waste is procured from the Aluminium Smelter units who have valid authorization for the same from the concerned SPCB as required under Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016.

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

19) The unit shall maintain record of hazardous waste utilised, residues 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 SPCB.

20) A log book with information on source of procurement, quantity, date wise utilization of the same, quantity of products manufactured, hazardous waste generation and its disposal etc. shall be maintained including analysis report of emission monitoring & effluent discharged, as applicable.

21) In case of environmental damages arising due to improper handling of hazardous wastes including accidental spillage during generation, storage, processing, transportation and disposal, the unit 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.

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

1.2 Checklist of Minimal Requisite Facilities

S. No	Requisite Facilities
1	Covered sheds for process operations including material handling. The sheds should prevent entry of any moisture/rain water during monsoon.
2.	Covered storage shed of adequate capacity shall be provided to store aluminium dross. The size of shed shall be adequate to store atleast 1 month quantity of utilization.
3.	Covered storage shed(s), of adequate capacity shall be provided to temporarily store scrubber sludge, residues and rejects. Size of shed shall be adequate to store at least 90 days of waste generation
4.	Crucible furnace made of cast iron or any other suitable material to operate at a temperature around 700°C.
5.	A blower unit may be installed for supplying combustion air to the furnace.
6.	Coke / hard coke or any other conventional fuels maybe used for heating the furnace.
7.	There should an enclosure around the furnace with suction hood at the top connected to air pollution control devices. A provision of shutters shall be made at front side to enable charging, material retrieval and other operations.
8.	May install mechanical stirrer to mix molten metal inside the crucible.
9.	The Pulveriser, crusher and screening units shall be connected to air pollution control devices comprising of cyclone dust collector and bag filter with pulse jet cleaning followed by alkali scrubber.
10.	The stack attached to Pulveriser, crusher and screening units shall be of 6 meters above the roof level of the adjoining structure or as specified in CTO issued by SPCB whichever is higher.
11.	The flue gases generated form crucible furnace including the combustion emissions shall be treated in wet alkali scrubber and the cleaned gases shall be vented through stack of height 6 meters above the roof level of the adjoining structure or as specified in CTO issued by SPCB whichever is higher.
1 2.	Dumpers, loaders, feeders and other equipment shall be used for mechanical handling of hazardous waste.

Utilization of residue/rejects generated from processing of Aluminium Dross of Aluminium Smelting process for production of synthetic slag

SOP - 51

Residue / Rejects from Aluminium Smelting process

(Category: 11.5 of Schedule I of HOWM Rules, 2016)

1.0 Utilization of Spent Aluminium Dross residue/rejects

Type of HW	Source of generation	Recovery/Product
Spent Aluminium Dross residue / rejects (Category no.11.5 or Schedule I of HOWM Rules, 2016)	generated during aluminium smelting process	Calcium Aluminate (Synthetic Slag)

1.1 Source of Waste

The Aluminium Dross residue/rejects is generated from utilisation of Al dross ie. white dross (generated from cast house of primary Aluminium Smelters) involves pulverizing of aluminium dross using crusher, pulverisers and mechanical screens to recover >0.5 mm and <20 mm size metal rich granule. These granules are melted in a crucible furnace to recover molten aluminium metal. The rejects from screen and residues/dross from furnace is referred as aluminium dross rejects/residue. The aforesaid Spent Aluminium Dross residue/rejects is categorized as Hazardous waste at S. No. 11.5 of Schedule I of HOWM Rules. 2016 which are required to be disposed in authorized disposal facility in accordance with authorization condition, when not utilized as resource recovery.

Typical Characteristics of the Aluminium dross residues/waste is given below:

Parameters	Results
Alumina (as Al_2O_3)	89.4%
Heavy Metals (As, Mn, Cu, Zn)	0.026%
Calcium Oxide (as CaO)	0.73%
Silica Dioxide (SiO_2)	2.19%
Titanium Dioxide (as TiO_2)	0.004%
Magnesium Oxide (as MgO)	0.81%
Ferrous Oxide (as Fe_2O_3)	1.06%
Disodium Oxide (as Na_2O)	4.89%
Sulphur Trioxide (as SO_3)	BDL

Manganese Oxide (as MnO)	0.03%
Dichromium Trioxide (as Cr_2O_3)	0.02%
Fluoride (as F)	0.12%

1.2 Utilization Process

Aluminium dross residues/ rejects contains large amounts of alumina and is used as an alumina source for calcium aluminate production. The process involves use of Al dross residue which has granulometry of 100 % < 0.5mm. Al dross residue/ reject and other raw materials i.e calcined lime & dololime are fed to the furnace through hoppers. Dust collector and pulsejet bag filters are attached to the suction hood provided to feeding hoppers. As the charge moves down the furnace the temperature increases upto 1550 °C which melts the charge and eliminates the toxic compounds (i.e Aluminium carbide, Aluminium Nitride, Aluminium Sulfides) during the course of the reaction. Calcium aluminates are formed when the appropriate proportions of calcium carbonate and aluminium oxide are heated together.

Molten synthetic slag i.e Calcium Aluminate is then tapped in the refractory tray for air cooling and solidification, which will be used in steel making furnace as desulphurization slag.

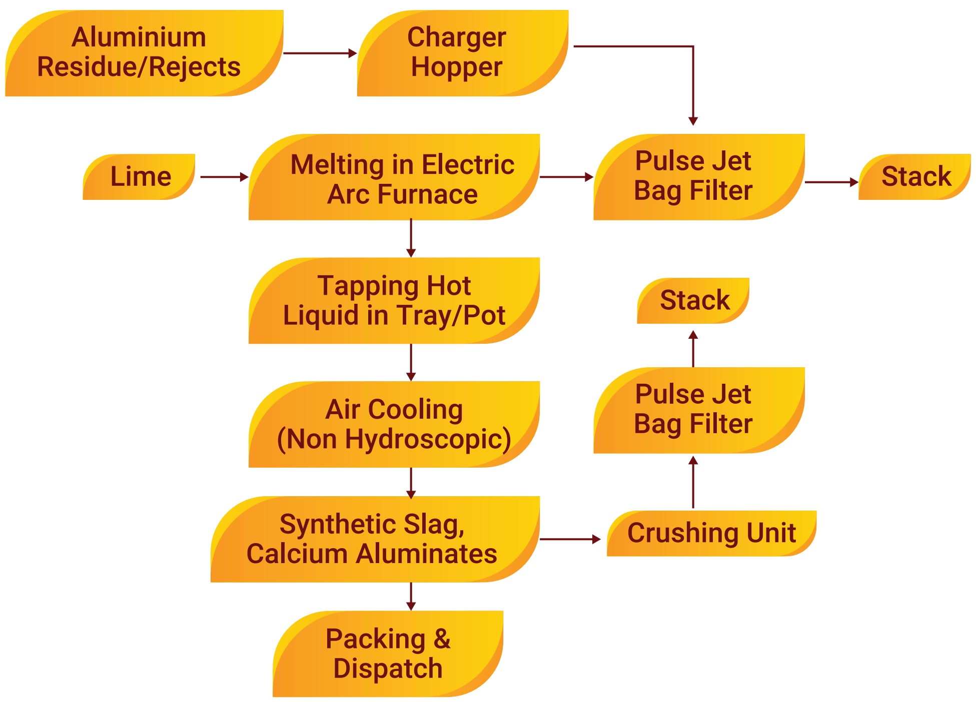


Fig 1: Flow diagram of Utilization of Aluminium Dross residue/rejects for manufacturing of Calcium Aluminate (Synthetic Slag)

1.3 Product Usage / Utilization

The Aluminium Dross residue/rejects will be utilized in the production of Calcium Aluminate (Synthetic Slag).

1.4 Standard Operating Procedure for utilization

This SoP is applicable only for the utilization of Spent Aluminium Dross residue/rejects generated from Aluminium Smelting industries.

1) The Spent Aluminium Dross residue/rejects shall be transported in covered trucks fitted with requisite safeguards. The material shall be stored under covered shed on concreted floor.

2) The furnace shall be enclosed completely with shutters at the front side with facility for charging and material retrieval operations. It shall be ensured that fume extractions systems are operated continuously during firing, charging and retrieval operations of the furnace.

3) There shall be a closed system of crusher and screening unit for size reduction of aluminium dross/rejects, where the fugitives shall be controlled by suction through Pulse jet bag filter followed by stack of adequate height.

4) The flue gases emission along with gases from furnace shall be extracted through APCD ie. Spark Arrestor followed by Pulsejet Bag Filter and stack of adequate height.

5) A mechanical mixer shall be installed, to mix the molten material in crucible remotely while the firing in progress.

6) There should be a provision for inspection window with glass lenses to inspect the interior portion of the furnace during firing and mixing operations.

7) The furnace shall be operated at the temperature of about 1500°C.

8) The storage and handling material shall be done under a shed and over imperviously lined flooring.

9) The handling of hazardous waste shall be carried out using mechanical means with minimal manual intervention.

10) A closed system of crusher and screening unit for size reduction of calcium aluminate (product) shall be installed with control measures for the fugitives such as suction through pulse jet bag filter followed by stack of adequate height.

11) The reject/ residue from due dust from Pulsejet bag filters, and residue/dross from furnace shall be reused in the said utilization process or shall be packed and temporarily stored in dedicated hazardous waste storage pit (imperviously lined) with cover and disposed in common hazardous waste treatment, storage and disposal facility within 90 days.

12) The unit shall ensure that all personnel involved in the plant operation shall wear proper personal protective equipment such as masks, safety gloves, goggles, safety shoes etc.

13) The unit shall install storage tank under cool, dry, well ventilated covered storage shed(s), surrounded by garland drain and settling pit 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.

14) It shall be ensured that the aforesaid hazardous waste is procured from the industries who have valid authorization for the same front the concerned State Pollution Control Board as required under Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016.

15) Transportation of Spent Aluminium Dross residue/rejects shall be carried out by sender (generator) or receiver (utilizer) only after obtaining authorisation from the concerned SPCB under the Hazardous and Other Wastes (Management & Transboundary Movement) Rules, 2016. Requisite manifest document shall be followed as laid down under the said Rules.

16) Prior to utilization of Spent Aluminium Dross residue/rejects, the unit shall obtain authorization for generation, storage, and utilization of Aluminium Dross residue/rejects from the concerned State Pollution Control Board under the Hazardous and Other Wastes (Management and Transboundary Movement) Rules 2016.

17) 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.

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

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

1.5 Record/Returns Filing

1) The utilizer shall maintain a passbook issued by the concern SPCB w herein the following details of each procurement of Spent Aluminium Dross residue/rejects shall be entered:
   - Address of the sender
   - Date of dispatch
   - Quantity procured
   - Seal and signature of the sender
   - Date of Receipt in the premises
2) A log book with information on source and date of procurement of Spent Aluminium Dross residue/rejects, quantity, date wise utilisation of the same, quantity of synthetic slag manufactured, hazardous waste generation and its disposal, etc. shall be maintained including analysis report of emission monitoring & effluent discharged, as applicable.
3) The unit shall maintain record of hazardous waste utilised, hazardous waste 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.
4) The unit shall submit quarterly and annual information on hazardous wastes consumed. its source, products generated or resources conserved (specifying the details like, type and quantity of resources conserved) to the concerned SPCB

1.6 Standards

1) Fugitive emission in the work zone shall comply with the following standards:

Ammonia	35.0 mg/m^3 TWA*
PM_{10}	5.0 mg/m^3 TWA*

Reference. Occupational Safty and Health Standard 1910 : 1000

**TWA- times-weighted average*

**The permissible Exposure Limit is 8-hours TWA*

A ceiling limit is one that may not be exceeded for any period of time, and is applied to irritants and other materials that have immediate effects.

2) Source emission monitoring from the stack attached to the Pulsejet bag filter shall comply with the following standards or as prescribed by the concerned SPCB/PCC, whichever is stringent;

Carbon Monoxide	100.0 mg/Nm^3
PM	50.0 mg/Nm^3

3) Monitoring of the specified parameters for source emission shall be carried out quarterly for the 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 accredited or ISO17025 /EPA approved laboratories and the results shall be submitted to the concerned SPCB/PCC on a quarterly basis.

1.7 Siting of Industry

Facilities for utilization of Aluminium Dross residue/rejects shall be located in a notified industrial area or industrial park/estate/cluster or inside existing premises of Aluminium Smelter Plant or Al dross reprocessing plant and in accordance with Consent to Establish issued by the concerned SPCB/PCC.

1.8 Size of Plant & Efficiency of utilisation

Maximum 506 Kg of Aluminium Dross residue/rejects would be required to yield 1MT of synthetic slag. Therefore, requisite facilities of adequate size of storage shed and other plants & machineries as given in section 5.10 shall be installed accordingly.

1.9 On-line detectors / Alarms / Analysers

Online emission monitoring systems shall be installed in case of continuous process operations for parameters as prescribed by the SPCBs/PCCs.

1.10 Checklist of Minimal Requisite Facilities

S. No	Requisite Facilities
1.	Covered Storage shed of adequate capacity to store Aluminium Dross residue/rejects of at least two weeks requirement but preferably for 90 days
2.	Cool, dry well-ventilated covered storage shed(s) for Aluminium Dross residue/rejects storage, product storage and process activities within premises
3.	Crusher, Pulveriser and screen for size reduction of Aluminium dross residues/ rejects
4.	Mechanized system for transfer of Spent Aluminium Dross residue/rejects morn storage area to the charge hopper
5.	The process units shall have proper ventilation (preferably with ventilation ducts above the process units connected to ID fan with exhaust above root level)
6.	Electric Arc Furnace
7.	Electric Arc Furnace be attached with Spark Arrester followed by pulsejet Bag tilter and stack of height as prescribed by the SPCBs/PCCs
8.	Tapping Trays
9.	Suction arrangement to channelize emissions from charge hopper and Electric Arc furnace to the pulsejet Bag filter
10.	Dedicated hazardous waste storage area for temporary storage of hazardous waste generated during utilization process.
11.	Crusher, Pulveriser and screen for sizing of the product after cooling
12.	Pulse jet bag filter be attached to the material transfer points of crusher and screen of the raw material and product followed by stack of adequate height.
13.	Dumpers, loaders, feeders and other equipment tor mechanical handling of aluminium dross and its residues.
14	Stack to have 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.

Utilization of Aluminium dross residues generated from separation of metal from Aluminium dross or Aluminium dross reprocessing units for manufacturing of Alum

SOP - 54

Aluminium dross residues from Aluminium dross reprocessing units

(Category: 12/A72 of Schedule I of HOWM Rules, 2016)

1.0 Utilization of aluminium dross residues:

Type of HW	Source of generation	Recovery/Product
Aluminium dross residues (Schedule II Category A 12/A72 of HOWM Rules, 2016)	Generated from separation of metal from Aluminium dross / aluminium dross reprocessing units	As a supplementary resource for manufacturing of Alum

The utilization process shall involve pulverising aluminium dross using crushers, pulverisers and mechanical screens to recover > 0.5mm and <20mm size metal rich granules. These rich granules are melted in a crucible furnace to recover molten metal.

1.1 Source of Waste

The dross residues is generated from separation of metal or cross reprocessing is categorized as Hazardous waste at S. No. 12 and 72 of Schedule II of HOWM Rules, 2016, due to the presence of nitrogen as nitrate and fluoride, which are required to be disposed in authorized disposal facility in accordance with authorization condition, when not utilized as resource recovery.

Typical characteristics of the aluminium dross residues are given below:

Parameters	Results(%)
Alumina as Al_2O_3	83.5
Heavy metals (As, Mn Cu Zn)	0.026
Calcium Oxide as CaO	0.62
Silicon Dioxide SiO_2	1.40
Titanium Dioxide as TiO_2	0.12
Magnesium Oxide(as MgO)	0.81
Ferric Oxide as Fe_2O_3	1.12
Disodium Oxide as Na_2O	0.21
Sulphur Trioxide as SO_3	0.30
Manganese Oxide as MnO	0.07
Chromium Trioxide (Cr_2O_3)	0.02
Fluoride as F	ND
Nitrogen as N	3.0

1.2 Utilization Process

The dross residues generated from separation of metal or dross reprocessing can be processed to produce alum. The production of alum by hydrometallurgical processing mainly includes unit operations like leaching, solid liquid separation, crystallization and centrifugation. The solid waste generated from the process may be washed with water prior to sending to TSDF and washed water may be re-used in the process in case of further recovery of resources in the waste.

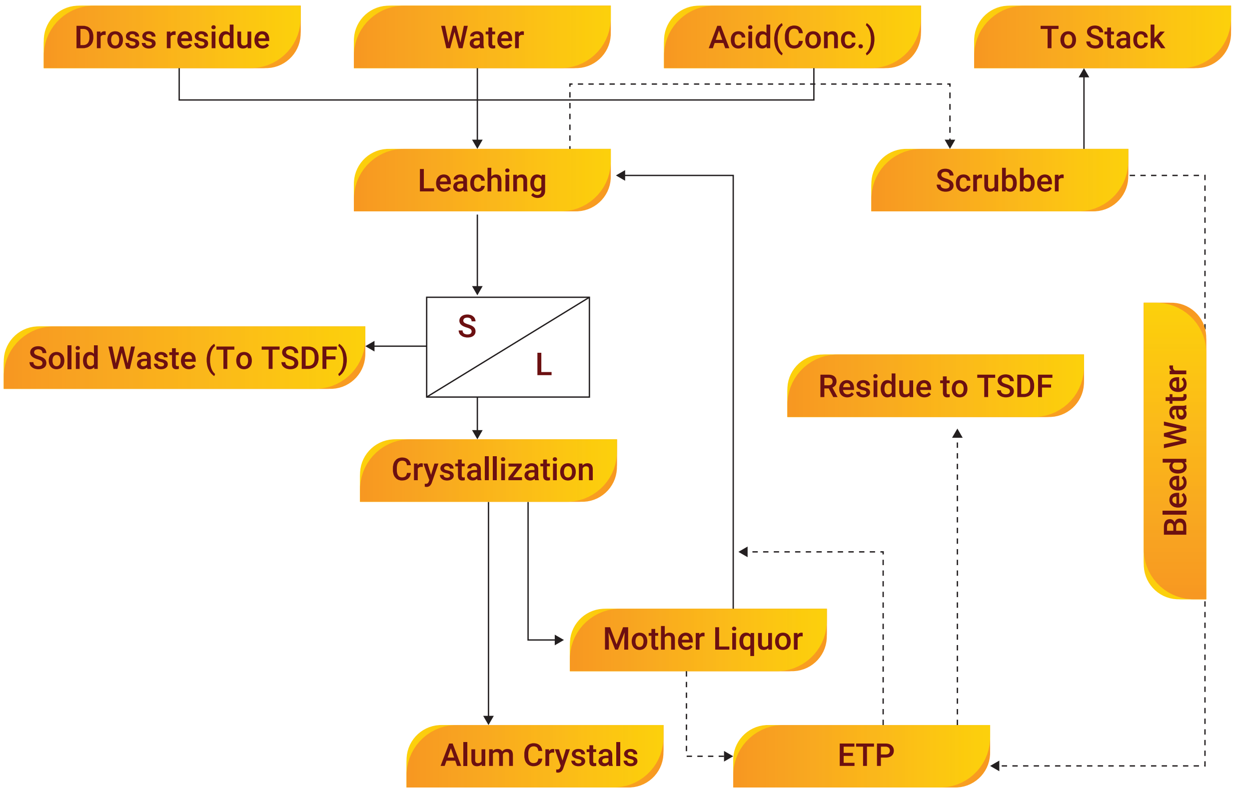


Fig 1: Process flow diagram for utilization of Aluminium dross residues

1.3 Product Usage/ Utilization

The Aluminium dross residues will be utilized in the production of alum. Product (Alum) to be used only for treatment of industrial effluent or for industrial applications and shall not be used for treating in case for drinking water use or in food/beverages applications, etc.

The unit shall label its product (i.e. alum) manufactured by utilizing aforesaid hazardous waste as "This Alum has been manufactured by utilizing aluminium dross residues generated from separation of metal from Aluminium dross originated from primary Aluminium production".

1.4 Standard Operating Procedure for utilization

This SoP is applicable only for utilization of aluminium dross residues generated from material separation or dross reprocessing.

1) The aluminium dross residues shall be transported in SPCB/PCC authorized covered vehicles with requisite safe guards.

2) 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 dross residue) to control acid fumes/vapours liberated form the reaction vessel. The suction hood shall be connected with alkali scrubber and stack of adequate height.

3) The fugitive emission of dust anywhere near the work zone shall be extracted through APCD i.e., Pulse jet Bag Filter and stack of adequate height.

4) The storage and handling of material shall be done under a shed of proper vertical height and over imperviously lined flooring.

5) The handling of hazardous waste shall be carried out using mechanical means with minimal manual intervention.

6) The solid residues generated from the process shall be reused in the said utilization process or shall be packed and temporarily stored in dedicated hazardous waste storage pit (imperviously lined) with cover and disposed in common hazardous waste treatment, storage and disposal facility within 90 days.

7) The unit shall install storage tank under cool, dry, 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 of sulphuric acid shall 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 maybe, through chemical process pump.

8) There shall be no manual handling of the sulphuric acid. Acid Proof pump shall be used for transfer of sulphuric acid through pipelines to the Leaching reactor. Spill containment arrangement shall be provided around the Sulphuric acid storage tanks.

9) The unit shall provide separate storage tanks for storage of chemicals and the storage tanks should be at designated place with proper cover and with acid brick lining floors.

10) The treated gases shall comply with emission norms and prior to dispersion into atmosphere through stack. The height of stack shall be a minimum of 6 m above the roof top or as prescribed by the concerned SPCB/PCC, whichever is higher.

11) The reactors, filters, thermic fluid heaters and centrifuges have to be a closed system and shall have vent ducts connected to common scrubbing system followed by dispersion through stack.

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 quality of the product alum shall match with the BIS commercial grade specifications.

14) Treatment and disposal of wastewater:

    Wastewater generated from floor-washings, spillages, reactor washing, scrubber bleed including the wastewater from filtration shall be treated Physico-Chemically in an ETP and may be sent to CETP for final disposal or be treated further in a captive facility to comply with surface water discharge standards. In case of zero discharge condition by SPCB/PCC, the treated waste water from ETP may be reused in process or cooling inside the factory or evaporated in forced evaporators like MEE. The concentrated liquid from the evaporator shall be sent to spray dryer for conversion into dry powder which may be disposed as given in the following point.

15) 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.

16) The hazardous wastes generated (namely the filter residue, ETP sludge, scrubber, effluent powder generated from spray dryer/forced evaporator, product spillages, damaged filter liners, etc.) shall be collected and temporarily stored in non-reactive drums/ bags under a dedicated hazardous waste storage area and be sent to authorized common TSDF or other authorized facility within 90 days from generation of the waste in accordance with the authorization issued by the concerned SPCD/PCC. Such storage area shall be covered with proper ventilation.

    It shall be ensured that the highly soluble dry-powdered effluent from MEE-Spray Dryer should be stabilized or immobilized with suitable cementing material prior to secured landfilling in TSDF.

17) The unit shall ensure that all personnel involved in the plant operation shall wear proper personal protective equipment such as masks, safety gloves, goggles, safety shoes, etc.

18) The unit shall install storage tank under cool, dry, well ventilated covered storage shed(s) surrounded by garland drain and settling pit within premises, as authorized by the concerned SPCB/ PCC under Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 so as to eliminate rain water intrusion.

19) It shall be ensured that the aforesaid hazardous waste is procured from the industries, which have valid authorization for the same from the concerned State Pollution Control Board as required under Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016.

20) Transportation of aluminium dross residues shall be carried out by sender (generator) or receiver (utilizer) only after obtaining authorisation from the concerned SPCB under Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016. Requisite manifest document shall be followed as laid down under the said Rules.

21) Prior to utilization of aluminium dross residues, the unit shall obtain authorisation for generation, storage and utilization of aluminium dross residues from the concerned State Pollution Control Board under Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016.

22) 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.

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

24) 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.

1.5 Record/Returns Filing

1) The unit shall maintain a passbook issued by concern SPCB wherein the following details of each procurement of dross residues shall be entered:
   - Address of the sender
   - Date of dispatch
   - Quantity procured
   - Seal and signature of the sender
   - Date of Receipt in the premises
   - Quantity of alum produced and quality certificate from a NABL accredited Laboratory of few samples in a month randomly.
2) A log book with information on source and date of procurement of dross residues, quantity, date wise utilisation of the same, hazardous waste generation and its disposal, etc. shall be maintained including analysis report of fugitive emission monitoring &effluent discharged, as applicable.
3) The unit shall maintain record of hazardous waste utilised, hazardous waste 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.
4) The unit shall submit quarterly and annual information on hazardous wastes consumed, its source, products generated or resources conserved (specifying the details like, type and quantity of resources conserved) to the concerned SPCB.

1.6 Standards

1) Source emissions from the stack connected to reactors/processs tack shall comply with the following standards or as prescribed by the concerned SPCB/PCC, whichever is stringent;

PM	50mg/Nm³
SO_2	200mg/Nm³
Acid Mist (H_2SO_4)	50mg/Nm³
NH_3	30mg/Nm³

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

PM_{10}	5mg/m³TWA*(PEL)
Ammonia	35mg/m³TWA*(PEL)

**PEL' Permissible Exposure Limit*

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

**short term exposure limit (STEL).measured for 15 minutes duration of exposure*

1.7 Siting of Industry

Facilities for utilization of dross residues 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.

1.8 On-line detectors/Alarms/Analysers

In case of continuous process operations, online emission analysers for PM in the stack shall be installed and the online data be connected to the server of the concerned SPCB/PCC.

1.9 Checklist of Minimal Requisite Facilities

S. No	Requisite Facilities
1.	Covered storage shed of adequate capacity to store Aluminium dross residues of atleast two weeks requirement but preferably for 90days.
2.	Cool, dry well-ventilated covered storage shed(s) for Aluminium dross residues storage, product storage and process activities within premises.
3.	Mechanized system for transfer of Aluminium dross residues from storage area to reactor vessels.
4.	The process units shall have proper ventilation (preferably with ventilationducts above the process units connected to ID fan with exhaust above roof level)

5.	Dedicated hazardous storage area for temporary storage of hazardous waste generated during utilization process.
6.	Dumpers, loadcrs, feeders and other equipment for mechanical handling of aluminium dross and its residues.
7.	Stack to have 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.
8.	Mechanical Filter Press
9.	Crystallizer unit (open tanks, jacketed crystallizers, crystallizers with evaporators, etc.)
10.	Centrifuges
11.	Zero Liquid Discharge (ZLD) to be maintained.

Utilization of Aluminium dross & its residues for recovery of Aluminium metal and manufacturing of Aluminium oxide briquette

SOP - 74

Aluminium dross & its residues for recovery of Aluminium metal & manufacturing of Aluminium oxide briquette

(Category: 11.5 of Schedule I of HOWM Rules, 2016)

1.0 Utilization of Aluminium dross

Stage of operation	Type of HW	Source of generation	Recovery/Product
Stage-I & II	Aluminium dross, Category - 11.5 of Schedule-I, HOWM Rules, 2016	Primary Aluminium smelting process	Recovery of Aluminium metal
Stage-III	Aluminium dross residue, Category - 11.5 of Schedule-I, HOWM Rules, 2016	Generated from separation of metal from Aluminium dross	Manufacturing of Aluminium oxide briquette (Utilized in steel manufacturing)

1.1 Source of Waste:

Aluminium dross forms within the units handling liquid Aluminium metal. Aluminium dross is mass of solid impurities floating on the molten metal and has formed by the reaction of liquid metallic Aluminium with the atmosphere. Aluminium Dross is a mixture of primarily metallic Aluminium, Aluminium Oxide and Aluminium Nitride. The aforesaid Aluminium Dross & its residues are categorized as hazardous waste at S, No. 11.5 of Schedule-I of HOWM Rules, 2016, and required to be disposed in authorized disposal facility in accordance with authorization condition, when not utilized as resource recovery.

1.2 Utilization Process:

The utilization process for Aluminium metal extraction and Aluminium oxides manufacturing involves three stages namely Stage I, Stage II and Stage III as shown in the process flow diagram given in Fig.1.

Stage I - Utilization of skimmed hot Aluminium dross for recovery of molten Aluminium: During this stage, skimming of hot dross from Aluminium smelter is collected in specialized hot dross handling buckets. The buckets are transferred to a hot dross processing unit for extraction of molten Aluminium metal. The rotary processing unit operates at molten temperature of Aluminium. However, if the temperature of the received dross buckets is less than molten temperature (i.e. less than 660°C) then transferred for preheating. Extracted molten Aluminium is collected and transferred to the Aluminium smelters. The depleted hot dross is cooled by raking and cold depleted dross is transferred to Stage II process.

Stage II - Recovery of Aluminium metal from cold depleted dross: During this stage, cold depleted dross is sieved to separate Aluminium dross residue < 2 mm followed by hammer mill. The metallic Aluminium particles > 2 mm are separated, collected using eddy current separator and transferred to Aluminium smelters. The dross residue < 2 mm are collected from the sieve for further processing in the Stage III.

Stage III — Production of Aluminium oxide briquette from Aluminium dross residue: The dross residue < 2 mm is transferred to mixer and mixed with organic binder by sprinkling water through fine mist spray. The mixer is followed by vibrating feeder, roller mixer and briquetting press. The mixer is briquetted in the briquetting press and collected as

1.3 Product Usage / Utilization

Aluminium dross and its residues is used for recovery of Aluminium metal and manufacturing of Aluminium oxide briquette respectively. Aluminium oxide briquette is further used as a slag conditioner in steel manufacturing.

1.4 Standard Operating Procedure for utilization

This SoP is applicable for Utilization of Aluminium Dross and its residues for recovery of Aluminium metal and manufacturing of Aluminium oxide briquette respectively.

1) Aluminium dross & dross residue shall be procured only in SPCB/PCC authorized closed trucks fitted with requisite safeguards ensuring no emission and unloaded in covered sheds to avoid contact with any moisture. If the hazardous waste (i.e., Aluminium dross & dross residue) movement is within the premises of the unit necessary measures shall be ensured for no emissions.
2) The unit shall maintain storage area under cool, dry, well ventilated covered storage shed(s) of proper vertical height and over imperviously lined flooring surrounded by garland drain and settling pit within premises, as authorized by the concerned SPCB/PCC under HOWM, Rules, 2016, so as to eliminate rain water intrusion.
3) The unloading, storage, crushing, transfer and other handling of hazardous waste (i.e., Aluminium Dross & residues) shall be carried out using mechanical means with minimal manual intervention.
4) There shall be a closed system for all unit operations of utilization process with APCD i.e., Bag Filter followed by stack.

5) The handling of hot dross shall be done mechanically with care.

6) To alert the operators an automatic NH_3 detector shall be installed near the unit operation in stage-III process, if NH_3 exceeds the limit and to take appropriate measures.

7) The unit shall install wet Scrubber after Bag Filter to control emission of Ammonia in Stage –III.

8) The unit shall stop the operation if there is any failure in the detectors/sensors or any other pollution control device.

9) The fugitive emission of dust anywhere near the work zone shall be extracted through suction hood followed by APCD i.e., Bag Filter and stack.

10 The solid residues generated from the said utilization process (i.e., dust from bag filters) shall be reused in the utilization process or shall be packed and temporarily stored in dedicated hazardous waste storage pit (imperviously lined) with cover and disposed in common hazardous waste treatment, storage and disposal facility within 90 days as per the provisions of HOWM Rules, 2016.

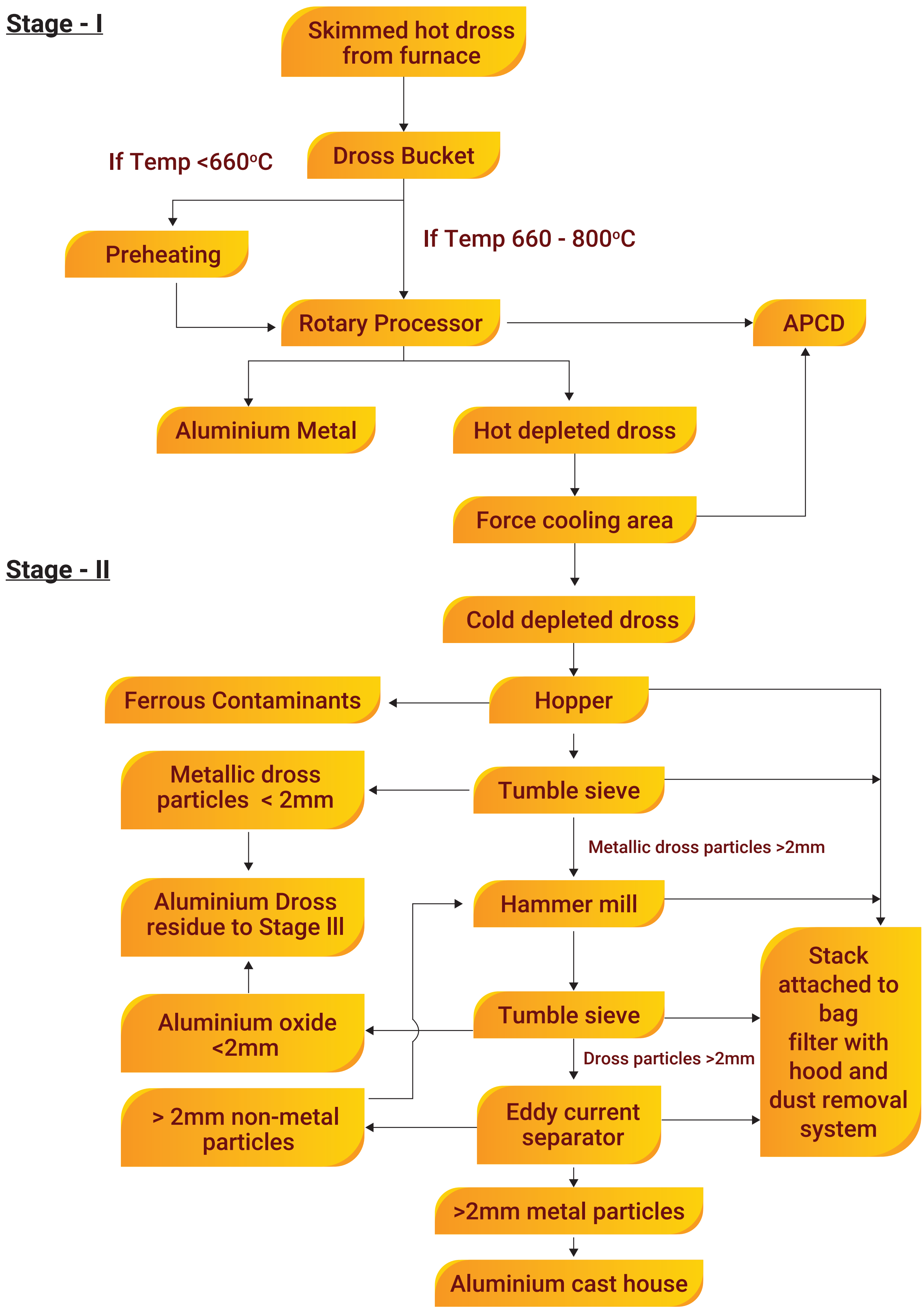
11) All unit operations shall be connected with suction hood above the feeding point/ material transfer points (if open) and potential dust generating points to control fumes/emissions liberated. The suction hood shall be connected with bag filter and stack of adequate height.

12) The gases shall comply with emission norms prior to dispersion into atmosphere through stack. The stack height shall be minimum of 30m from ground level or as prescribed by the concerned SPCB/PCC, whichever is higher.

13) 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.

14) The Treatment and disposal of wastewater: Wastewater generated from floor-washings, reactor washing shall be treated Physico-Chemically in an ETP or may be sent to CETP for final disposal or be treated further in a captive facility to comply with surface water discharge standards. In case of zero discharge condition, the treated waste water from ETP may be managed as per conditions stipulated by the SPCB/PCC.

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


Stage - I
Skimmed hot dross from furnace
Dross Bucket
If Temp <660°C
Preheating
If Temp 660 - 800°C
Rotary Processor
APCD
Aluminium Metal
Hot depleted dross
Force cooling area
Stage - II
Cold depleted dross
Ferrous Contaminants
Hopper
Metallic dross particles < 2mm
Tumble sieve
Metallic dross particles >2mm
Aluminium Dross residue to Stage III
Hammer mill
Stack attached to bag filter with hood and dust removal system
Aluminium oxide <2mm
Tumble sieve
Dross particles >2mm
> 2mm non-metal particles
Eddy current separator
>2mm metal particles
Aluminium cast house

Stage - III

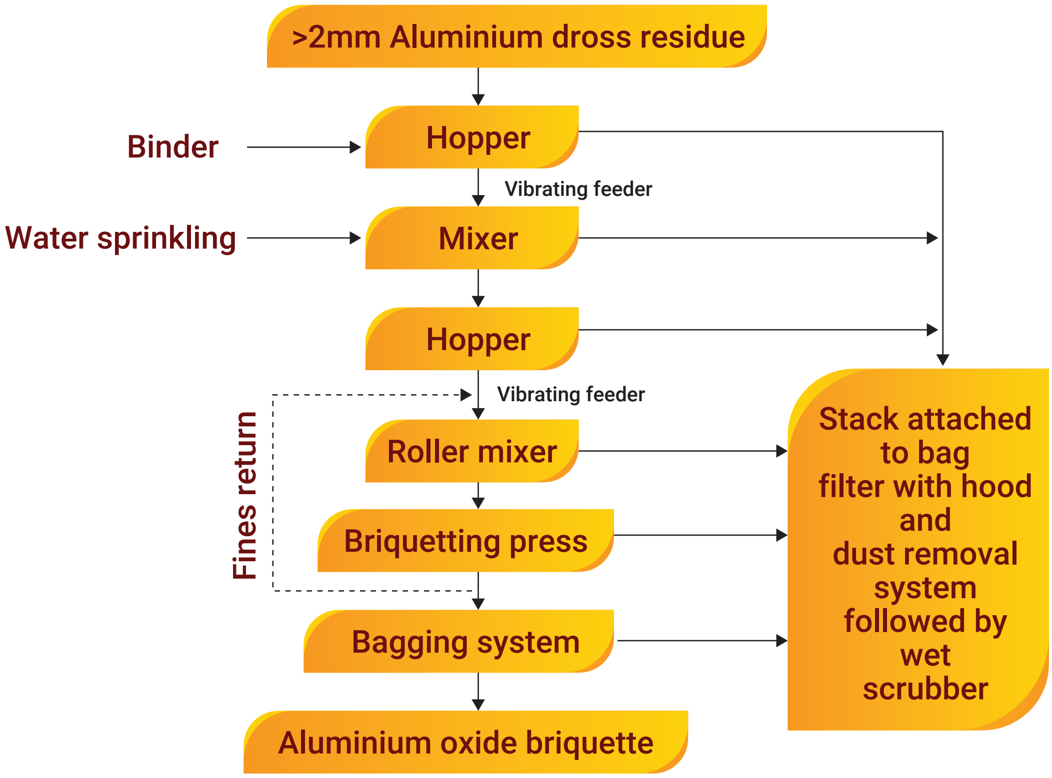


Fig 1: Process flow diagram for utilization of Aluminium Dross

16) This SoP shall be valid for units intend to operate Stage-I, II & III in conjunction or individually. However, Stage-I is applicable only for Aluminium smelter units.

17) The unit shall ensure that the hazardous waste is procured from the authorized industries, as per HOWM Rules, 2016.

18) Transportation of Aluminium Dross & and its residues shall be carried out by sender (generator) or receiver (utilizer) only after obtaining authorization from the concerned SPCB/PCC under HOWM, Rules, 2016. Requisite manifest document shall be followed as laid down under the said Rules.

19) Prior to utilization of Aluminium Dross and/ its residues, the unit shall obtain authorization for generation, storage and utilization of Aluminium Dross and/ its residues from the concerned State Pollution Control Board under HOWM, Rules, 2016.

20) 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.

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

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

1.5 Record/Returns Filing

1) The unit shall maintain a passbook issued by concern SPCB/PCC wherein the following details of each procurement of Aluminium Dross and its residues and its rejects/residues shall be entered:

   - Address of the sender
   - Date of dispatch
   - Quantity procured
   - Seal and signature of the sender
   - Date of Receipt in the premises

2) A log book with information on source and date of procurement of Aluminium Dross and its residues, date wise utilization of the same, hazardous waste generation and its disposal, etc. shall be maintained including analysis report of fugitive emission monitoring & effluent discharged, as applicable.

3) The unit shall maintain record of hazardous waste utilised, hazardous waste generated and disposed as per Form 3 & shall file annual returns in Form 4 as per Rule 20 (1) and (2) of the HOWM, Rules, 2016, to concerned SPCB/PCC.

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

1.6 Standards

1) Source emissions from the stack connected to reactors/process stack shall comply with the following Emission standards or as prescribed by the concerned SPCB/PCC, whichever is stringent;

Particulate Matter	50 mg/Nm³
CO	100 mg/Nm³
NH_3	30 mg/Nm³
Total Flouride	25 mg/Nm³

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

PM_{10}	5 mg/m³ TWA* (PEL)
NH_3	1 mg/m³ TWA*(PEL)
Fluoride	3 mg/m³ TWA*(PEL)

**PEL - Permissible Exposure Limit*

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

A ceiling limit is one that may not be exceeded for any period of time, and is applied to irritants and other materials that have immediate effect.

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 ISO 17025 accredited or EPA, 1986 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 concerned 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.

1.7 Siting of Industry

Facilities for utilization of Aluminium dross and its residues shall be preferably located in a notified industrial area or industrial park/estate/cluster or inside the existing premises of Aluminium smelter plant or Aluminium dross reprocessing plant and in accordance with Consent to Establish issued by the concerned SPCB/PCC.

1.8 Size of Plant and Efficiency of Utilisation

Stage-I: Processing 1 MT of Hot dross yields 400 Kg of Aluminium metal and 660 Kg Depleted dross (10% weight gain due to hygroscopic nature and oxidation).

Stage-II: Processing 660 Kg of depleted dross yields 40 Kg of Aluminium metal and 620 Kg Aluminium dross residue (particle size of < 2mm)

Stage-III: Processing 620 Kg of Aluminium dross residue (particle size of < 2mm) along with other raw materials yields to 670 Kg Aluminium oxide briquette.

Therefore, requisite facilities of adequate size of storage shed and other plant & machineries as given in section 3.10 below shall be installed accordingly.

1.9 On-line Detectors / Alarms / Analyzers

In case of continuous process operations, online emission analyzers for PM, Ammonia, Fluoride, in the stack shall be installed and the online data be connected to the server of the concerned SPCB/PCC.

1.10 Checklist of Minimal Requisite Facilities:

i. Stage I – Utilization of skimmed hot Aluminium dross for recovery of metal Aluminium:

S. No	Requisite Facilities
1.	Closed system for all unit operations in the utilization process.
2.	Suction hood/Dust extraction system followed by Bag filter and stack.
3.	Covered storage shed of adequate capacity to store raw material i.e., Aluminium dross (at least two weeks requirement) and wastes generated such as APCD dust, residues and rejects to store at least for 90 days.
4.	Cool, dry well-ventilated covered sheds for process operations including material handling.
5.	Mechanized system for transfer of Aluminium dross handling and transfer.

6.	Hot dross handling bucket, hot dross rotatable machine, catch tray and other equipment for mechanical handling of hot Aluminium dross and product molten i.e., Aluminium metal.
7.	Stack to have 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.

ii. Stage II - Recovery of Aluminium metal from cold depleted dross:

S. No	Requisite Facilities
1.	Closed system for all unit operations in the utilization process.
2.	Suction hood/Dust extraction system followed by Bag filter and stack.
3.	Covered storage shed of adequate capacity to store raw material i.e., Aluminium dross (at least two weeks requirement) and wastes generated such as APCD dust, residues and rejects to store at least for 90 days.
4.	Cool, dry well-ventilated covered sheds for process operations including material handling.
5.	Covered storage shed(s), of adequate capacity shall be provided to temporarily store APCD dust, residues and rejects. Size of shed shall be adequate to store at least 90 days of waste generation
6.	Mechanized system for handling and transfer of Aluminium dross.
7.	Hoppers, feeders, Conveyors, sieves, size reduction equipment, Eddy Current Separator, and other equipment for mechanical handling of Aluminium dross.
8.	Stack to have 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.

iii. Stage III — Production of Aluminium oxide briquette from Aluminium dross residue:

S. No	Requisite Facilities
1.	Closed system for all unit operations in the utilization process.
2.	Suction hood/Dust extraction system followed by Bag filter and stack.
3.	Covered storage shed of adequate capacity to store Aluminium dross residue of at least two weeks requirement but preferably for 90 days.
4.	Cool, dry well-ventilated Covered sheds for process operations including material handling. The sheds for utilization of Hazardous Waste should prevent entry of any moisture/rain water during monsoon.
5.	Covered storage shed(s), of adequate capacity shall be provided to temporarily store APCD dust, residues and rejects. Size of shed shall be adequate to store at least 90 days of waste generation
6.	Mechanized system for handling and transfer of Aluminium dross residue.
7.	Automatic NH_3 detector.
8.	Wet Scrubber after Bag Filter to control emission of Ammonia from the process of Stage-III.
9.	Hoppers, feeders, mixers, Conveyors, and other equipment for mechanical handling of Aluminium dross residue.
10.	Stack to have 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.

Anode Butt

Utilization of Used Anode Butt generated from Aluminium smelters to produce Carbon Pellets and High Energy (HE) Coke for use in Steel furnaces / foundries.

SOP - 07

Used Anode Butt form Aluminium smelters

(Category: 29.1 of Schedule I of HOWM Rules, 2016)

1.0 Utilization of Used Anode Butt

This SoP is applicable only for utilization of Used Anode Butt as described below:

Type of HW	Source of generation	Recovery/Product
Used Anode Butt	Aluminum Smelter units	Carbon pellets and High Energy Coke for use in Steel furnaces/foundries

The utilisation process involves removal of fluoride bearing bath material from the surface of Used anode butts in a shot blasting machine followed by crushing and screening. The fine particles are mixed with molasses, bentonite, Dextrin, Anode fines, etc. to produce carbon pellets in a palletisation machine. The coarse particles are further crushed in a crusher and mixed with pet coke to produce High Energy Coke.

1.1 Standard Operating Procedure

1) The used anode butt shall be procured from the Aluminium smelter units without cutting and breaking of the same and of size not less than 250 mm.

2) The unit shall store used anode butts in covered storage shed(s) within premises, as authorized by the concerned SPCB under the Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016, so as to eliminate rain water intrusion.

3) Cutting or sizing of used anode at the unit shall not be allowed prior to shot-blasting

4) Handling/transfer of used anodes and shot blasted anodes are required to be done using mechanical loader (such as hydra loader with pallet fork, etc.).

5) Minimum 25 mm of outer layer of used anode butt shall be removed during shot blasting and such shot blasting machine shall have dust/ball collection system followed by dust and ball separation unit so that separated balls can be reused in shot blasting. The said system shall be operated under suction and outlet of dust and ball separation system shall be connected to a bag dust filter house and stack.

6) Surface cleaned material is required to be handled by mechanical means for crushing, screening and blending operations.

7) Crushing, screening, transfer and blending operations shall be carried out in enclosed systems connected to dust extraction systems with bag dust collectors and stack. It shall be ensured that the height of the stack shall be as specified in the consent issued by concerned SPCB or at least 06 m above roof top of adjacent structure, whichever is higher.

8) The process of mixing/ blending shall not involve any chemical reaction so that there are no air emissions or generation of heat.

9) The percentage mix of cleaned used anode butt in the product shall not exceed 50% and the record of the same shall be maintained by the unit.

10) The unit shall only produce Carbon Pellet and High Energy (HE) Coke from the cleaned used anode butts for utilization in Steel Plant/Steel foundries.

11) The unit shall maintain proper ventilation in the work zone of loading/unloading of Used Anode Butt and shot blasting machine. all personnel involved in the plant operation shall wear proper personal protective equipments such as masks, safety gloves, goggles, safety shoes etc

12) The PM_{10} and Fluoride in fugitive dust of the work zone area of the crushing and mixing operations shall not exceed 4000 $\mu g/m^3$ and 2.5 mg/m^3 (8-hour time weighted average (TWA)). The stack emissions shall comply with PM and total fluoride emission of 150 and 25 mg/Nm^3.

13) Monitoring of work zone and stack emissions shall be carried out quarterly. The monitoring shall be carried out by NABL/EPA accredited laboratories and the results shall be submitted to the concerned SPCB quarterly.

14) Transportation of the aforesaid waste shall be carried out by the sender or receiver (utilizer) after obtaining authorization from the concerned SPCB under the Hazardous and Other Wastes (Management & Transboundary Movement) Rules, 2016.

15) It shall be ensured that the aforesaid hazardous waste is procured from the Aluminium Smelter units who have valid authorization for the same from the concerned State Pollution Control Board as required under Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016.

16) The residue generated from the shot blasting operation and bag filter house shall be packaged in HDPE bags and temporarily stored in a dedicated hazardous waste storage area and sent to common hazardous waste TSDF within 90 days from generation of the waste. Such hazardous waste shall be stored under covered shed with proper ventilation.

17) The unit shall maintain a passbook issued by concerned SPCB wherein the following details of each procurement of used anode butt shall be entered:

- Address of the sender
- Date of dispatch
- Quantity procured
- Seal and signature of the sender
- Date of receipt in the premises

18) The unit shall submit quarterly and annual information on used anode butts consumed, its source, products generated or resources conserved (specifying the details like type and quantity of resources conserved) to the concerned SPCB.

19) The unit shall maintain record of hazardous waste utilised, residues 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 SPCB.

20) A log book with information on source of procurement, quantity, date wise utilization of used anode butt, quantity of products manufactured, hazardous waste generation and its disposal etc. shall be maintained including analysis report of emission monitoring & effluent discharged, as applicable and shall be made available for inspecting officials from SPCB/CPCB.

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

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

1.2 Checklist of Minimal Requisite Facilities

S. No	Requisite Facilities
1.	Storage shed for storage of Used Anode Butt. The shed shall be covered so as to eliminate rain water intrusion.
2.	Size/capacity of storage shed to be adequate to store at least one week's requirement of used anode butt
3.	Mechanical loader (such as hydra loader with pallet fork, etc.) for handling of used anodes in shot-blaster machine
4.	Shot blasting machine of adequate chamber size so as to feed used anode butt of size about 1.5 m x 1.0 m x 0.5 m directly into the chamber without cutting and breaking.
5.	Unit for separation of shot blasting balls from shot blasted residue
6.	Bag house dust collectors attached with shot-blaster machine followed by stack
7.	Mechanical means of waste handling for crushing, grinding screening and blending operations. a) Crushers (such as Jaw crusher, Triple Roller) b) Grinder (such as ball mills , roller mills-), as per product requirement c) Mechanical screens as per product requirement d) Vertical pellet extruder machine (in case of Carbon pellets) e) Mechanical mixer (s) f) Conveyor system for transfer of material, as per requirement
8.	Crushing, screening, grinding, transfer and blending operations to be carried under closed and covered area and connected to bag filters and stack
9.	Provision of ventilation in process and waste handling area
10.	Packaging & storage of residue generated during utilization process in dedicated storage area

Utilization of Used Anode Butt generated from Aluminium smelters to produce Carbon Blended Coke / Electrode carbon Paste /Carburiser for use in Steel or ferroalloy furnaces

SOP - 08

Used Anode Butt from Aluminium smelters

(Category: 29.1 of Schedule I of HOWM Rules, 2016)

1.0 Utilization of Used Anode Butt

This SoP is applicable only for utilization of Used Anode Butt as described below:

Type of HW	Source of generation	Recovery/Product
Used Anode Butt	Aluminum Smelter units	Carbon Blended Coke / Electrode carbon Paste / Carburizer for use in Steel or Ferro Alloy furnaces

The utilisation process involves following steps;

For Electrode Carbon Paste: Removal of fluoride bearing bath material from the surface of Used anode butt in a shot blasting machine followed by crushing, screening, grinding and mixing in a mixer with pet coke and coal tar pitch. This material is then moulded and cooled to produce Electrode Carbon Paste for use in Ferro Alloy Plants.

For Carburizer: Removal of fluoride bearing bath material from the surface of Used anode butt in a shot blasting machine. The cleaned anode butt is crushed in a crusher, blended with Calcined petroleum coke and screened to produce Carburizer for use in Steel plants.

1.1 Standard Operating Procedure

1) The used anode butt shall be procured from the Aluminium smelter units without cutting and breaking of the same and of size not less than 250 mm.

2) The unit shall store used anode butts in covered storage shed(s) within premises, as authorized by the concerned SPCB under the Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016, so as to eliminate rain water intrusion.

3) Cutting or sizing of used anode at the unit shall not be allowed prior to shot-blasting

4) Handling/transfer of used anodes and shot blasted anodes are required to be done using mechanical loader (such as hydra loader with pallet fork, etc.).

5) Minimum 25 mm of outer layer of used anode butt shall be removed during shot blasting and such shot blasting machine shall have dust/ball collection system followed by dust and ball separation unit so that separated balls can be reused in shot blasting. The said system shall be operated under suction and outlet of dust and ball separation system shall be connected to a bag dust filter house and stack.

6) Surface cleaned material is required to be handled by mechanical means for crushing, screening, grinding and mixing/blending operations.

7) Crushing, screening, grinding, transfer and blending operations shall be carried out in enclosed systems connected to dust extraction systems with bag dust collectors and stack. It shall be ensured that the height of the stack shall be as specified in the consent issued by concerned SPCB or at least 06 m above roof top of adjacent structure, whichever is higher.

8) The process of mixing/ blending shall not involve any chemical reaction so that there are no air emissions or generation of heat.

9) The percentage mix of cleaned used anode butt in the product shall not exceed 50% and the record of the same shall be maintained by the unit.

10) The effluent generated, if any, shall be discharged as per the conditions stipulated by the SPCB under the Water (Prevention and Control of Pollution) Act, 1974.

11) The unit shall only produce Electrode Carbon Paste/Carburizer from the cleaned used anode butts for utilization in Ferro Alloy Plant & Steel Plant respectively.

12) The unit shall maintain proper ventilation in the work zone of loading/unloading of Used Anode Butt and shot blasting machine. All personnel involved in the plant operation shall wear proper personal protective equipment such as masks, safety gloves, goggles, safety shoes etc

13) The PM_{10} and fluoride in fugitive dust of the work zone area of the crushing and mixing operations shall not exceed 4000 $\mu g/m^3$ and 2.5 mg/m^3 (8-hour time weighted average (TWA)). The stack emissions shall comply with PM and total fluoride emission of 150 and 25 mg/Nm^3.

14) Monitoring of work zone and stack emissions shall be carried out quarterly. The monitoring shall be carried out by NABL/EPA accredited laboratories and the results shall be submitted to the concerned SPCB quarterly

15) Transportation of the aforesaid waste shall be carried out by the sender or receiver (utilizer) after obtaining authorization from the concerned SPCB under the Hazardous and Other Wastes (Management & Transboundary Movement) Rules, 2016.

16) It shall be ensured that the aforesaid hazardous waste is procured from the Aluminium Smelter units who have valid authorization for the same from the concerned SPCB as required under the Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016.

17) The residue generated from the shot blasting operation and bag filter house shall be packaged in HDPE bags and temporarily stored in a dedicated hazardous waste storage area and sent to TSDF within 90 days from generation of the waste. Such hazardous waste shall be stored under covered shed with proper ventilation.

18) The unit shall maintain a passbook issued by concerned SPCB wherein the following details of each procurement of used anode butt shall be entered:
    - Address of the sender
    - Date of dispatch
    - Quantity procured
    - Seal and signature of the sender
    - Date of receipt in the premises

19) The unit shall submit quarterly and annual information on used anode butts consumed, its source, products generated or resources conserved (specifying the details like type and quantity of resources conserved) to the concerned SPCB.

20) The unit shall maintain record of hazardous waste utilised, residues 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 SPCB.

21) A log book with information on source of procurement, quantity, date wise utilization of Used anode butt, quantity of products manufactured, hazardous waste generation and its disposal etc. shall be maintained including analysis report of emission monitoring & effluent discharged, as applicable and shall be made available for inspecting officials from SPCB/CPCB.

22) In case of environmental damages arising due to improper handling of hazardous wastes including accidental spillage during generation, storage, processing, transportation and disposal, the unit 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.*

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

1.2 Checklist of Minimal Requisite Facilities

S. No	Requisite Facilities
1.	Storage shed for storage of Used Anode Butt. The shed shall be covered so as to eliminate rain water intrusion.
2.	Size/capacity of storage shed to be adequate to store at least one week's requirement of used anode butt
3.	Mechanical loader (such as hydra loader with pallet fork, etc.) for handling of used anodes in shot-blaster machine
4.	Shot blasting machine of adequate chamber size so as to feed used anode butt of size about 1.5 m x 1.0 m x 0.5 m directly into the chamber without cutting and breaking.
5.	Unit for separation of shot blasting balls from shot blasted residue
6.	Bag house dust collectors attached with shot-blaster machine followed by stack
7.	Mechanical means of waste handling for crushing, grinding screening and blending operations. a) Crusher (such as Jaw crusher) b) Grinder (such as ball mills , roller mills) - as per product requirement c) Mechanical screens – screen size as per product requirement d) Mechanical mixer e) Conveyor system for transfer of material - as per requirement
8	Crushing, screening, grinding, transfer and blending operations to be carried under closed and covered area and connected to bag filters and stack
9	Provision of ventilation in process and waste handling area
10	Thermic fluid heater for heating the mixture i.e. cleaned anode butt, calcined petroleum coke and coal tar pitch in case of manufacturing Electrode Carbon Paste
11	Packaging & storage of residue generated during utilization process in dedicated storage area

Utilization of pre-processed Used Anode Butt generated from Aluminium smelters to produce Green Anodes through Anode-Baking Process for use in Aluminium Smelters

SOP - 09

Used Anode Butt from Aluminium smelters

(Category: 29.1 of Schedule I of HOWM Rules, 2016)

1.0 Utilization of Used Anode Butt (pre-processed)

This SoP is applicable only for utilization of Used Anode Butt as described below:

Type of HW	Source of generation	Recovery/Product
Pre-processed Used Anode Butt	Aluminum Smelter units	Green Anodes for use in Aluminium Smelters

The utilisation process involves crushing and screening of pre-processed Used anode butt followed by mixing with petroleum coke & coal tar pitch in a heater (thermic fluid) to produce Anode blocks, which are baked at 1100°C in baking furnace for 28 hrs to produce Green Anodes for use in Aluminium Smelters after rodding operation.

1.1 Standard Operating Procedure

- **For Pre-processing of Used Anode Butt**

It is required to pre-process the used anode butt to remove the bath material prior to utilize in making green anodes. Pre-processing may consists of the following steps:

1) Minimum 25 mm of outer layer of used anode butt shall be removed in a shot blasting unit connected with bag dust filter house and stack.

2) Handling/transfer of used anodes and shot blasted anodes are required to be done using mechanical loader (such as hydra loader with pallet fork, etc.).

3) If required, shot blasted material shall be crushed to desired size using mechanical crusher connected to dust extraction system with bag filter, ID fan and stack of height as specified in the consent issued by concerned SPCB/PCC.

4) The residue generated from the shot blasting operation and bag filter house shall be packaged and temporarily stored in a dedicated hazardous waste storage area and sent to common or captive hazardous waste TSDF within 90 days from generation of the waste. Such hazardous waste shall be stored under covered shed with proper ventilation.

- **For manufacturing Green Anodes**

5) Pre-processed used anode butt shall be crushed & screened to the desired size and mixed with petroleum coke & coal tar pitch in a thermic fluid heater to produce unbaked Green Anode blocks

6) The un-baked green anode material shall be baked in anode baking unit at a temperature of 1100°C for a period of 28 hours. The fumes from anode baking furnace shall be treated in Flue gas treatment Plant (FTP) where Alumina is used as dry scrubbing media. The treated gas are passed through bag dust collection system vented through stack of height as specified in the consent issued by concerned SPCB and Fluoride and PM emitted from the stack shall comply to the standards specified in the consent issued by the concerned SPCB.

7) The unit shall store the pre-processed used anode butts in covered storage shed(s) within premises, as authorized by the concerned SPCB under the Hazardous and Other Waste (Management & Transboundary Movement) Rules, 2016, so as to eliminate rain water intrusion.

8) Pre-processing material is required to be handled by mechanical means for crushing, screening and mixing operations.

9) Crushing, transfer and mixing operations shall be carried out in enclosed systems connected to dust extraction systems with bag dust collectors, ID fan and stack. It shall be ensured that the height of the stack shall be as specified in the consent issued by concerned SPCB or at least 06 m above roof top of adjacent structure, whichever is higher.

10) The process of mixing/ blending shall not involve any chemical reaction thereby release of no air emissions or generation of heat.

11) The percentage mix of pre-processed used anode butt in the product shall not exceed 50% and the record of the same shall be maintained by the unit.

12) The unit shall maintain proper ventilation in the work zone of loading/unloading of pre-processed Used Anode Butt. All personnel involved in the plant operation shall wear proper personal protective equipment such as masks, safety gloves, goggles, safety shoes etc.

13) The PM_{10} and Fluoride in fugitive dust of the work zone area of the crushing and mixing operations shall not exceed 4000 $\mu g/m^3$ and 2.5 mg/m^3 (8-hour time weighted average (TWA)). The stack emissions for the stack connected to the shot blasting unit, crushing and screening operations shall comply with PM and total fluoride emission of 150 and 25 mg/Nm^3.

14) Monitoring of work zone and stack emissions shall be carried out monthly and quarterly respectively. The monitoring shall be carried out by NABL/EPA accredited laboratories and the results shall be submitted to the concerned SPCB quarterly.

15) The unit shall submit quarterly and annual information on pre-processed used anode butts consumed, its source, products generated or resources conserved (specifying the details like type and quantity of resources conserved) to the concerned SPCB.

16) The residue generated from the bag filter house shall be packaged and temporarily stored in a dedicated hazardous waste storage area and sent to TSDF within 90 days from generation of the waste. Such hazardous waste shall be stored under covered shed with proper ventilation.

17) The unit shall only produce Green Anodes from the cleaned used anode butts for utilization in Aluminium Smelters

18) The unit shall maintain a passbook issued by concerned SPCB wherein the following details of each procurement of pre-processed used anode butt shall be entered:

   - Address of the sender
   - Date of dispatch
   - Quantity procured
   - Seal and signature of the sender
   - Date of receipt in the premises

19) Transportation of the pre-processed Used Anode Butt and residues generated during utilisation process shall be carried out by the sender or receiver (utilizer/TSDF operator) as per authorization issued by the concerned SPCB under the Hazardous and Other Waste (Management & Transboundary Movement) Rules, 2016.

20) The unit shall ensure that the pre-processed used anode butt is procured from unit who has requisite authorization from SPCB for handling, pre-processing, packaging, transportation, transfer, etc. as applicable of Used anode butt generated within their plant and transferring/sale the pre-processed used anode butt to utilizer unit.

21) The unit shall maintain record of hazardous waste utilised, residues 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 SPCB.

22) A log book with information on source of procurement, quantity, date wise utilization of the same, quantity of products manufactured, hazardous waste generation and its disposal etc. shall be maintained including analysis report of emission monitoring & effluent discharged, as applicable.

23) In case of environmental damages arising due to improper handling of hazardous wastes including accidental spillage during generation, storage, processing, transportation and disposal, the unit 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.*

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

1.2 Checklist of Minimal Requisite Facilities

S. No	Requisite Facilities
I	**Pre-processing of Used Anode Butt**
1.	Covered storage shed for storage of Used Anode Butt
2.	Mechanical loader (such as hydra loader with pallet fork, etc.) for handling of used anodes in shot-blaster machine
3.	Shot blasting machine of adequate chamber size so as to feed used anode butt directly into the chamber without cutting and breaking.
4.	Unit for separation of shot blasting balls from shot blasted residue
5.	Bag house dust collectors attached with shot-blaster machine followed by stack
6.	Packaging & storage of residue generated during shot blasting & from bag house in dedicated storage area
II.	**For manufacturing Green Anode**
1.	Storage shed for storage of Pre-Processed Used Anode Butt. The shed shall be covered so as to eliminate rain water intrusion.
2.	Size/capacity of storage shed to be adequate to store at least one week's requirement of used anode butt

3.	Mechanical means of waste handling for crushing, grinding screening and blending operations. a) Crushers (such as Jaw crusher, Triple Roller,etc.) b) Mechanical screens (as per product requirement) c) Mechanical mixer (s) d) Conveyor system for transfer of material, as per requirement
4.	Crushing, transfer and mixing operations to be carried under closed and covered area and connected to bag filters and stack
5.	Provision of ventilation in process and waste handling area
6.	Thermic fluid heater for heating the mixture i.e. pre-processed anode butt, petroleum coke and coal tar pitch for manufacturing Green Anode
7.	Packaging & storage of residue generated during utilization process in dedicated storage area
8.	Flue Gas Treatment Plant for Anode Baking Unit with Alumina Scrubber & bag house connected to stack

Utilization of pre-processed used Anode Butt generated from Aluminium smelters to produce Carbon Electrode Paste.

SOP - 10

Used Anode Butt from Aluminium smelters

(Category: 29.1 of Schedule I of HOWM Rules, 2016)

1.0 Utilization of Used Anode Butt (pre-processed)

This SoP is applicable only for utilization of pre-processed Used Anode Butt as described below:

Type of HW	Source of generation	Recovery/Product
Pre-processed Used Anode Butt	Aluminum Smelter units	Carbon Paste for use in Ferro Alloy Plants

The utilisation process involves crushing and screening of pre-processed Used anode butt followed by mixing with petroleum coke & coal tar pitch in thermic fluid heater to produce Carbon Electrode Paste.

1.1 Standard Operating Procedure

For Pre-processing of Used Anode Butt

It is required to pre-process the used anode butt to remove the bath material prior to utilize in making carbon Paste. Pre-processing may consists of the following steps:

1) Minimum 25 mm of outer layer of used anode butt shall be removed by shot blasting and such shot blasting machine shall have dust/ball collection system followed by dust and ball separation unit so that separated balls can be reused in shot blasting. The said system shall be operated under suction and outlet of dust and ball separation system shall be connected to a bag dust filter house and stack.

2) Handling/transfer of used anodes and shot blasted anodes are required to be done using mechanical loader (such as hydra loader with pallet fork, etc.).

3) If required, shot blasted material shall be crushed to desired size using mechanical crusher connected to dust extraction system with bag filter, ID fan and stack of height as specified in the consent issued by concerned SPCB/PCC or at least 6 m above roof top of adjacent structure, whichever is higher.

4) The residue generated from the shot blasting operation and bag filter house shall be packaged and temporarily stored in a dedicated hazardous waste storage area and sent to TSDF within 90 days from generation of the waste. Such hazardous waste shall be stored under covered shed with proper ventilation.

For Producing Carbon Paste

5) Only pre-processed Used anode butt crushed & screened to desired size shall be mixed with petroleum coke & coal tar pitch in a thermic fluid heater to produce Carbon Electrode Paste.

6) The unit shall store the pre-processed used anode butts in covered storage shed(s) within premises, as authorized by the concerned SPCB under the Hazardous and Other Wastes (Management & Transboundary Movement) Rules, 2016, so as to eliminate rain water intrusion.

7) Pre-processing material is required to be handled by mechanical means for crushing, screening and mixing operations.

8) Crushing, transfer and mixing operations shall be carried out in enclosed systems connected to dust extraction systems with bag dust collectors, ID fan and stack. It shall be ensured that the height of the stack shall be as specified in the consent issued by concerned SPCB or at least 06 m above roof top of adjacent structure, whichever is higher.

9) The process of mixing/ blending shall not involve any chemical reaction thereby release of no air emissions or generation of heat.

10) The percentage mix of pre-processed used anode butt in the product shall not exceed 50% and the record of the same shall be maintained by the unit.

11) The unit shall maintain proper ventilation in the work zone of loading/unloading of pre-processed Used Anode Butt. All personnel involved in the plant operation shall wear proper personal protective equipment such as masks, safety gloves, goggles, safety shoes etc.

12) The PM_{10} and Fluoride in fugitive dust of the work zone area of the crushing and mixing operations shall not exceed 4000 $\mu g/m^3$ and 2.5 mg/m^3 (8-hour time weighted average (TWA)). The stack emissions for the stack connected to the shot blasting unit, crushing and screening operations shall comply with PM and total fluoride emission of 150 and 25 mg/Nm^3.

13) Monitoring of work zone and stack emissions shall be carried out monthly and quarterly respectively. The monitoring shall be carried out by NABL/EPA accredited laboratories and the results shall be submitted to the concerned SPCB quarterly

14) The unit shall submit quarterly and annual information on spent anode butts consumed, its source, products generated or resources conserved (specifying the details like type and quantity of resources conserved) to the concerned SPCB.

15) The residue generated from the bag filter house shall be packaged and temporarily stored in a dedicated hazardous waste storage area and sent to TSDF within 90 days from generation of the waste. Such hazardous waste shall be stored under covered shed with proper ventilation.

16) The unit shall only produce Carbon Electrode Paste from the cleaned used anode butts for utilization in Ferro Alloy Plants

17) The unit shall maintain a passbook issued by concerned SPCB wherein the following details of each procurement of pre-processed used anode butt shall be entered:

- Address of the sender
- Date of dispatch
- Quantity procured
- Seal and signature of the sender
- Date of receipt in the premises

18) Transportation of the pre-processed Used Anode Butt and residues generated during utilisation process shall be carried out by sender or receiver (utilizer/TSDF operator) as per authorization issued by the concerned SPCB under the Hazardous and Other Wastes (Management & Transboundary Movement) Rules, 2016, with requisite safeguards ensuring no pilferage of the wastes or leachates, if any.

19) The unit shall ensure that the pre-processed used anode butt is procured from unit who has requisite authorization from SPCB for handling, pre-processing, packaging, transportation, transfer, etc. as applicable of Used anode butt generated within their plant and transferring/sale the pre-processed used anode butt to his unit.

20) The unit shall maintain record of hazardous waste utilised, residues 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 SPCB.

21) A log book with information on source of procurement, quantity, date wise utilization of the same, quantity of products manufactured, hazardous waste generation and its disposal etc. shall be maintained including analysis report of emission monitoring & effluent discharged, as applicable.

22) In case of environmental damages arising due to improper handling of hazardous wastes including accidental spillage during generation, storage, processing, transportation and disposal, the unit 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.*

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

1.2 Checklist of Minimal requisite Facilities

S.No.	Requisite Facilities
I.	**Pre-processing of Used Anode Butt**
1.	Covered storage shed for storage of Used Anode Butt
2.	Mechanical loader (such as hydra loader with pallet fork, etc.,) for handling of used anodes in shot-blaster machine
3.	Shot blasting machine of adequate chamber size so as to feed used anode butt directly into the chamber without cutting and breaking
4.	Unit for separation of shot blasting balls from shot blasted residue
5.	Bag house dust collectors attached with shot-blaster machine followed by stack
6.	Packaging & storage of residue generated during shot blasting & from bag house in dedicated storage area
II.	**For manufacturing Carbon Paste**
1.	Storage shed for storage of Pre-Processed Used Anode Butt. The shed shall be covered so as to eliminate rain water intrusion.
2.	Size/capacity of storage shed to be adequate to store at least one weeks requirement of used anode butt
3.	Mechanical means of waste handling for crushing, grinding screening and blending operations. a) Crushers (such as Jaw crusher, Triple Roller) b) Mechanical screens (as per product requirement) c) Mechanical mixer (s) d) Conveyor system for transfer of material, as per requirement
4.	Crushing, transfer and mixing operations to be carried under closed and covered area and connected to bag filters and stack
5.	Provision of ventilation in process and waste handling area
6.	Thermic fluid heater for heating the mixture i.e. pre-processed anode butt, petroleum coke and coal tar pitch for manufacturing Green Anode
7.	Packaging & storage of residue generated during utilization process in dedicated storage area

Contaminated Barrels

Utilization of contaminated barrels/ containers/drums containing hazardous wastes/chemicals/oil and lubricants

SOP - 12

Contaminated Barrels / Containers / Drums containing Hazardous Wastes

(Category: 33.1 of Schedule I of HOWM Rules, 2016)

1.0 Utilization of contaminated barrels / containers / drums containing hazardous wastes/chemicals/oil and lubricants

This SoP is applicable only for utilization of contaminated barrels/containers/drums as described below:

Type of HW	Source of generation	Recovery/Product
Contaminated barrels/ containers/ drums containing hazardous wastes/ chemicals/oil and lubricants.	All industrial process except pesticide industry.	Cleaned barrel and drums for industrial re-use and / or / production of plastic granules.

The utilization of contaminated barrels/containers/drums for further re-use involves two stage cleaning i.e. Caustic /surfactants (detergent) cleaning in hot water, followed by fresh water cleaning with fixed nozzles arrangement. During the first stage of washing i.e. cleaning with hot water with caustic solution up to 2% concentration or adequate quantity of detergent shall be carried out. In case of producing plastic granules, there should be two-stage cleaning as specified above followed by shredding. The waste water is recycled after treatment.

1.1 Standard Operating Procedure

1) Collection Storage & Handling of contaminated barrels/containers/drums

- The unit shall procure only those drums for washing whose contents are compatible with cold water/hot water/detergents/caustic solutions and do not react or become spontaneously flammable or give off flammable/toxic gases in contact with the same.
- Transportation of contaminated barrels/containers/drums shall be carried out by sender or receiver (utilizer) after obtaining authorization from the concerned SPCB under the Hazardous and Other Wastes (Management & Transboundary Movement) Rules, 2016.
- It shall be ensured that the contaminated containers/drums/barrels to be procured from the units, who have valid authorization for the same from the concerned State Pollution Control Board as required under the Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016.

2) The cleaning of barrels/ containers/ drums contaminated with chemicals listed below generated from pharmaceuticals, food processing, cosmetic, textile, paint formulation and beverages industries and not exhibiting characteristics of Class C3, C4, C5, C6 and C11 of Schedule II of HOWM Rules, 2016 and also does not liberate toxic gases in contact with air or water:

Ethyl Acetate	Glucose	Starch
Glycerine	Sorbitol	Calcium carbonate
Light Liquid Paraffin	Perfume	Vegetable Oil (Nutmeg, Eucalyptus, etc.)
Propylene Glycol	Methyasalicylate	Distilled Hydrogenated Coconut Fatty Acid
Cyanoacrylate Adhesive	Zinc Pyrithone	Surfactant (Sodium lauryl alcohol sulphate)
Thinner	Ethyl Panthenol	Iso Propyl Alcohol (IPA)
Povidone	Lactose Monohydrate	Telmisartan

3) The unit shall provide separate covered storage area for both contaminated containers and cleaned containers so as to eliminate rain water intrusion. Further, the sheds shall have proper slope and spillage collection pit so as collect spillages/floor washings. The collected spillages/floor washings shall be channelized to Effluent Treatment Plant for their treatment.

4) There shall be a designated space for dry draining of drums contaminated with oils & lubricants where drums to be hanged in inverted position on saw dust bed for 2-3 hours before washing. Oil & lubricant soaked dust to be collected and send to TSDF for disposal, the liquid effluent shall be channelized to Effluent Treatment Plant for treatment.

5) Some vapors may liberate at the time of opening of cap of drums containing chemicals which may not be safe for the workers/personnel. Therefore, it shall be ensured that:

   (i) The cap of the drums shall be opened only in well-ventilated area.

   (ii) The personnel handling the drum shall wear protective gas mask while opening the drum.

   (iii) Exhaust/suction blowers shall be provided in the shed area where drums will be opened as well as area, where these are proposed to be hanged invertedly.

6) The manifest system and logbook should be maintained. Labeling should be done on all contaminated drums indicating source, date of receipt and chemicals/ hazardous waste which were stored.

7) The unit shall ensure that prior to cleaning of contaminated containers / drums / barrels; the left-over or residual material in the drums is safely transferred into a separate container for storage and disposal at common Treatment Storage and Disposal Facility (TSDF).

   For washing of the drums/containers in both stages, the number of nozzles in 1 HP pump shall not exceed 03. Each of these nozzles can clean maximum 02 nos. of used drums per hour. Thus, number of nozzles and pump capacity thereof shall accordingly be installed for the permitted quantity of drums to be washed/day.

8) The nozzles should have multiple jets to ensure that water jets hit entire inner surface of the containers.

9) The unit shall provide bund wall along the container storage and washing area with proper slope and collection pit for channelization to Effluent treatment plant for further treatment.

10) There should be a separate area with provision of hose pipe with spray nozzle for washing outer surface of the containers along with proper slope, periphery drainage, oil and grease trap and collection pit followed by channelization to Effluent Treatment Plant for their treatment.

11) The unit should ensure zero discharge by recycling of treated wastewater in the washing process.

12) The effluent generated shall be evaporated and /or Physico-chemically treated by neutralization, coagulation, sedimentation, aeration, and filtration for recycling in the washing process, as applicable.

13) If feasible, the unit shall become member of Common Effluent Treatment Plant (CETP) and send their effluent for final treatment and disposal to CETP.

14) In case of evaporator, the flow to the evaporator should be regulated based on heating capacity of the evaporator. The vent of vacuum pump of the evaporator should be elevated at least up to 6 mtr above the roof level. MEE is preferred over simple evaporator. Water flow meter shall be installed at the inlet to evaporator and at the inlet to ETP.

15) The pre-existing labels on the drums/containers should be removed physically or with solvent then with a paint and the cleaned containers should be labeled with following prominent indelible text

"Drum Cleaned by: M/s:______________________ Date:_________________

_______________________" "For industrial use only

"NOT FOR STORAGE OF ANY FOOD MATERIAL"

16) The above labelling is not applicable in case the cleaned drums are dismantled, shredded and re-cycled.

17) The unit shall ensure that all personnel involved in the plant operation shall wear proper personal protective equipments such as masks, safety gloves, goggles, safety shoes etc.

18) The monitoring of the effluent for the parameters specified in the Consent issued by the concerned SPCB shall be carried out quarterly through NABL/EPA accredited laboratory and report shall be submitted quarterly to the concerned the SPCB.

19) Transportation of the contaminated drums and residues generated from cleaning shall be carried out by sender or receiver (drum cleaners / TSDF operator) as per authorization issued by concerned SPCB under the Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016.

    The unit shall submit quarterly and annual information on quantity of used drums procured & cleaned and their source, mode of cleaning the drum (i.e. detergent/caustic solution), quantity of waste water generated, treated & recycled and residue generated ((i.e. left over residue, Evaporator residue & ETP Sludge) or resources conserved (specifying the details like type and quantity of resources conserved) to the concerned SPCB.

20) The residue generated from the drums, evaporator and sludge generated from ETP shall be packaged and temporarily stored in a dedicated hazardous waste storage area and sent to TSDF within 90 days from generation of the waste as per the conditions stipulated under consent/authorization issued by concerned SPCB.Such hazardous waste shall be stored under covered shed with proper ventilation.

21) The unit shall maintain a passbook issued by concerned SPCB wherein each procurement details of contaminated barrels/containers/drums as follows shall be entered:

    - Address of the used Drum supplier
    - Date of dispatch
    - Quantity procured
    - Seal and signature of the sender
    - Date of receipt in the premises

22) The unit shall maintain record of contaminated drums cleaned, residues 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 SPCB.

23) A log book with information on source of procurement, quantity, date wise number of drums cleaned / quantity of granules manufactured, hazardous waste generation and its disposal etc. shall be maintained including analysis report of emission monitoring & effluent discharged, as applicable.

24) In case of environmental damages arising due to improper handling of hazardous wastes including accidental spillage during generation, storage, processing, transportation and disposal, the unit 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 Waste and Penalty " published by CPCB.*

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

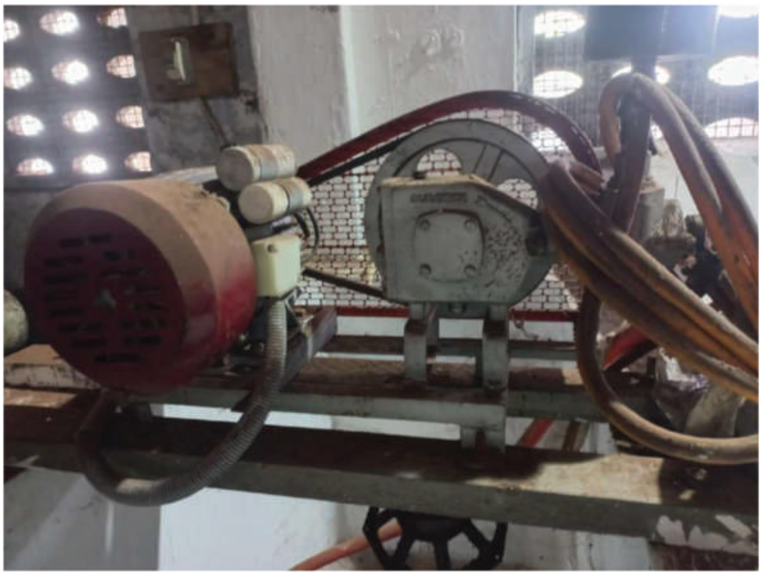
1.2 Checklist of Minimal Requisite Facilities

S. No	Particulars
1.	Separate covered storage area for both contaminated containers and cleaned containers with proper slope and spillage collection pit and channelizing to ETP.
2.	Exhaust/ Suction blowers in the contaminated drums/container handling and storage area.
3.	Size/capacity of storage sheds to be adequate to store at least 7 days requirement of contaminated drums
4.	Shed with dry draining facility for used drums, having saw dust bed for dry draining of oily/ lubricant/ greasy drums
5.	Two stage cleaning facility (i.e. hot water with caustic solution/ detergent followed fresh water cleaning) having fixed nozzles arrangement.

6.	Bund wall along the container storage and washing area.
7.	Number of nozzles for 1 HP pump shall not exceed 03.
8.	Multiple jets to ensure that water jets hit entire inner surface of the containers.
9.	Separate area with provision for washing outer surface of the containers with periphery drainage, adequate slope and collection pit and channelizing to ETP.
10.	Designated space for drum cleanings channelized to Effluent Treatment Plant.
11.	Effluent Treatment Plant and/or Forced Evaporator of adequate capacity.
12.	Sludge drying Bed of adequate size.
13.	Zero discharge by evaporation of the effluent and/ or recycling of treated effluent in washing process or member of Common Effluent Treatment Plant.
14.	Water flow meter at the inlet to evaporator and ETP.
15.	Vent of vacuum pump (if any) elevated at least up to 6 mtr above the roof level.
16.	Separate covered hazardous waste storage area to store hazardous waste generated during the utilization process viz. left over residues from contained drums, residue from forced evaporator and ETP sludge.

COMPONENTS / EQUIPMENTS IN BARREL WASHING

Saw Dust Bin for Draining of Contaminated Drums



Water Jet arrangements & ETP

Drums washing area

Cleaning & Emptying of Contaminated Drums on site

Metal Bearing Waste

Utilization of Tungsten Scrap (Tungsten carbide insert tips) generated from metal cutting operations

SOP - 31

Tungsten Scrap from metal cutting operations

(Category: B1010, Part D of Schedule I of HOWM Rules, 2016)

1.0 Utilization of Tungsten Scrap

Type of Hazardous Waste	Source of generation	Recovery/Product
Tungsten Scrap (Tungsten carbide insert tips)-Basel No. B1010,Part D of schedule-III of HOWM Rules, 2016	Metal cutting operations (using Tungsten carbide insert)	To reclaim Tungsten Carbide Powder

1.1 Source of Waste

Tungsten carbide insert after being used for metal cutting becomes worn-out and is of no use as the edge becomes blunt. These worn-out and blunt tungsten carbide inserts are discarded as a scrap material and categorised as "other waste" under Basel No. B1010 -Part D of schedule-III of HOWM Rules, 2016. The same is required to be disposed in authorized disposal facility in accordance with authorization condition, when not utilized as resource recovery.

1.2 Utilisation Process

- The utilization process involves sorting of the used Tungsten carbide inserts to remove the unwanted materials first by cleaning with hot water followed by magnetic separation system. Magnetic separation system has a belt and permanent magnet arrangements. Distance of the magnets are set to separate high magnetic material like ferrous materials (steel screws, washers, steel bur, etc.) and low magnetic inserts.
- After sorting, the material is transferred to de-coating mill where the coating layers (with different types of coating layer) of inserts is removed by tumbling the inserts with water. During tumbling process, the tungsten carbide coating gets eroded due to self-abrasion and is collected separately in the form of sludge, which contains more than 50% of tungsten carbide, which may have potential for further recovery of Tungsten carbide (such utilization is not in scope of this SOP).The wet de-coated inserts are dried over a drying belly in electrically heated chamber to get sorted tungsten carbide inserts.
- The sorted tungsten carbide inserts are heated in graphite crucible vacuum furnace along with zinc which works as a catalyst and debonds the Tungsten carbide inserts to

make it more brittle and porous which can be easily crushed into powder in a crusher. After crushing the material is sieved and homogenized in a mixer, which is packed as final product i.e. Reclaimed Tungsten Carbide Powder.

- The wastewater generated from hot water cleaning, decoating mill and washing of decoated inserts is treated in Effluent treatment. Fumes from the vacuum furnace are condensed in a condenser followed by passing through high efficiency filter and dispersion into the atmosphere through stack. The dust generated during the crushing and sieving is passed through the dust collection system and finally dispersed into the atmosphere through stack. The collected dust from bag filters is used in the process.

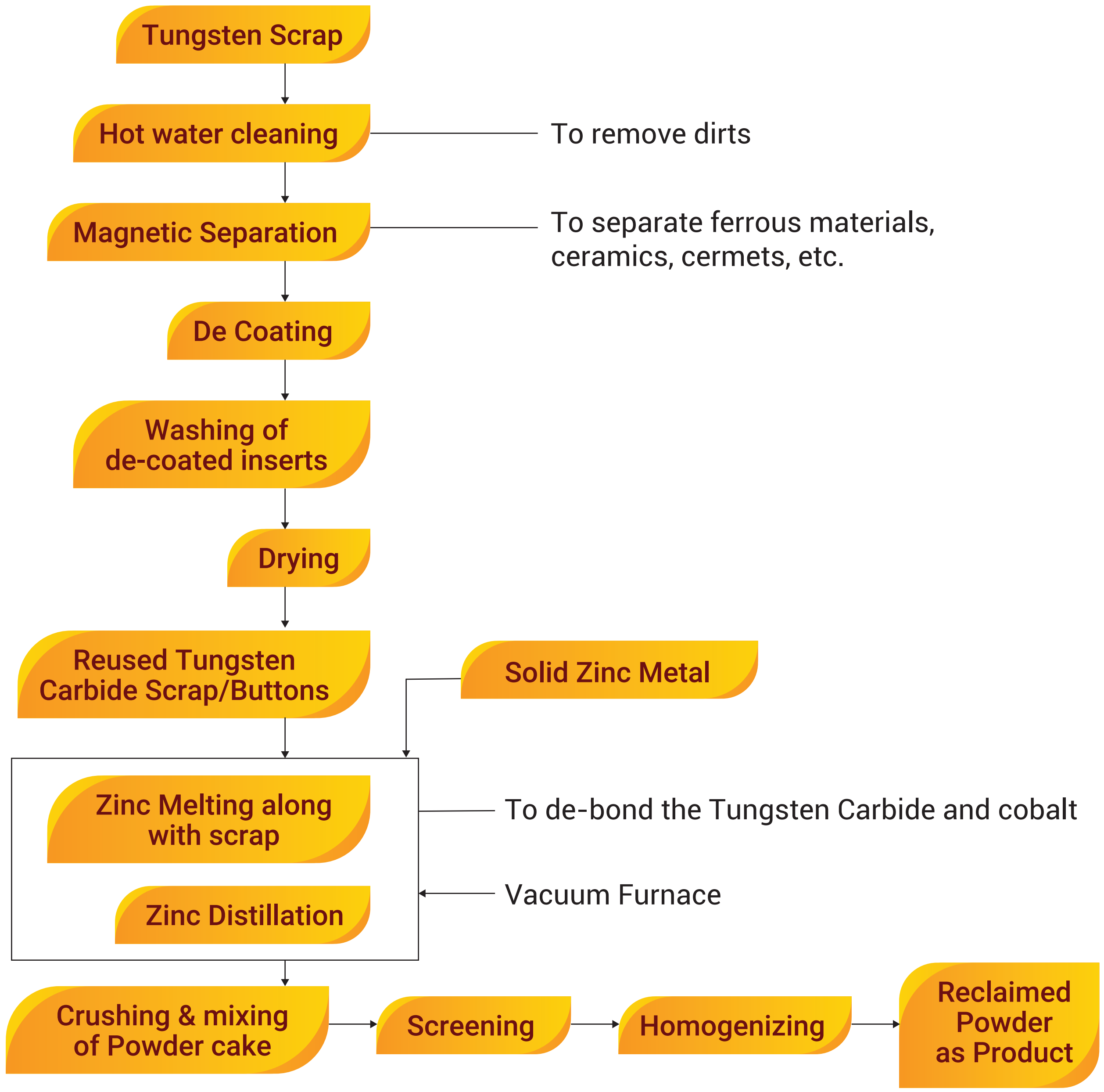


Fig 1. Process Flow diagram for utilization of Tungsten scrap

1.3 Product Usage / Utilization

The Reclaimed Tungsten carbide powder is used proportionately in manufacturing of Tungsten carbide insert after being used for metal cutting.

1.4 Standard Operating Procedure for utilization

This SoP is applicable only for utilization of used Tungsten carbide inserts generated from insert tips scrap to recover Tungsten carbide powder.

1) The used Tungsten carbide inserts shall be collected and stored in non-reactive drums/container in accordance with the provisions stipulated in Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016.

2) There should be a designated space for storage of used Tungsten carbide inserts in drums/containers under covered storage shed within premises.

3) Transfer of used Tungsten carbide inserts from the storage shed shall be carried out through mechanised conveyor system to the sorting unit. The sorting shall be carried out in two stages i.e first by hot water cleaning with detergent followed by magnetic separation system to remove the unwanted material.

4) The sorted material shall be subjected to de-coating of the different layers on the insert using trumbling process with water in a de-coating mill followed by electric drying system. The sludge from the mill is transferred to decanter tank. Supernatant from the decanter tank shall be channelized to ETP through mechanized system and slurry shall be dried. Analysis of dried sludge vis-a-vis parameters of the Schedule II of the HOWM Rules shall be carried to categorise whether the same is hazardous waste or other waste or not. In case of classification as hazardous waste or other waste, the same shall be disposed in facility authorized by SPCB/PCC or utilized in accordance with provision of Rule 9 of the HOWM Rules 2016

5) The wet de-coated insert shall be dried in electrically heated drying unit.

6) The dried sorted tungsten carbide material shall be subjected to heating in vacuum furnace alongwith zinc at a temperature of not less than 850°C at 1020 mbar pressure during heating and penetration system. Further, temperature shall be raised up to 940-980°C for 30 minutes to convert molten zinc into vapours. After this, vacuum pumps are started to bring the pressure from 1040 mbar to 20 mbar in 4.5 - 6 hours.

The zinc vapors generated from the vacuum furnace shall be collected through a guide pipe to the bottom condenser where all zinc vapors are condensed. Solid Zinc recovered from condensing zinc vapour shall be collected separately.

7) A high efficiency primary filter of not less than 2 microns size shall be connected on the vacuum line to vacuum pump, to arrest the traces of zinc entering into vacuum pump. An oil separator shall also be connected at the outlet of vacuum pump to separate oil mist, if any. The outlet of the vacuum shall be connected to stack of height as prescribed by concerned SPCB/PCC.

8) The cooled heated material, obtained in cake form is fragile and shall be converted into lumps of 100 mm min size under the hydraulic press. These lumps are crushed into powder form in ball mill followed by sieving and homogenizing.

9) Cake breaking, Crushing, sieving, transfer and homogenizing operations shall be carried out in enclosed systems connected to dust extraction systems with bag dust collectors and stack. It shall be ensured that the height of the stack shall be as specified in the consent issued by concerned SPCB or atleast 06 m above roof top of adjacent structure, whichever is higher.

10) The dust collected from the dust collection system shall be collected and used within the process.

11) Treatment and disposal of wastewater:

    The following are the sources of wastewater from utilization process;

    a) From hot water sorting belt unit

    b) Washed water from the de-coating mill

    c) Washing of de-coated inserts

    d) Floor washing/process units/vehicle wash/spillages, etc.

    The above wastewater shall be treated Physico-Chemically by neutralization, coagulation, sedimentation & filtration and 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.

12) The unit shall ensure that all personnel involved in the plant operation shall wear proper personal protective equipment such as masks, safety gloves, goggles, safety shoes etc.

13) The hazardous waste (viz. sludge from de-coating mill, as applicable, ETP sludge, contaminated gloves, masks, dusters, filters, etc.) generated from utilization process shall be collected and temporarily stored in non-reactive drums / bags under a dedicated hazardous waste storage area and be sent to authorized common TSDF or other authorized facility within 90 days from generation of the waste in accordance with the authorization issued by the concerned SPCB/PCC. Such storage area shall be covered having proper ventilation.

    Recovered Zinc and oil shall only be sent to recyclers/utilizers authorized by the SPCB/PCC under the Hazardous and Other Wastes (Management & Transboundary Movement) Rules, 2016.

14) The unit shall ensure that all the discarded/used drums/barrels are either sent back to the unit from where the Tungsten scrap is procured or to the facility who has authorisation for utilization of used drums/barrels or to the Common Hazardous Waste Treatment Storage and Disposal facility (CHWTSDF) for disposal, as authorized by the SPCB/PCC. In case of cleaning the discarded/used drums/barrels is carried out within the premises, authorisation for the same shall be obtained from the concerned SPCB/PCC.

15) Transportation of the aforesaid waste shall be carried out by the sender or receiver (utilizer) after obtaining authorization from the concerned SPCB under the Hazardous and Other Wastes (Management & Transboundary Movement) Rules, 2016.

16) Prior to utilization of Tungsten Scrap (Tungsten carbide insert tips), the unit shall obtain authorization from the concerned State Pollution Control Board under the Hazardous and Other Wastes (Management & Transboundary Movement) Rules, 2016, for storage and utilisation of Tungsten Scrap (Tungsten carbide insert tips).

17) In case of import of Tungsten Scrap (Tungsten carbide insert tips) /export of recovered tungsten powder or export of sludge from de-coating ball mill, the same shall be carried out as per the procedures laid down under the Hazardous and Other Wastes (Management & Transboundary Movement) Rules, 2016.

18) In case of environmental damages arising due to improper handling of hazardous wastes including accidental spillage during generation, storage, processing, transportation and disposal, the unit 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.*

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

1.5 Records & Returns

1. The unit shall maintain a passbook issued by concerned SPCB wherein the following details of each procurement of Tungsten Scrap (Tungsten carbide insert tips) shall be entered:
   - Address of the sender
   - Date of dispatch
   - Quantity procured
   - Seal and signature of the sender (in case procured from Industries located within the country)
   - Date of receipt in the premises
2. The unit shall submit quarterly and annual information on Tungsten Scrap (Tungsten carbide insert tips) consumed, quantity utilised, product recovered, hazardous wastes generated, resources conserved (specifying the details like type and quantity of resources conserved) to the concerned SPCB/PCC.
3. A log book with information on source, quantity, date wise utilization of Tungsten Scrap (Tungsten carbide insert tips), product recovered, hazardous wastes generated, etc. shall be maintained including analysis report of emission monitoring & effluent discharged, as applicable.
4. The unit shall maintain record of hazardous waste generated, utilised 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 SPCB.

1.6 Standards

(i) Fugitive emissions in the work zone shall comply with following standards

Tungsten (as W) Insoluble compounds	: 5.0 mg/m^3 TWA*
Tungsten (as W) Soluble compounds	: 1.0 mg/m^3 TWA*

Tungsten carbide containing cobalt as binder : 0.1 mg/m^3 TWA*

Tungsten carbide containing nickel as binder : 1.0 mg/m^3 TWA*

** Time-weighted average {TWA}, Short-term exposure limits (STEL}. The Permissible Exposure Limit is 8-hour TWA.*

(ii) Source emission standards for Particulate Matter shall comply with the limit of 50 mg/Nm^3 in the stack attached to breaking/crushing/sieving/homogenizing sections or vacuum furnace.

(iii) Wastewater discharge from the unit shall comply with the standards prescribed by the concerned SPCB/PCC.

(iv) Monitoring of the specified parameters for source emission shall be carried out quarterly for the first year followed by atleast 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 accredited or EPA approved laboratories results shall be submitted to the concerned SPCB/PCC quarterly.

1.7 Siting of Industry

Facilities for processing of used Tungsten carbide inserts should preferably 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.

1.8 Size of Plant & Efficiency of utilisation

About 2 tons of used Tungsten carbide insert tips can recover approx. 1.8 tons of tungsten powder. Other raw material consumed i.e Zinc shall also be recovered (About 1.2 tons of zinc usage recovers about zinc @ 1.18 tons from melting process). Therefore, requisite facilities of adequate size of storage shed and other plant & machineries as given in para 1.10 below shall be installed accordingly.

The recycling facility shall achieve> 99.08% recovery efficiency for Tungsten powder.

1.9 On-line detectors I Alarms / Analysers

Online emission analyzer for PM in the stack shall be installed and the online data be connected to the server of the concerned SPCB/PCC and CPCB.

1.10 Checklist of Minimal Requisite Facilities:

Online emission analyzer for PM in the stack shall be installed and the online data be connected to the server of the concerned SPCB/PCC and CPCB.

S. No	Particulars
1.	Covered Storage shed (s) for storage of Tungsten Scrap (Tungsten carbide insert tips) in drums/containers.
2	Mechanised system for hot water cleaning in tank to remove dirt from Tungsten Scrap (Tungsten carbide insert tips)
3.	Appropriate mechanized magnetic separator system to sort out ferrous materials, ceramics & cermets and Tungsten Scrap (Tungsten carbide insert tips)
4.	De-coating ball mill
5.	Decanter tank for sludge generated from De-coating ball mill
6.	Electric Drying unit for wet de-coated inserts
7.	Vacuum Furnace with vacuum pump & safety valve arrangement having provision of electrical heating to raise required temperature up to 940-980°C
8.	Zinc distillation unit with condenser system for recovery of Zinc from zinc vapors of the vacuum furnace.
9.	Oil separator to separate oil mist, if any
10.	Stack (attached to Zinc distillation unit) of height as prescribed by concerned SPCB/PCC Stack 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.*
11.	Mechanical means of closed conveying system during cake breaking, crushing, screening and homogenizing having following units: a) Cake breaking unit (Such as tilted table with hydraulic press) b) Crushers (such as Jaw crusher, Triple Roller, etc.) c) Mechanical screens/ sieving unit

	d) Mechanical mixer/blender for homogenizing e) Conveyor system for transfer of material, as per requirement
12.	Crushing, transfer and mixing operations to be carried under closed and covered area and with provisions of dust extraction system followed by bag filters and stack of height as prescribed by concerned SPCB/PCC Stack 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.
13.	Provision of ventilation in process and waste handling area.
14.	Effluent treatment Plant comprising of physico-chemical treatment, sedimentation and filtration unit.
15.	Packaging & storage of various hazardous/other wastes ETP sludge/ residue/wastes generated during utilization process in dedicated storage area.
16.	Online analyzers for Particulate Matter emission monitoring in stack.
17.	Dedicated hazardous waste storage area for temporary storage of hazardous waste generated during utilization process.

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

SOP - 64

Metal and Metal bearing waste (Tin / Tungsten / Cobalt / Vanadium / Tantalum / Niobium Scrap)

(Category: B-1010 Part D of Schedule III of HOWM Rules, 2016)

1.0 Utilization of metal and metal bearing wastes

S.No	Type of HW/OW		Source of generation	Recovery/Product
	Name of HW	Category of HW		
01	Tin scrap	Basel No.B-1010 Part D of Schedule-III of HOWM Rules, 2016)	Scrap generated during smelting, cutting tools, plating droppings, Melting pots, ordinance Factory, scrap traders, etc.	Refined tin metal.
02	Tungsten Scrap			Recovery of sodium tungstate and tungsten carbide powder
03	Cobalt Scrap			Cobalt hydroxide
04	Tantalum and Niobium Scrap			Metal powder of vanadium, tantalum and niobium.

1.1 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

1.2 Utilization Processes

1.2.1 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

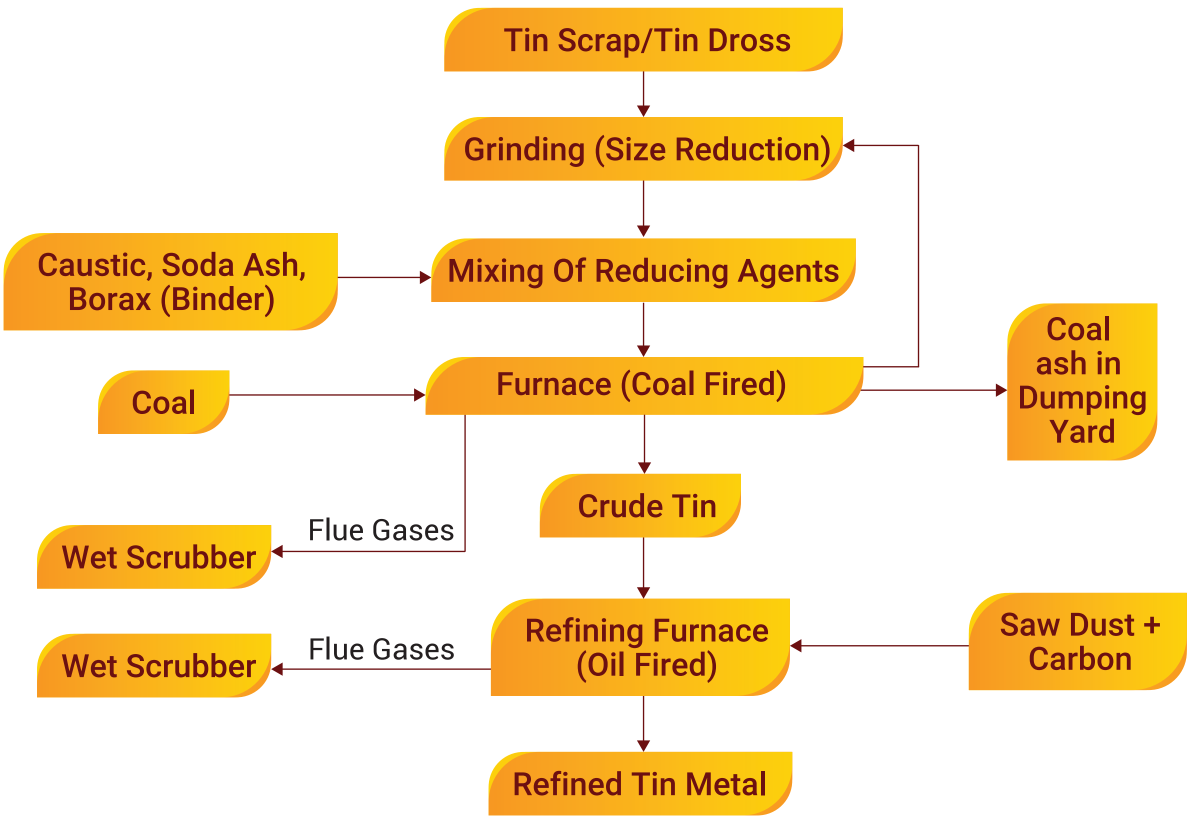


Fig 1: Process flow diagram for utilization tin scrap/dross for recovery of Tin Metal.

1.2.2 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 is 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.

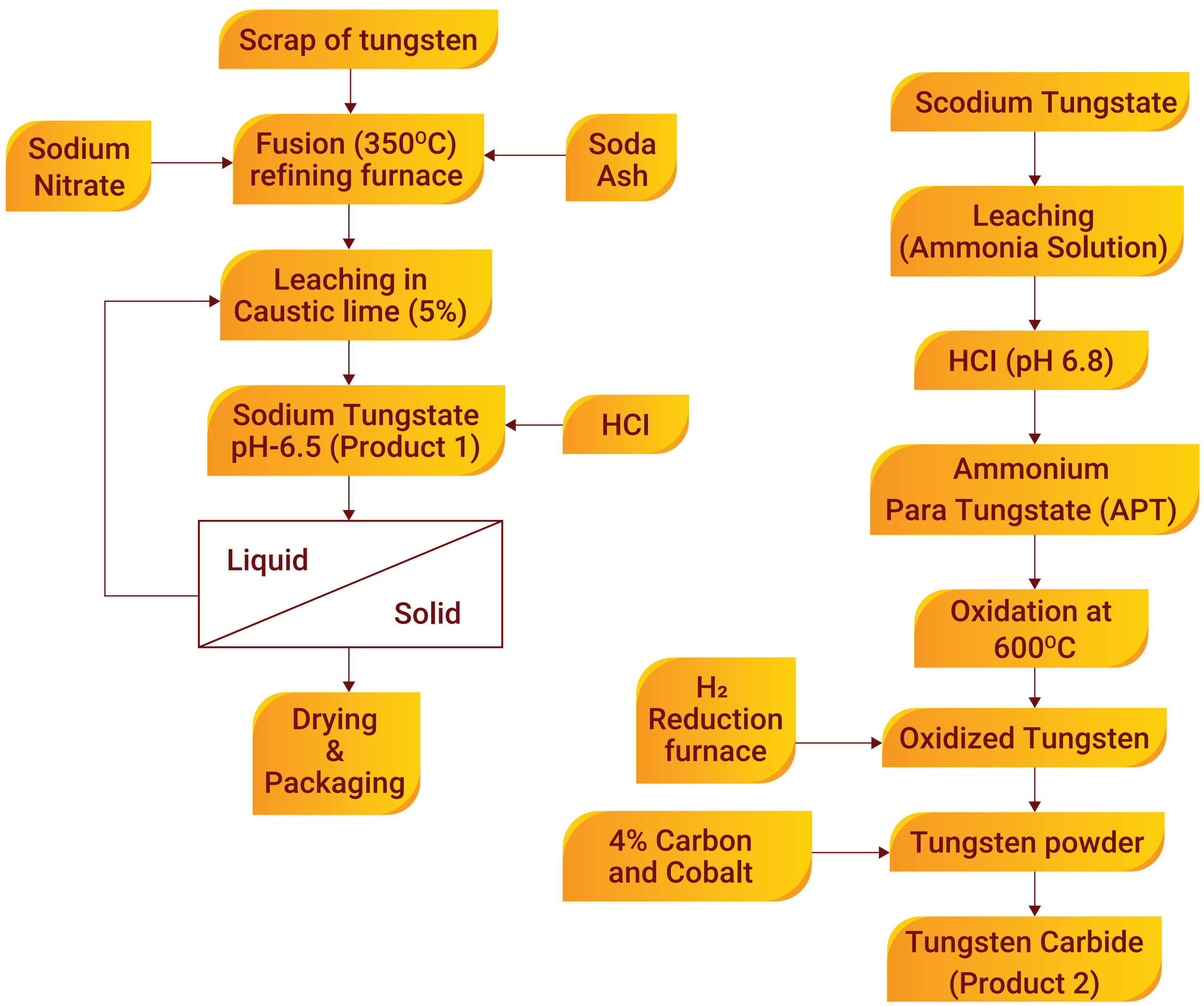


Fig 2: Process flow diagram for utilization tungsten scrap for recovery of tungsten Carbide Power.

1.2.3 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 wasted with water and dried.

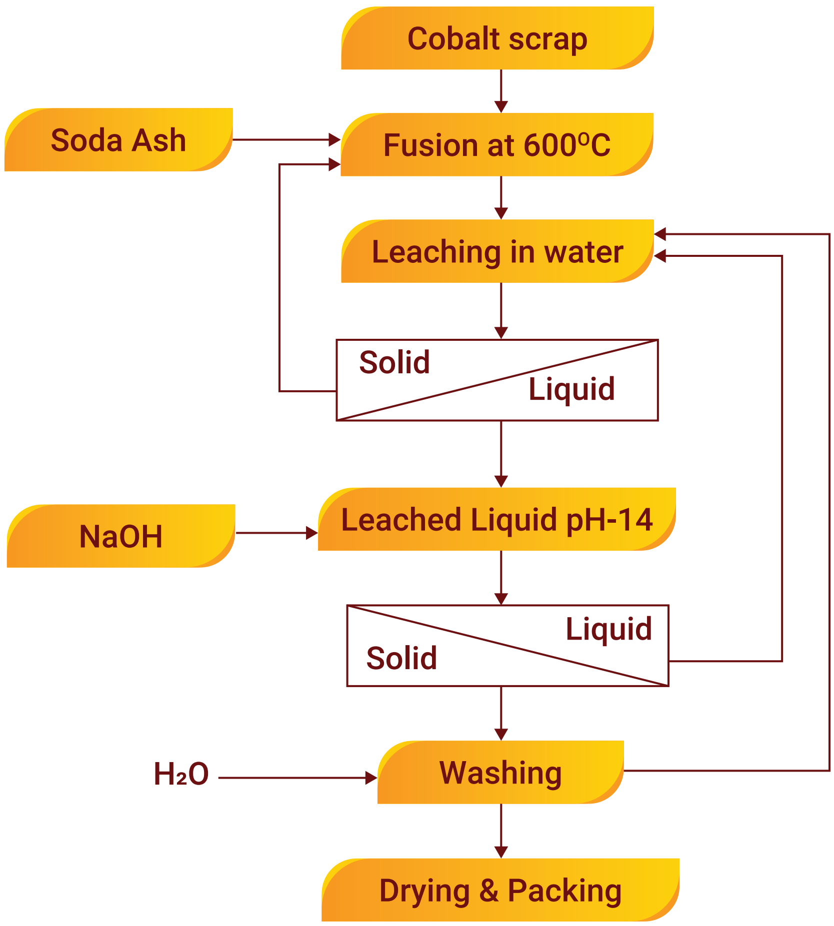


Fig 3: Process flow diagram for utilization cobalt scrap for recovery of cobalt hydroxide.

1.2.4 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 is obtained at their respective magnetic flux density.

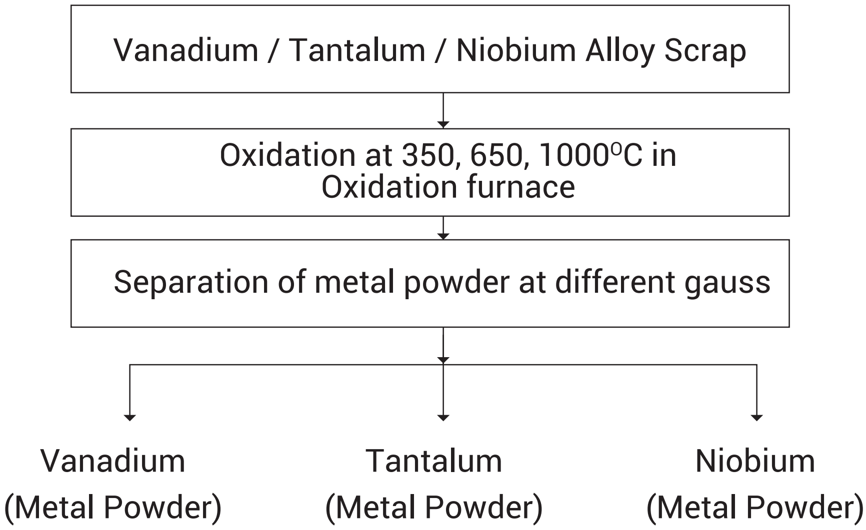


Fig 4: Process flow diagram for utilization of Vanadium, Tantalum and Niobium scrap for recovery of their metal alloys

1.3 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 resource for recovery of their metal Powder, to be further used for manufacturing metal alloys.

1.4 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 that are generated during smelting, cutting tools, plating droppings, melting pots and procured from ordinance factory, scrap traders, etc. 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 waste 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 at least 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 from 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 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, 1984, 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 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.

1.5 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 utilized, 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 the 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.

1.6 Standards

1) Source emission from the stack connected to Air Pollution Control Board 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 setup:

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

(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	2mg/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
Hafnium	0.5 mg/m^3 TWA*

#C - Ceiling limit

**Time - weighted average (TWA): measured over a period of 8 hours of operation 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 subsequently 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.

1.7 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 park/estate/cluster and in accordance with Consent to Establish by the concerned SPCB/PCC.

1.8 Online Detectors/ Alarm/ Analyzers

In case of continuous process operations, online emission analysers for PM and SOx 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.

1.9 Checklist of Minimal Requisite Facilities

S. 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 harzardous and other wastes, other raw materils/ 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 Bags Filters (APCD)
8	Stack of proper height as prescribed by the SPCB with sampling port, platform, access to the platform etc as per the guidelines on the methodologies for the source emission monitoring published by CPCB under Labaratory Analysis Techniques published by CPCB under Laboratory Analysis Techniques LATS/80/2013-14.

Oil based Mud / Drill Cuttings

Utilization of Synthetic Oil based Mud / Drill Cuttings Waste in Road Construction

SOP - 36

Synthetic Oil based Mud / Drill Cuttings

(Category: 2.1 & 2.3 of Schedule I of HOWM Rules, 2016)

1.0 Utilization of Synthetic Oil based Mud/drill cuttings:

Type of HW	Source of generation	Recovery/Product
Synthetic Oil based mud / drill cuttings waste (Category 2.1 & 2.3 as per Schedule I of the HOWM Rules, 2016)	Crude Oil & Natural Gas Production	Treatment of Synthetic Oil based Mud/drill cuttings waste for utilization as sub-base material in Road Construction as per specifications/guidelines prescribed by Indian Road Congress

1.1 Source of Waste

The Synthetic Oil based Mud and drill cuttings waste is generated from Onshore/ offshore drilling activity of Crude oil & Natural Gas Exploration, and the same have been categorized as hazardous waste at S.No.2.1 & 2.3 respectively of Schedule-I of HOWM Rules, 2016 which are required to be disposed in authorized disposal facility in accordance with authorization condition, when not utilized.

Synthetic Oil based mud is a base oil (lubricating oil) with proportionate composition of additives such as Barite (Barium Sulphate), Bentonite (Clay), Emulsifiers, Viscosifiers, Fluid loss additives, drilling detergents, wetting agents etc. Synthetic oil based mud is used to lubricate the drill bit and transport the drill cuttings to the surface. Wastes as the Synthetic oil based mud /drill cuttings are broken bits of solid material that are produced as the drill bit passes under the ground. Synthetic based mud/drill cuttings wastes comprises of 10-15% oil, 20% water and remaining solids.

1.2 Utilization Process

The utilization process involves transferring of the Synthetic Oil based mud/ drill cuttings from storage tank to the vibratory feeder, wherein bigger particles are removed. The screened material is passed through preconditioner where the material is allowed to pass through specially designed paddled shafts rotating in the opposite direction which ensures the materials gets pre-heated using indirect heat by circulating hot thermic fluid through the jacket at 80-90^{o}C. The homogenized material is then passed through lump breaker followed by sieve shaker where material of size more than 0.75 inches are separated and fed into the preconditioner. The material which passes through the sieve shaker is fed to Stage I Thermal Evaporator (Dryer) wherein the material is heated upto 180-200°C under negative pressure (i.e 200 to 300 mm Hg) with a retention time of 45 minutes. The indirect heat is provided by thermic fluid from thermic fluid heater. In the thermal evaporator, the hot mixture is moved forward with the help of hollow paddle conveyor and discharged through rotary air lock valve.

The process flow diagram is shown Fig 1:

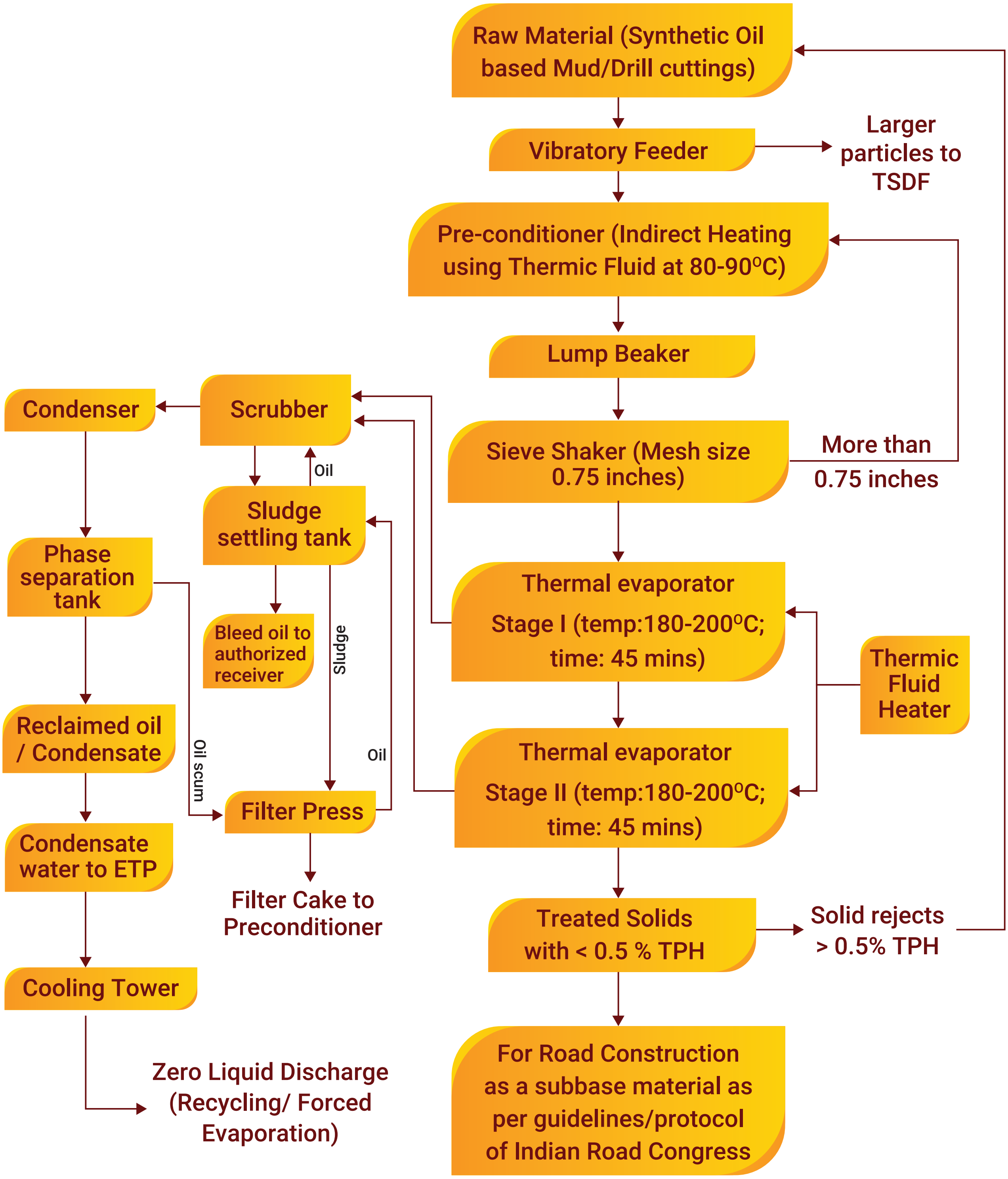


Fig 1: Process flow diagram for utilization of Synthetic Oil Based Mud / Drill Cutting Wastes

- The hot solids after Stage I Thermal Evaporator (Dryer) passes through Stage II Thermal Evaporator (Dryer), wherein the material is further heated to a temperature of 180 - 200°C under negative pressure (i.e 200 to 300 mmHg) and moved forward with the help of hollow paddle conveyor with the same retention time of 45 minutes and discharged through rotary air lock valve. The organic compounds, hydrocarbons and water molecules are evaporated in both the Thermal Evaporators and the vapours are passed through oil scrubber followed by condenser. The condensate is stored in a storage tank for phase separation of oil and water. The condensate oil is passed through cloth filter so as to obtain as reclaimed oil. The oil scum is sent to filter press. The condensate water is treated in ETP and treated water may be used in cooling tower. The vapours from both the dryers are scrubbed in scrubber using oil as scrubbing medium so as to remove dust from vapours. The oi1, as scrubbing medium from the scrubber, is settled in a settling tank from where the oil is recirculated into the scrubber.
- The sludge from the said settling tank is passed through Filter Press. The filter cake formed is mixed with Synthetic oil based mud / drill cuttings in the said preconditioner and is again processed through two stage dryers as above. The recovered oil from filter press is used as scrubbing medium in the scrubber. However, after some cycle of recycling the said oil in scrubber, the recycled oil may loose its properties and requires to be replaced with fresh oil. The replaced oil may be sent to authorised used oil recycler for recycling.
- The dried solids coming out of Stage II Dryer are checked for quality control. The dried solids with < 0.5 % Total Petroleum Hydrocarbon (TPH) content is sent for use in road construction as a subbase material as per specifications/guidelines prescribed Indian Road Congress. Dried Solids with >0.5 % TPH content is again mixed with the Synthetic Oil based Mud/drill cuttings in the preconditioner.

1.3 Product Usage/Utilization

Treated mud (<0.5 % TPH) may be used for road construction as a sub-base material in a proportion subject to approval of the Indian Road Congress and in accordance with approval/guidelines/standards prescribed therein. Proper records for such usages shall be maintained and also be informed to the concerned SPSCB/PCC. It shall not be used in Water Bound Macadam (WBM) Road.

1.4 Standard Operating Procedure (SoP) for utilization

This SoP is applicable only for utilization treated mud (<0.5% TPH) in road construction, where the treated mud is used as a sub-base material in road construction as per approval/guidelines/standards from Indian Road Congress.

1) Synthetic Oil based mud/drill cuttings shall be procured in a non-reactive covered containers like skips and transported to the unit as authorized by SPSC/PCC.

2) Only those synthetic oil based mud/drill cuttings wastes shall be procured which are generated from use of only low toxicity OBM in accordance with provisions stipulated under Section 2 of the guidelines for disposal of solid waste drill cutting and drilling fluids for offshore and onshore drilling notified under E (P) Rules, 1986 vide notification 546(E) dated: 30.08.2005.

3) The containers like skips shall be transferred in a covered designated storage place like cement dyke, which shall be placed above the ground with low raise bund wall. The same shall be under cool, dry, well ventilated under covered storage shed, as authorized by the concerned SPCB/PCC under the HOWM Rules, 2016, so as to eliminate water intrusion.

4) Synthetic Oil based mud/drill cutting wastes shall be transferred mechanically through sholves to the feeding hopper and conveyed to the vibratory feeder to homogenize the mud/drill cuttings.

5) The bigger particles in the mud/drill cuttings separated in the vibratory feeder shall be sent to TSDF. The material shall then be passed through pre-conditioner to further loosen up the material so as to homogenize at temperature of about 85-90^{o}C. The said temperature shall be attained by indirect heat using thermic fluid. Thereafter, the homogenized material shall be passed through lump breaker for further homogenization.

6) Conveying of materials to all intermediate processing unit shall be carried out in a closed mechanical conveying system like Redlor Conveyor.

7) The homogenized material shall be passed through a series of two thermal evaporators (Dryers) (with a retention time of 45 minutes each) maintain a temperature between 180-200^{o}C through indirect thermic fluid heating system. Negative (suction) pressure condition shall be maintained in the range of 200 to 300 mmHg using appropriate vaccum pump.

8) There shall be a provision to collect thermic fluid from dryers in a tank and shall be reused in the thermic evaporator as a heating medium.

9) The vapours shall be passed through oil scrubbers followed by Condensers. Oil shall be used as scrubbing medium. The scrubbed oil (containing fines) shall be filtered through filter like Pressure Leaf Filter and the filtered oil be allowed to settle in a sludge tank from where the oil shall be recirculated to the scrubber.

10) There shall be a vent of the vacuum pump of condenser of adequate height as prescribed by the concerned SPCB/PCC having 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 in the condenser at a height as prescribed by the SPCB/PCB.

11) The condensate from the condensers shall be allowed to settle in Phase separation tank. Oil shall be recovered as reclaimed oil from Phase separation tank.

12) The reclaimed oil may be sent to used oil recyclers having authorisation from the concerned SPCB/PCC. Alternatively, the reclaimed oil may be used as fuel in captive thermic fluid heater provided it meets the standards as prescribed under PART B of Schedule V of the HOWM Rules, 2016 and the concerned SPCB/PCC permits the same.

13) Water from Phase separation tank shall be treated in an effluent treatment plant so as to meet the effluent discharge standards prescribed for Petroleum oil refinery notified vide notification G.S.R. 186 (E) dated 18/3/2008 under the Environment (Protection) Act, 1986. The treated water may be used in cooling tower of the condenser system and other industrial operations within the unit.

    The unit shall meet zero liquid discharge condition. Therefore, left over or unused treated water shall not be discharged and suitable arrangement like forced evaporation system (single or multi effect evaporator) shall also be installed to meet the said zero liquid discharge.

14) The oil sludge settled in the aforesaid sludge settling tank attached to the scrubber; oil scum generated during oil reclamation from the aforesaid Phase separation tank, and residues of the Pressure Leaf Filter, shall be filtered through filter press.

    The filter cake generated shall be sent to the aforesaid preconditioner for homogenization the synthetic oil based mud/drill cutting waste.

15) Bleed oil from the scrubber shall he sent to used oil recyclers having authorization from the concerned SPCB/PCC.

16) The dried solids coming out of Stage II Dryer shall be checked for quality control. The dried solids only with <0.5 % Total Petroleum Hydrocarbon (TPH) content shall be sent for use in road construction as a sub-base material as per approval/specifications/guidelines prescribed by Indian Road Congress, Dried Solids with >0.5 % TPH content is again mixed with the Synthetic Oil based Mud/drill cuttings in the preconditioner.

17) Only upon obtaining the said approval/specifications/guidelines from Indian Road Congress, the dried solids only with <0.5 % TPH shall be handed over for the said use road construction. Further, the unit shall maintain a record pertaining to quantity of the dried solids with corresponding TPH content, details of the person/contractor to whom the same has been handed over, location where the same has been used, etc. the same shall also be intimated to the concerned SPCB quarterly and ann

18) The unit shall ensure proper ventilation in the work zone and process areas. All the personnel involved in the waste utilization process shall wear proper personal protective equipment (PPE) such as protective eye goggles, full face shield/ full face aspirator mask, body suits/aprons and / or coverall of chemical resistant material and impervious boot/ shoes etc. The safety precautions of the worker shall be in accordance with the Factory Act, 1948, as amended from time to time.

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

20) It shall be ensured that Synthetic Oil based Mud / drill cuttings waste is procured from the industries who have valid authorization for generation storage of the same from the concerned SPCB/PCC as required under the HOWM Rules, 2016. Further, transportation of the same shall be in accordance with the provisions stipulated under the said Rules.

21) Prior to utilization of Synthetic Oil based Mud / drill cuttings wastes, the unit shall obtain authorization for transportation (in case carried out by the unit), storage and utilization of Synthetic Oil based Mud / drill cuttings from the concerned State Pollution Control Board under the Hazardous and Other Wastes (Movement &Transboundary Movement) Rules, 2016.

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

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

1.5 Records/Return Filing

1) The unit shall maintain a passbook issued by concerned SPCC wherein the details of each procurement of synthetic oil based mud/drill cuttings waste shall he entered:

- Address of the sender
- Date of dispatch
- Quantity procured
- Seal and signature of the sender Date of receipt in the premises

2) A log book shall be maintained with information on source and date of procurement of synthetic oil based mud/drill cuttings, quantity, date wise utilization of the same including operational parameters such as temperature, pressure etc, hazardous waste generation and its disposal, etc. Further, the unit shall also maintain record pertaining to quantity of the dried solids with corresponding TPH content, details of the person /contractor to whom the same has been handed over, location where the same has been used etc.

3) The unit shall maintain record of hazardous waste utilised, hazardous waste generated and disposed as per Form 3 and 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.

1.6 Standards

1) Fugitive emissions in the work zone shall comply with following

Respirable dust (PM_{10})	- 5000 µg/m^3 TWA*
Lead	- 50 µg/m^3 TWA*
Cadmium	- 5 µg/m^3 TWA*
Nickel	- 0.5 µg/m^3 TWA*
Barium	- 0.5 µg/m^3 TWA*
Mineral Oil Mist	- 0.5 µg/m^3 TWA*

**TWA - Time weighed Average measured over a period*

(2) a) Emission from vent of the condenser shall comply with the following:

TOC - 20 mg/Nm^3 (corrected at 11% O_2)

b) Emissions from boiler of the thermic fluid heater shall comply with the emissions prescribed by the concerned SPCB/PCC.

3) The treated effluent water shall meet the following standards prescribed for Oil, Drilling and Gas Extraction Industry under the Environment (Protection) Act, 1986.

S. No	Parameters	Standards
1.	pH	5.5-9.0
2.	Temperature	40°C
3.	Suspended Solids	100 mg/L
4.	Zinc	2 mg/L
5.	BOD	30 mg/L
6.	COD	100mg/L
7.	Chlorides	600 mg/L
8.	Sulphates	1000 mg/L
9.	TDS	2100 mg/L
10.	% Sodium	60 mg/L
11.	Oil and Grease	10 mg/1
12.	Phenolics	1.2 mg/L
13.	Cyanides	0.2 mg/L
14	Fluorides	1.5 mg/L
15.	Sulphides	2.0 mg/L
16.	Chromium (Cr^{6+})	0.1 mg/L
17.	Chromium (Total)	1.0 mg/L
18.	Copper	0.2 mg/L
19.	Lead	0.1 mg/L
20.	Mercury	0.01 mg/L
21.	Nickel	3.0 mg/L

4. The synthetic oil based drilling mud/drill cuttings that are procured for the said utilization process shall meet the specifications as prescribed under the "Guidelines for disposal of solid waste, drill cutting and drilling fluids for offshore and onshore drilling operation as notified under the gazette notification vide G.S.R 546 (E) dated 30.08.2005 including the following:

   a) The chemical additives used for the preparation of DF should have low toxicity i.e 96 hr LC_{50} > 30,000 mg/L as per mysid toxicity or toxicity test conducted on locally available sensitive sea species. The chemicals used (mainly organic constituents) should be biodegradable.

b) DC separated from OBM after washing should have oil content at < 10 gm/kg for disposal at disposal pit.

c) Barite used in preparation of DF shall not contain Hg >1 mg/kg & Cd > 3 mg/kg.

5. Monitoring of the specified parameters for source emission shall be carried out quarterly for the 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, accredited or EPA approved laboratories results shall be submitted to the concerned SPCB/PCC quarterly.

1.7 Siting of Industry

Facilities for processing of processing of synthetic oil based mud/drill cuttings wastes shall preferably 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.

1.8 Size of plant & Efficiency of Utilization

One ton of synthetic oil based mud/drill cuttings waste will yield about 0.865 ton of dried solid (<0.5 % TPH) which will be used for the said road construciton. Further, about 220 L of condensed water will be generated which requires to be treated in ETP. Therefore, requisite facilities of adequate size of storage shed and other plant & machineries as given in Section 1.10 shall be installed accordingly.

1.9 On-line detectors / Alarms / Analysers

Online emission or effluent monitoring systems with transmission of the online emission data to CPCB and SPCB servers should be installed as and when directed by SPCB/ PCCC/ SPCB.

1.10 Checklist of Minimal Requisite Facilities

S. No	Minimal Requisite Facilities
1.	Designated area with impervious lining like cement dyke of adequate capacity to store Synthetic Oil based mud/drill cuttings wastes for at least seven days of plant capacity. Further, such area shall be above the ground with low bund wall and under cool, dry, well ventilated and covered storage shed, so as to eliminate rain water intrusion. Further, the said storage area shall also have provisions for unloading the wastes.
2.	Closed Conveyor systems like Redlor conveyor for conveying the material to all the intermediate units during processing and treatment of synthetic Oil based mud/drill cuttings waste
3.	Vibratory Feeder, Preconditioning chamber, lump breaker and sieve shaker
4.	Two stage Thermal evaporator (Dryers)
5.	Rotary air lock valve
6.	Thermic fluid Heater
7.	Scrubber
8.	Condenser
9.	Vacuum Pumps
10.	Vent of the vacuum pump of condenser shall be of adequate height as prescribed by the concerned SPCB/PCC having sampling port, platform, access to the platform etc as per the Guidelines on Methodologies for Source Omission Monitoring published by CPCB under Laboratory Analysis Techniques LATS/80/2013-14.
11.	Cooling Tower
12.	Receiver Tank to collect condensate
13.	Phase Separation Tank

14.	Separation tank for storage of reclaimed oil and condensed water from Phase Separation Tank
15.	Settling tank for oil being recirculated to the scrubber
16.	Pressure Leaf Filter or other arrangements for separation of fines in scrubbed oil of scrubber
17.	Filter Press
18.	Thermic Fluid storage tank
19.	Effluent Treatment Plant
20.	Zero Liquid Discharge (Recycling/Forced Evaporation)
21.	Stack (attached to the thermic fluid heater) of height as prescribed by the concerned SPCB/PCC having 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
22	Covered storage shed for storage of dried solids to be used in road construction of adequate capacity to store at least seven days of production capacity

Residues

Utilization of Coal Tar/Tarry Residue generated from coal gasifier for energy recovery in sodium silicate industry.

SOP - 11

Coal Tar/Tarry Residue in sodium silicate industry

schedule

1.0 Utilization of Coal Tar/ Tarry Residue

This SoP is applicable only for utilization of Coal Tar/Tarry Waste as described below:

Type of HW	Source of generation	Recovery/Product
Coal Tar/Tarry residue	Coal gasifier units	As supplementary fuel in furnace for energy recovery in sodium silicate units

The utilisation process involves heating of coal tar and firing of liquid coal tar through burners in pre-heated furnace (after the furnace achieves a temperature >1100 ºC) as a supplementary fuel in place of conventional fuels such as furnace oil, LPG, CNG, LDO etc. The solid sodium silicate glass cullet is mixed with water and kept in open pans and heated from bottom utilising the waste heat (after heat economiser) to liquefy the amorphous solid glass. The sodium silicate solution thus produced is stored in vessels The flue gases after passing through heat economiser and heating pans is cleaned in alkali scrubbers.

1.1 Standard Operating Procedure

1) Tarry waste shall be procured only in tanker mounted vehicles.

2) Tarry waste shall be received into storage tank and a transfer pump shall be used to transfer the tarry waste to day tank. All the tanks and transfer pump shall be under covered shed to eliminate any contact with rain water. The storage tanks shall be provided with water seals to all probable leaking points so as to minimise the VOCs emissions.

3) Melting of tarry waste for use in furnace shall be done by using electric heaters and molten tarry waste shall be transferred using transfer pumps to day-tank.

4) Utilisation of tarry waste shall not exceed 0.3 MT per 1 MT of liquid sodium silicate production.

5) The unit shall not operate the furnace at >70% of the rated capacity while utilizing tarry waste.

6) Tarry waste shall not be injected into the furnace until the temperature of the furnace is heated up to > 1100 , using conventional fuels such as furnace oil, LPG, CNG, LDO etc. as per the consent issued by the concerned SPCB under Air (Prevention and Control of Pollution) Act, 1981.

7) Fume extraction hoods shall be provided above the tarry waste melting unit, day-tank and molten cullet tapping point and the same shall be channelized as combustion air into the furnace.

8) The hot flue gases shall be passed through heat economiser (for heating combustion air) followed by pan heaters and treated in alkali scrubber with ID fan connected to stack of height as specified by SPCB.

9) The scrubber bleed liquor shall be treated in an effluent treatment plant and treated effluent shall be discharge as per the conditions stipulated in consent issued by the concerned SPCB under Water (Prevention and Control of Pollution) Act, 1974.

10) The unit shall ensure that all personnel involved in the plant operation shall wear proper personal protective equipment such as masks, safety gloves, goggles, safety shoes etc.

11) The unit shall install online analyzers for CO emission monitoring in stack with provision to transfer online emission data to SPCB and CPCB server.

12) The unit shall comply with following emission standards ;

Stack Emission Standards

- Particulate Matter - as stipulated by concerned SPCB
- Oxides of Nitrogen – 400 mg/Nm^3
- Carbon Monoxide – 100 mg/Nm^3
- TOC – 20 mg/Nm^3
- SO_2 – 200 mg/Nm^3

Proposed Work Zone standards

- (8-hour time-time weighted average values)
- Respirable dust (PM_{10}) - 5000 µg/m^3
- Carbon Monoxide - 50 ppm
- Coal tar volatiles (benzene-soluble fraction viz. anthracene, Benzo (a) Pyrene, phenanthrene, Dibenzo[b,e]pyridine, chrysene & pyrene) : 0.2 mg/m^3

13) Monitoring of the specified parameters for source and work zone emissions (PM_{10} & CO) shall be carried out by NABL/EPA accredited laboratories and the results shall be submitted to the concerned SPCB quarterly and monthly respectively. The results of coal tar volatiles as above shall be carried out annually.

14) The unit shall submit quarterly and annual information on tarry waste consumed; its source, products generated or resources conserved (specifying the details like type and quantity of resources conserved) to the concerned SPCB.

15) The residue generated from flue gas scrubber and tar-containing wastes (generated due to spills/debris containing tarry wastes, used oils, scrubber residue etc.) shall be disposed as hazardous wastes through common TSDFs as per the conditions stipulated under consent/authorization issued by concerned SPCB.

16) The unit shall maintain a passbook issued by concerned SPCB wherein the following details of each procurement of coal tar/tarry waste shall be entered:

- Address of the sender
- Date of dispatch
- Quantity procured
- Seal and signature of the sender
- Date of receipt in the premises

17) Transportation of the tarry waste and residues generated during utilisation shall be carried out by the sender or receiver (utilizer/TSDF operator) as per the authorization issued by concerned SPCB under the Hazardous and Other Wastes (Management & Transboundary Movement) Rules, 2016.

18) It shall be ensured that the aforesaid hazardous wastes are procured from coal gasifier units, who have valid authorization for the same from the concerned State Pollution Control Board as required under Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016.

19) The unit shall maintain record of hazardous waste utilised, residues 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 SPCB.

20) A log book with information on source and date of procurement, quantity, date wise utilization of the same, quantity of products manufactured, hazardous waste generation and its disposal etc. shall be maintained including analysis report of emission monitoring & effluent discharged, as applicable.

21) In case of environmental damages arising due to improper handling of hazardous wastes including accidental spillage during generation, storage, processing, transportation and disposal, the unit 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*.

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

1.2 Checklist of Minimal Requisite Facilities

S. No	Requisite Facilities
1.	MS tanks for receiving and storage of Tarry waste.
2.	Cover over tarry waste storage tank, transfer pump, day-tank etc. so as to eliminate any contact with rain water.
3.	Storage tanks for conventional fuels FO/LDO/LPG/CNG etc.
4.	Fire prevention facilities
5.	Covered shed for storage of HW generated (leaks/spills/debris containing tarry wastes, used oils, and scrubber residue etc.)
6.	Electric heating system for melting of tarry waste
7.	Fume extraction systems (with suction hoods and ducts) over storage tanks, tarry waste melting unit, molten cullet tapping point and day-tank connected to FD fan for use as combustion air.
8.	Flue gas heat recuperator (heat exchanger) to heat the combustion air
9.	Heating Pan where solid sodium silicate glass cullet is mixed with water and kept in open pans and heated using flue gases after economiser
10.	Alkali Scrubber (for cleaning flue gases) connected to stack through ID fan
11.	Scrub liquor recycling and ETP for treatment of bleed liquor
12.	Stack of height as prescribed by SPCB with easy access to port hole, for conducting stack monitoring
13.	Online analyzers for CO emission monitoring in stack and connecting the online emission date to CPCB and SPCB servers.

Utilization of Coal Tar / Tarry Residue generated from Coal Gasifier Units

SOP - 34

Coal Tar / Tarry Residue generated from Coal Gasifier Units

(Category: 35.1 of Schedule I of HOWM Rules, 2016)

1.0 Utilization of Coal Tar / Tarry Residue Waste:

This SoP is applicable only for utilization of Coal Tar/Tarry Waste as described below:

Type of HW	Source of generation	Recovery/Product
Coal Tar/Tarry residue waste (category no. 35.1 as per Schedule I of the HOWM Rules, 2016)	Coal gasifier units	As energy recovery in Frit Manufacturing units

1.1 Source of Waste

The Coal Tar/Tarry Residue waste is generated from gas cleaning unit (wet ESP) of coal gasifier plants where coal is gasified to produce coal gas categorized as hazardous waste at S.No.35.1 of schedule-I of HOWM Rules, 2016 which are required to be disposed in authorized disposal facility in accordance with authorization condition, when not utilized as energy/resource recovery.

1.2 Utilization Process

Frit is produced by fusing a variety of minerals in Furnace at temperature of 1350-1450°C and then rapidly quenching the molten material. The raw materials for manufacturing frit are quartz, feldspar, calcite, dolomite, china clay, zir floor, zinc oxide, borax, soda ash, etc. in desired proportions and the same are mixed in a mixer and conveyed through conveyor to hopper for continuous feeding to the Furnace.

Utilisation process of the Coal Tar/Tarry Residue waste involves heating of the same and firing of liquid coal tar/Tarry Residue through burners in pre-heated furnace (after the furnace achieves a temperature>1100) as a supplementary fuel in place of conventional fuels such as furnace oil, LPG, CNG, LDO etc. The resulting molten mass is poured in water bath to form crystals after cooling/quenching. The product- frit is then packaged in bags.

The flue gas from furnace passes through recuperaters (heat exchanger to heat the combustion air) alkali scrubber and exits from stack. The water used for cooling /quenching is re-circulated through collection tank and cooling tower.

1.3 Product Usage/Utilization

Coal tar/tarry residue shall be used for energy recovery in Frit manufacturing units.

1.4 Standard Operating Procedure (SoP) for utilization

This SoP is applicable only for the utilization of coal tar/tarry residue generated from gas cleaning unit (wet ESP) of coal gasifier plants for energy recovery in Frit manufacturing units

1) Coal Tar/Tarry Residue waste shall be procured only in tanker mounted over vehicles as authorised by SPCB/PCC.

2) It shall be ensured that the Coal Tar/Tarry Residue shall be free from water content at the point of procurement. Residual water, if any, present in the Coal Tar/Tarry Residue shall be injected into the furnace (refer point no. 8 below) along with the Coal Tar/Tarry Residue.

3) Coal Tar/Tarry Residue waste shall be received into storage tank and a transfer pump shall be used to transfer the tarry waste today tank. All the tanks and transfer pump shall be under covered shed to eliminate any contact with rain water. The storage tanks shall be provided with water seals to all probable leaking points so as to minimise the VOCs emissions.

4) The storage tank shall be placed above the ground with low raise bund wall & acid proof floor with slope to collect spillages, if any, to collection pit. The collected seepage shall be reused in the process.

5) There should be designated space for unloading Coal Tar/Tarry Residue waste into storage tank.

6) Melting of Coal Tar/Tarry Residue waste for use in furnace shall be done by using electric heaters and molten tarry waste shall be transferred using transfer pumps to day-tank.

7) Utilisation of Coal Tar/Tarry Residue waste shall not exceed 0.45 ton per ton of Frit production.

8) Coal Tar/Tarry Residue waste shall not be injected into the furnace until the temperature of the furnace is heated up to > 1100°C, using conventional fuels such as furnace oil, LPG, CNG, LDO etc. as per the consent issued by the concerned SPCB under Air (Prevention and Control of Pollution) Act, 1981. Temperature in Furnace during utilization of Coal Tar/Tarry Residue waste shall always be maintained more than 1350°C and a temperature display system shall be provided to display the same.

9) Fume extraction hoods shall be provided above the Coal Tar/Tarry Residue waste melting unit, day-tank and molten mass tapping point and the same shall be channelized as combustion air into the furnace. Negative (suction) pressure condition shall be maintained in the Furnace as well as the said fume extraction hoods using pumps of suitable capacity.

10) The hot flue gases shall be passed through heat economiser (for heating combustion air) and treated in Venturi scrubber with ID fan connected to stack of height as specified by SPCB/PCC. Venturi scrubber shall have provision of chemical dosing in scrubbing medium for pH correction.

11) Treatment and disposal of wastewater: Sources of waste water generation are — (i) scrubber bleed, and (ii) floor washing. The waste water from scrubber bleed shall be treated Physico-Chemical by collection, neutralization, settling and filtration and treated effluent shall be evaporated in single or multi effect evaporator so as to meet zero discharge. The wastewater generated from floor washing shall be sent for disposal to authorized common hazardous waste incinerator. Alternate to ETP and single or multi effect evaporator, the scrubber bleed water may also be sent to authorized common hazardous waste incinerator.

12) The ETP residue and/or residue of single or multi effect evaporator, as applicable, shall be collected and temporarily stored in non-reactive drums /bags under a dedicated hazardous waste storage area and be sent to authorized common TSD For other authorized facility within 90 days from generation of the waste in accordance with the authorization issued by the concerned SPCB/PCC. Such storage area shall be covered with proper ventilation.

13) The unit shall ensure that all personnel involved in the plant operation shall wear proper personal protective equipment such as masks, safety gloves, goggles, safety shoes etc.

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

15) It shall be ensured that coal tar/tarry residue is procured from the industries who have valid authorization for generation/storage of the same from the concerned SPCB/PCC as required under Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016.

16) Prior to utilization of coal tar/tarry residue, the unit shall obtain authorization for generation, storage and utilization of Spent Pot Lining from the concerned State Pollution Control Board under the Hazardous and Other Wastes (Management & Transboundary Movement) Rules, 2016.

17) In case of environmental damages arising due to improper handling of hazardous wastes including accidental spillage during generation, storage, processing, transportation and disposal, the unit 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.

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

1.5 Records/Return Filing

1) The unit shall maintain a passbook issued by concerned SPCB where in the following details of each procurement of resin waste shall be entered:
   - Address of the sender
   - Date of dispatch
   - Quantity procured
   - Seal and signature of the sender
   - Date of receipt in the premises

2) A log book shall be maintained with information on source and date of procurement of resin waste, quantity, date wise utilization of the same, hazardous waste generation and its disposal, etc.

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

1.6 Standards

1) Fugitive emission sin the work zone shall comply with following:

- Respirable dust (PM_{10}) – 5000 µg/m^3
- Carbon Monoxide – 50 ppm

- Coal tar volatiles (benzene – soluble fraction viz. Anthracene, Benzo (a) Pyrene, phenanthrene, Dibenzo [b,e] pyridine, chrysene & pyrene] : 0.2 mg/m^3 (8-hour time-time weighted average values)

2) Emissions from stack shall comply with the following:

- Particulate Matter— as stipulated by concerned SPCB
- Oxides of Nitrogen— 400 mg/Nm^3
- Carbon Monoxide—100 mg/Nm^3
- TOC 20 mg/Nm^3
- SO_2 200 mg/Nm^3

3) Monitoring of the specified parameters for source emission shall be carried out quarterly for the 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 accredited or EPA approved laboratories results shall be submitted to the concerned SPCB/PCC quarterly.

1.7 Siting of Industry

Facilities for processing of coal tar/tarry residue shall preferably 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.

1.8 Size of Plant & Efficiency of utilisation

Utilisation of Coal Tar/Tarry Residue waste shall not exceed 0.45 ton per ton of Frit production. Therefore, requisite facilities of adequate size of storage shed and other plant & machineries as given in para 1.10 below shall be installed accordingly.

1.9 On-line detectors / Alarms / Analysers

Online analyzers for CO emission monitoring in stack with transmission of the online emission date to CPCB and SPCB servers. Smoke detector and fire alarm system shall be installed at coal tar/tarry residue storage and handling area.

1.10 Checklist of Minimal Requisite Facilities

S. No	Particulars
1.	MS tanks for receiving and storage of Tarry waste.
2.	Cover over tarry waste storage tank, transfer pump, day-tank etc. so as to eliminate any contact with rain water.
3	Storage tanks for conventional fuels FO/LDO/LPG/CNG etc.
4.	Fire prevention facilities
5.	Suction arrangement to arrest dust from raw materials mixer (while unloading raw material) and hopper and channelization of the same to scrubber
6.	Dedicated covered shed for storage of HW generated (leaks/spills/debris containing tarry wastes, used oils, and scrubber residue etc.)
7.	Electric heating system for melting of Coal Tar/Tarry Residue waste
8.	Closed Furnace for fusing minerals (raw materials) with provisions of burners for consented Fuel and Coal Tar/Tarry Residue waste
9.	Temperature display system for displaying temperature in the Furnace
10.	Fume extraction systems (with suction hoods and ducts with induced draft arrangement) over storage tanks, Coal Tar/Tarry Residue waste melting unit, molten mass tapping point and day-tank connected to FD fan for use as combustion air to the Furnace.
11.	Flue gas heat recuperator (heat exchanger) to heat the combustion air
12.	Venturi Scrubber (for cleaning flue gases) with chemical dosing arrangement for pH correction and outlet be connected to stack through ID fan

13.	Stack with sampling port, platform, access to the plat form etc. as per the Guidelines on Methodologies for Source Emission Monitoring published by CPCB under Laboratory Analysis Techniques LATS/80/2013-14.
14.	Online analyzers for CO emission monitoring in stack with transmission of the online emission data to CPCB and SPCB servers.
15.	Effluent Treatment Plant (ETP) and single or multi effect evaporator Or Arrangement for disposal of waste water to authorized common hazardous waste incinerator.

Utilization of Flue gas cleaning residue generated from Steel Scrap Melting Induction Furnace, for zinc extraction

SOP - 37

Flue gas cleaning residue

(Category: 35.1 of Schedule I of HOWM Rules, 2016)

1.0 Utilization of Mixed/Waste salts:

Type of HW	Source of generation	Recovery/Product
Flue gas Cleaning Residue (Category 35.1 of schedule-I of HOWM Rules, 2016)	Bag filter connected to the Steel Scarp Melting Induction Furnace	Zinc Metal

1.1 Source of Waste

Flue gas cleaning residue is generated from the Bag Filter used as Air Pollution Control Device (APCD) attached to the Induction furnace of Steel Scrap melting process. The dust captured in the Bag filter house is collected in bags at the bottom of the hopper through Rotary air lock valve. These dust collected from the Bag filter house is categorized as hazardous waste at S. No. 35.1 of Schedule-I of the HOWM Rules, 2016, which are required to be disposed in authorized disposal facility in accordance with authorization condition, when not utilized.

1.2 Utilisation Process

- The said hazardous waste i.e Flue gas cleaning residue (APCD dust) containing Zinc (> 30 %) first undergoes calcination in a closed chamber to remove carbon and sulphur content.
- The calcined APCD dust is utilised to recover Zinc metal using Hydrometallurgical process. The utilization process involves preparation of leaching solution by mixing Ammonium Chloride and Calcium Chloride in Water. The flue gas cleaning residue is mixed with the said leaching solution with constant stirring for about 60-90 minutes in a leaching tank where pH raises to about 5.8 followed by addition of H_2O_2 to form zinc complex and precipitate water insoluble oxides. The mixture is passed through filter press-I to remove precipitates and other undissolved materials. The filter press-I residue contains iron and other metals which may be used to recover the same in the induction furnace.
- The leachate from the filter press-I is collected in the purification tank, where Zinc powder is added and agitated for about 15 minutes. The Zinc powder reduces oxides of lead and copper which gets precipitated. The reaction mixture from the purification tank is passed through filter press-II to remove the precipitates. The filter press-II residue contains lead which may be used to recover the same in a lead recycling unit having rotary kiln.
- The filtrate from the filter press-II is collected in a collection tank and sent to a Overhead Collection tank which further channelizes to the Electrolysis Cells (arranged in parallel

manner) at a equal flow rate. Additive like Poly ethylene glycol is added to the Overhead tank for efficient deposition of zinc on the electrodes. The electrolysis tanks consists of Cells having anodes (of Aluminium) and cathodes (of Carbon/graphite) where Zinc ions (Zn^{2+}) gets deposited to the cathode. Zinc metal deposited on the cathode plate is taken out and zinc strips are peeled out after complete electrolysis. The Zinc strips, which has purity of about 99% may further be processed to make Zinc metal items like zinc sheets or other products.

The Flow chart of the utilization process is provided in Fig 1 below;

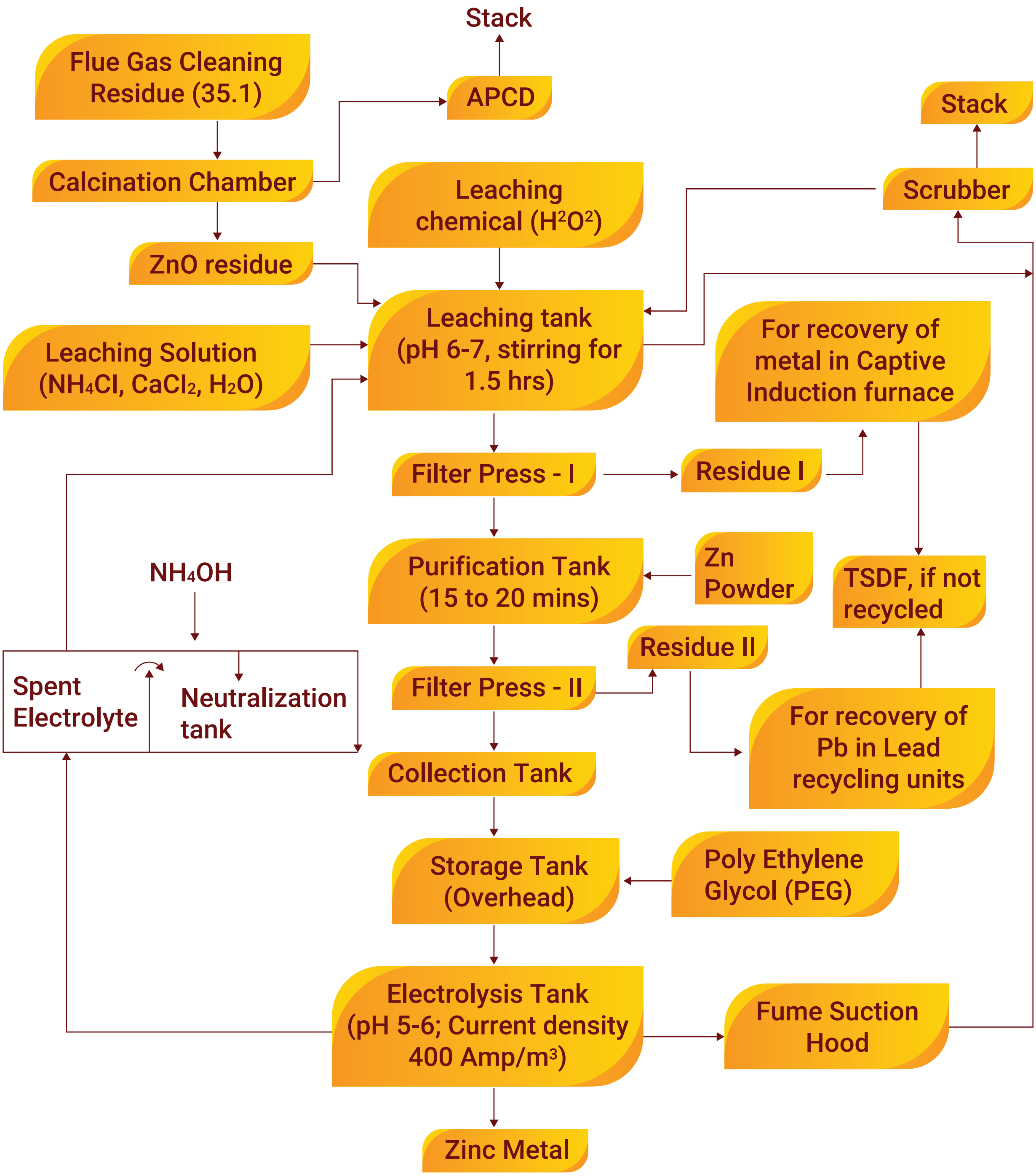


Fig 1: Flow diagram of Utilization of Flue Gas Cleaning Residue for extraction

The spent electrolyte (having pH about 3-4) is added with ammonium hydroxide to increase pH and recirculated into electrolysis tank through the aforesaid Overhead tank. Part of the spent electrolyte is also used in the leaching tank along with the aforesaid leaching solution.

The leaching tank, purification tank and electrolysis tanks are provided with suction hood, where dust, chemical and acid mist emissions are captured to control fugitive emissions. The hood is connected to scrubber where water is used as scrubbing medium to capture dust and vapours of HCl and ammonia. The bleed water from the scrubber is recycled in the leaching tank of the process.

1.3 Product Usage / Utilization

The zinc metal extracted from the above utilization process, shall be utilized for industrial applications such as zinc coating/galvanization/electroplating and batteries.

1.4 Standard Operating Procedure for utilization

This SoP is applicable only for utilization of Flue gas cleaning residue generated from Steel scrap melting plant using induction furnace, as a raw material for extraction of Zinc metal.

1. The said Flue gas cleaning residue shall contain Zinc more than about 30%, to be viable for economic recovery.

2. The Flue gas cleaning residue shall be collected in dry condition from the Bag filter connected to the steel scrap induction furnace, using bags at the bottom of the hopper through rotary air lock valve.

3. Labelling, packaging and transportation of the hazardous waste (i.e Flue gas cleaning residue) and residue generated during utilization process shall be carried out by sender or receiver as per authorization issued by the concerned SPCB under the HOWM Rules, 2016, with requisite safeguards ensuring no pilferage of the wastes.

4. The flue gas cleaning reside shall be stored in a covered designated storage place and the same shall be under cool, dry, well ventilated and under covered storage shed, as authorized by the concerned SPCB/PCC under the HOWM Rules, 2016, so as to eliminate water intrusion.

5. The flue gas cleaning residue shall be calcined in a closed chamber by igniting remotely using a gas burner (only to initiate ignition). Calcination of the same shall be carried out in a closed chamber under negative pressure, with a provision of APCD like Bag filter followed by stack of adequate height as prescribed by the concerned SPCB/PCC.

6. The dust collected in the bag filter connected to the calcination chamber may be used in the leaching tank.
7. Chemicals and additives shall be procured in non-reactive containers/drums and stored under cool, dry, well ventilated and covered storage shed.
8. Such storage sheds for chemicals and additives shall have impervious lined floor, adequate slope and seepage collection pit. The loading/unloading space for chemicals and additives shall also be under the covered shed.
9. The flue gas cleaning residue shall be loaded using a mechanised conveyor system for transfer of the same (with no manual handling) to the leaching tank.
10. Mixing of Flue gas cleaning residue with chemicals and additives in leaching tank and mixing of chemicals in purification tank shall be achieved using appropriate mechanized mixing systems.
11. The chemicals, additives, leachate and filtrate of the utilization process shall be transferred to the appropriate reaction/storage tanks through mechanized conveyor system using chemical process pumps.
12. Residue generated from filter press-I may be used in captive induction furnace for recovery of metals.
13. Residue generated from filter press-II may be sent to only those lead recycling units having rotary kiln for lead recovery. Such recycling units shall have authorization for recycling of lead residue from the concerned SPCB/PCC under the HOWM Rules, 2016.
14. If not recycled/recovered, filter residues generated from both filter press-I and filter press-II shall be disposed in authorized TSDF in accordance with the provisions stipulated in Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016.
15. Fume suction hood systems made of fibre reinforced plastic or other suitable non-corrosive material shall be installed above the leaching reactor, electrolysis tanks and neutralization tank at appropriate height to control source & fugitive emissions. The fume hoods shall be connected with common ducting system to scrubber where water shall be used as scrubbing medium and the scrubbed gases shall be vented through a stack. The bleed water shall be used in the leaching tank.
16. Utilization of Flue gas cleaning residue shall not be carried out during unstable / breakdown conditions in process units / any of the emission control systems of the waste utilization process.
17. The entire process area shall have leak-proof pipelines with adequate slope to collect runoff/spillage, if any, into the collection pit. The spillages from the collection pit shall be transferred to ETP or Leaching tank, as the case may be, through chemical process pump.

18. The scrubbed gases/vapours from the stack shall comply with the emission norms and shall be dispersed into atmosphere through stack of height as prescribed by the concerned SPCB/PCC.

19. Sources of Wastewater: The following are the sources of wastewater from utilization process;

    a) Bearing cooling water (pump sealing water)

    b) Bleed water from scrubber

    c) Floor washing/reactor wash/vehicle wash/spillages etc.

    d) Pump sealing water, scrubber bleed water and reactor wash shall be reused in the leaching tank, wherever possible, whereas waste water generated from floor washing/ vehicle wash/spillages etc. shall be treated in Effluent Treatment Plant (ETP). Further, spent electrolyte may be generated during unstable/breakdown conditions, which shall also be treated in ETP. Therefore, an ETP shall be installed for the same.

20. Treatment and disposal of wastewater: The above wastewater shall be treated in ETP and management of treated effluent or its discharge shall be carried out 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.

21. Prior to utilization of Flue gas cleaning residue, the unit shall obtain authorization for generation (wherever applicable), storage and utilisation of Flue gas cleaning residue from the concerned State Pollution Control Board under the HOWM Rules, 2016.

22. The unit shall ensure proper ventilation in the work zone and process areas. All the personnel involved in the waste utilization process shall wear proper personal protective equipment (PPE) such as protective eye goggles, full face shield/ aspirator mask, body suits/a prons and/or coverall of chemical resistant material and impervious boots/shoes etc. The safety precautions of the worker shall be in accordance with the Factory Act, 1948, as amended from time to time.

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

24. In case of environmental damages arising due to improper handling of hazardous wastes (viz., accidental spillage during generation, storage, processing, transportation and disposal), the unit shall be liable to implement immediate corrective 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.

25. The unit shall become member of common hazardous waste treatment, storage and disposal facility, incase residues from the filter presses are not recycled as above.

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

1.5 Record/Return Filing

1. The unit shall submit quarterly and annual information on Flue gas cleaning residue generated, quantity utilized, resources conserved (specifying the details like type and quantity of resources conserved) to the concerned SPCB.

2. A log book shall be maintained with information on source, quantity, date wise utilization of Flue gas cleaning residue and record of analysis report of emission monitoring & effluent discharged, as applicable shall be maintained.

3. The unit shall maintain record of hazardous waste generated/utilised 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 SPCB.

1.6 Standards

(i) Source Emissions from the stack connected to calcination chamber shall comply with the following standards or as prescribed by the concerned SPCB/PCC, whichever is stringent;

PM : 50 mg/Nm^3

Note : Other parameters as prescribed by SPCB/PCC, if any, shall be complied.

(ii) Source Emissions from the stack connected to scrubber shall comply with the following standards or as prescribed by the concerned SPCB/PCC, whichever is stringent;

PM : 50 mg/Nm^3

Acid mist (HCl) : 50 mg/Nm^3

Ammonia : 75 mg/Nm^3

Note: Other parameters as prescribed by SPCB/PCC, if any, shall be complied.

(iii) Fugitive emissions in the work zone shall comply with the following standards;

Ammonia : 25 PPM (18 mg/m^3) TWA*

: 35 PPM (27 mg/m^3) STEL

Zinc Oxide: Total Dust (15 mg/m^3) TWA*

Respirable fraction — 5 mg/m^3 TWA*

Lead : 50 µg/m^3 TWA*

Cadmium : 5 µg/m^3 TWA*

Nickel : 0.5 mg/m^3 TWA*

**time weighted average (TWA) - measured over a period of 8 hours of operation of process*

**short term exposure limit (STEL) — measured for 15 minutes duration of exposure*

(iv) Monitoring of the above specified source emission parameter shall be carried out quarterly. The monitoring shall be carried out by NABL accredited or ISO17025 /EPA approved laboratories and the results shall be submitted to the concerned SPCB/PCC on a quarterly basis.

(v) Standards for wastewater discharge: The treated waste water 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. In case of zero discharge or no discharge condition stipulated in the said Consent or non-availability of the Common Effluent Treatment (CETP), zero discharge shall be met.

1.7 Siting of Industry

Facilities for utilization of Flue gas cleaning residue (from bag filter house connected to Induction furnace) shall be located in a notified industrial area or industrial park/estate/cluster and cited in accordance with Consent to Establish issued by the concerned SPCB/PCC.

1.8 Size of Plant & Efficiency of utilisation

100 MT of Flue gas cleaning residue yields about 30 MT of zinc metal or more depending upon zinc content in the Flue gas cleaning residue. Hence, requisite facilities of adequate size shall be installed accordingly as mentioned under para 1.10 below.

1.9 On-line detectors / Alarms / Analysers

Online emission analysers for Particulate Matter in the stack shall be installed and the online data be connected to the server of the concerned SPCB/PCC and CPCB within the time frame as prescribed by the concerned SPCB/PCC.

1.10 Checklist of Minimal Requisite Facilities

S. No	Particulars
1.	Designated space for loading, unloading and storage of Flue gas cleaning residue under cool, dry, well ventilated and covered storage shed, so as to eliminate water intrusion.
2.	Closed calcination chamber having Gas burner (Only to initiate ignition)
3.	APCD like Bag filter attached to the calcination chamber followed by stack of height as prescribed by the concerned SPCB/PCC
4.	Mechanised conveyor system for transfer of Flue gas cleaning residue to the leaching tank
5.	Chemicals and additives shall be procured/stored in non-reactive drums/containers in cool, dry, well ventilated and covered storage shed so as to eliminate water intrusion. The storage shed shall be with impervious lined floor and have adequate slope with seepage collection pit.
6.	Leaching Tank
7.	Purification Tank
8.	Two Filter Press units for filtering the liquid from leaching tank and purification tank
9.	Electrolysis tank
10.	Separate storage facility for residues from Press-I and Filter Press-II
11.	Collection tank for collecting filtrate from Filter press-II
12.	Overhead Storage tank for transfer and channelizing of filtrate to Electrolysis Tank
13.	Spent Electrolyte Storage tank with neutralization facility
14.	Fume Suction hood system with ducting attached to leaching reactor, electrolysis tanks and neutralization tank
15.	Scrubber connected to the said Fume Suction hood system followed by stack

16.	Stacks of height as prescribed by SPCB shall have easy access to port hole and arrangement of platform, ladder, etc. for conducting stack monitoring
17.	Effluent Treatment Plant
18.	Provisions for Proper ventilation in the entire process area
19.	Fire safety arrangements and flame proof electrical fittings
20.	PPEs to the worker suitable for acidic emissions, ammonia vapours and acidic spillages on floor

Utilization of Tarry residue waste & Coal Tar Sludge for Production of Naphthalene Oil, Creosote Oil (Heavy & Light), Anthracene Oil and Coal Tar Pitch

SOP - 52

Coal Tar Sludge & Tarry residue waste

(Category: 35.1 of Schedule I of HOWM Rules, 2016)

1.0 Points to be considered for utilization of Tarry residue generated from Coal Gasifier

1) Utilization of Tarry residue generated from Coal Gasifier Units for production of Creosote Oils and Coal Tar Pitch is provisionally released by Central Pollution Control Board (CPCB). This Standard Operating Procedures (SoP) way be withdrawn/amended by C PCB at any point of time as per the direction of the Hon'ble Tribunal/Courts or in the interest of environment protection, if considered necessary.

2) This SoP shall abide the judgements /orders of the Hon'ble National Green Tribunal (NGT) in the Original Application No. 20/2017 (WZ) (M. A. No. 344/20 17 & M. A. No. 91/2018) and other concerned matters listed in its order dated 06.03.2019.

3) SPCBs/PCCs shall ensure the compliance of any recommendations by oversight committee formed by Hon'ble NGT for handling and management of tarry residue generated morn coal gasifiers. In case of difference in recommendations of committee and provisions laid down in this SoP for generation, handling, transportation, utilization and disposal of hazardous wastes, the case shall be referred to CPCB for consideration.

1.1 Utilization of hazardous wastes:

Name of HW	Category of waste	Source of generation	Recovery/Product
Coal Tar Sludge	Category 35.1 - Schedule I of HOWM Rules. 2016	ESP attached to electrode baking furnace in carbon block manufacturing	As a supplementary resource for production of Naphthalene Oil, Creosote Oil (Heavy & Light), Anthracene Oil and Coal Tar Pitch.
Tarry Residue Waste		Coal Gasifier Units	

1.2 Source of Waste

The tarry residue waste is generated from gas cleaning unit (wet ESP) of coal gasifier plants where coal is gasified to produce coal gas and the coal tar sludge is generated during the baking process of the green blocks. Some pitch volatile fractions are vaporized and get condensed and then settle down in tar tanks attached to the ESP system as coal tar sludge. These wastes are categorized as Hazardous waste at S. No. 35.1 of Schedule 1 of HOWM Rules, 201 6 which are required to be disposed in authorized disposal facility in accordance with authorization condition, when not utilized as energy/resource recovery.

Table 1:- Characteristics of Tarry residue & Coal Tar Sludge are given below:

S.No.	Parameters	Tarry residue	Coal Tar Sludge
1 .	Moisture %	19-22	18.05
2.	Colour	Black	Dark Black
3.	Physical State	Semisolid/Thick viscous liquid	Thick viscous semisolid
4.	Calorific value Kcal/Kg	>6000	8000
5.	PAH %	0.24 - 0.27	0.25
6.	TCLP-CN mg/L	0.002 — 0.0001	0.0018
7.	Ammonia as NH; mg/kg	960 — 1 291	1040
8.	Carbon %	64 — 67	65.30
9.	Hydrogen %	6.60 — 7.00	6.85
10.	Nitrogen %	0.1 2 — 0.28	0.1 8
11 .	Sulphate %	0.73 — 0.97	0.76

1.3 Utilization Processes

A. **Utilization process of Tarry Residue:** The process involves pre-treatment of tarry residue for removal of moisture followed by vacuum distillation at different temperature for the production of creosote oils and coal tar pitch. In pre-treatment tank the tarry residue is heated at 60-80°C using thermic fluid heater. The de-watered coal tar from pre- treatment tank is transferred to vacuum distillation unit where tarry residue is further heated to produce Light Creosote Oil (at temperature range of 120-200°C). Heavy Creosote (at temperature range of 200-240°C) and Coal Tar Pitch (at the temperature range of 240-300°C).

B. **Utilization process of coal tar sludge:** The process involves mixing of above coal tar sludge with crude coal tar (generated from coke oven plant) in the ratio of 5:95 in a mixing tank. Process consists of mixing coal tar sludge (5%) with crude coal tar (95%) in a blending tank and mixture is pumped to the distillation vessel where the mixture is heated to remove moisture content, once the dehydration is completed mixture is distillate through vacuum distillation process to recover naphthalene oil & light creosote oil (at 180 - 270°C). heavy creosote oil & anthracene oil (at 270 - 320 °C) and coal tar pitch (at 320 - 340°C)

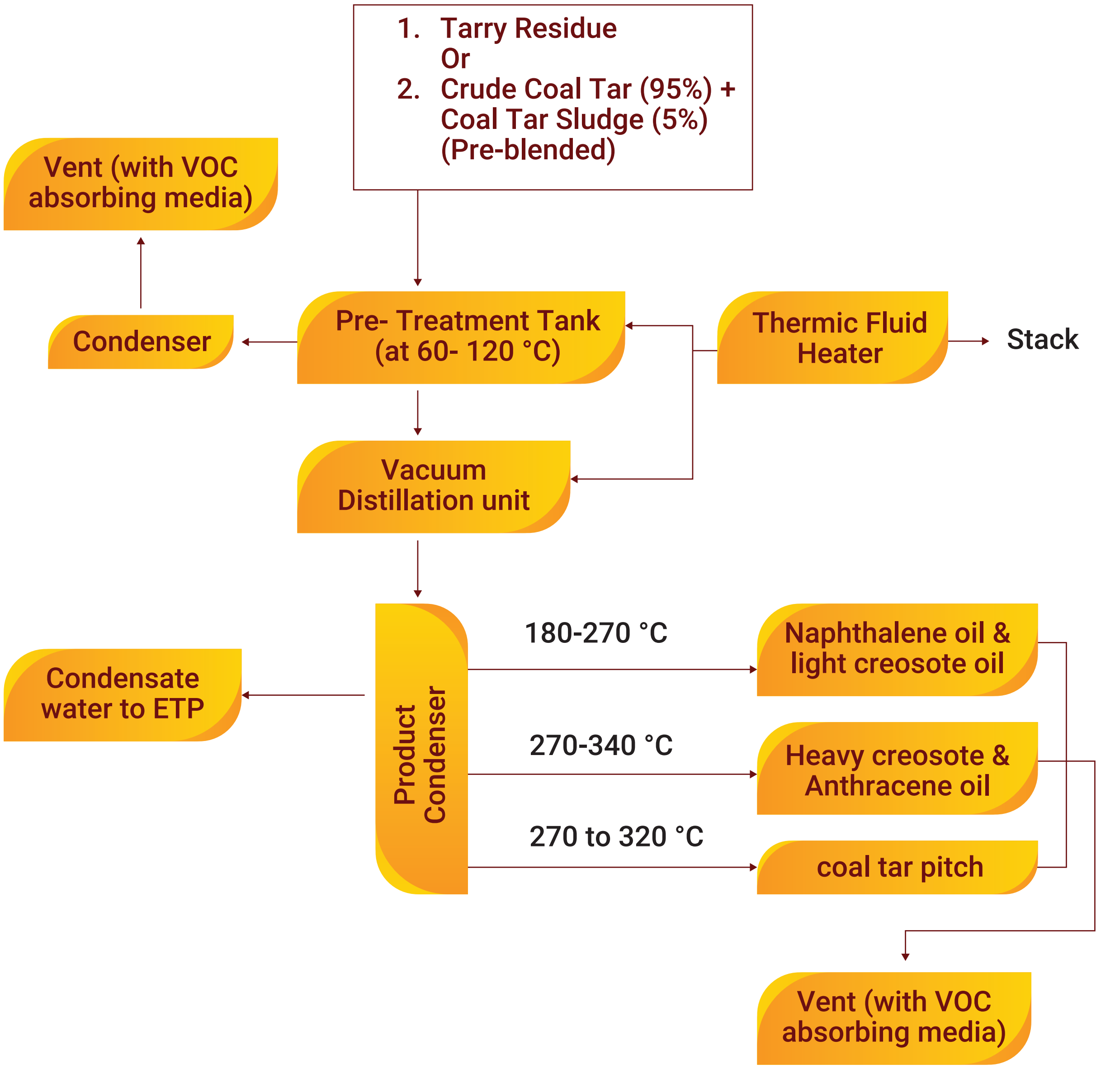


Figure 1:- Process flow Diagram for utilization of Tarry residue waste & Coal Tar Sludge

1.4 Product Usage / Utilization

Tarry Residue or ii. Coal tar sludge with crude coal tar shall be used for the production of Naphthalene oil, Creosote oils (light & heavy) and Coal Tar Pitch for industrial purpose.

1.5 Standard Operating Procedure for utilization

This SoP is applicable only for utilization of hazardous wastes i.e. Tarry Residue and Coal Tar sludge for production of Naphthalene oil, Creosote oils (light & heavy) and Coal Tar Pitch.

1) Tarry residue or coal tar sludge shall be procured only in tankers mounted over vehicles fitted with requisite safeguards ensuring no spillages, as authorised by SPCB/PCC.

2) Tarry residue or coat tar sludge shall be received into storage tank and a transfer pump shall be used to transfer the tarry residue. All the tanks and transfer pump shall be under covered shed to eliminate any contact with rain water. The storage tanks shall be provided with water seals to all probable leaking points so as to minimise the VOCs emissions.

3) There should be designated space for unloading of tarry residue or coal tar sludge into storage tank.

4) The storage tank shall be preferably placed above the ground with low raise bund wall & cemented floor with slope to collect spillages, if any, to collection pit. The collected seepage shall be reused in the process. The vent of storage tank shall be connected through condenser in case of underground storage of tarry residue or coal tar sludge. storage tank way be below the ground provided it has H DPE liner system beneath the tank and leachate collection system below HDPE liner. In the event of leachate detection in the leachate collection system, collective measures shall be taken immediately.

5) During loading and unloading of tarry residue and coal tar sludge from tanker to storage tanks or storage tank to tanker, vent (of both Storage Tank/Tanker) shall be connected to each other so as to minimize VOC's emissions.

6) The entire process area shall have cemented floor with the adequate slope to collect spillages, if any, into a collection pit. The spillages from collection pit shall be transferred to ETP or reaction tank, as the cases may be through pump.

7) The Tarry Residue shall be transferred to pre-treatment/vacuum distillation unit by using transfer pumps/pipeline system only.

8) Coal tar sludge shall be transferred to mixing tank through transfer pump/pipeline system only for blending of coal tar sludge and crude coal tar.

9) Once mixing is over the coal tar blend (crude coal tar + coal tar sludge) is transferred to pre-treatment /disti1lation unit by transfer pumps.

10) There shall be no manual hand ling of Tarry Residue and coal tar sludge.

11) The tarry residue or coal tar blend shall be heated in pre-treatment tank at the temperature range of 60- 120 to remove moisture content. The pre-treatment tank shall be connected to condenser through vent of minimum height of 30 meters or as prescribed by the concerned SPCB/PCC.

12) The vent of condenser shall be passed through VOC absorption media like activated carbon.

13) The de-watered coal tar from pre-treatment tank shall be transferred to vacuum distillation unit to produce Naphtalene Oil & Light Creosote Oil (at temperature range of 180-270^{o}C). Heavy Creosote Oil & Anthracene Oil (at temperature range of 270 to 320) and Coal Tar Pitch (at temperature range of 320-340)

14) The above products from the product condenser shall be collected in the separate covered product receiving tanks safety valves provision. The product receiving tank shall be connected with common suction system (having vacuum trap pot and water circulating system for creating vacuum in the suction line and scrubbing of vapours) and vent with VOC absorbing media like activated carbon.

15) The treated gases shall comply with emission norms and prior to dispersion into atmosphere through stack. The height of stack shall be a minimum of 30m or as prescribed by the concerned SPCB/PCC, whichever is higher.

16) Treatment and disposal of wastewater: Sources of waste water generation are — condensate water generated during distillation shall be treated Physico- chemically in an ETP of adequate capacity and treated effluent shall be evaporated in single or Multi Effect Evaporator (MEE) so as to meet zero discharge. The waste water generated from floor washing shall be sent to ETP for treatment. Alternate to ETP and single or multi effect evaporator, the condensate water may also be sent to authorized common hazardous waste incinerator for disposal.

17) The waste generated as bottom residue during the distillation process, residue of single or Multi Effect Evaporator /ETP residue, as applicable, shall be collected and temporarily stored in non-reactive drums / bags under a dedicated hazardos waste storage area and be sent to authorized common TSDF or other authorized facility within 90 days from generation of the waste in accordance with the authorization issued by the concerned SPCB/PCC. Such storage area shall be covered with proper ventilation.

18) 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) such as chemical goggles, full-face shield or a full-face respirator, impervious gloves of chemically resistant material (rubber or neoprene), safety shoes, etc.

19) It shall be ensured that the Tarry Residue and coal tar sludge is procured from the industries who have valid authorization for generation/storage of the sane from the concerned State Pollution Control Board as required under HOWM Rules, 2016.

20) Transportation of hazardous wastes such as coal tar sludge shall be carried out by sender (generator) or receiver (utilizer) only after obtaining authorization from the concerned SPCB under HOWM Rules, 2016. Requisite manifest document shall be followed as laid down under the said Rules.

2l) Prior to utilization of tarry residue or coal tar sludge, the unit shall obtain authorization for generation, storage and utilization of Tarry Residue and coal tai sludge from the concerned SPCB/PCC under HOWM Rules, 2016.

22) 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 C PCB.

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

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

1.6 Record/Returns Filing

1) The unit shall maintain a passbook issued by concern SPCB and maintain details of each procurement of Tarry Residue and coal tar sludge as mentioned below:

- Address of the sender
- Date of dispatch
- Quantity procured

- Seal and signature of the sender
- Date of Receipt in the premises

2) A log book with information on source and date of generation/procurement of tarry residue and coal tar sludge, quantity, date wise utilization of tarry residue and coal tar sludge, quantity of products manufactured, hazardous waste generation and its disposal, etc. Shah be maintained including analysis report of emission monitoring & effluent discharged, as applicable.

3) The unit shall maintain record of hazardous waste generated, utilized and disposed as per Form 3 & also file annual returns in Form 4 as per Rule 20 (1) and (2) of the HOWM Rules, 2016.

1.7 Standards

1) Source Emissions monitoring from the stack connected to distillation unit shall comply with the following emission standards or as prescribed by the concerned SPCB/PCC, whichever is stringent;

PM_{10}	50 mg/Nm³
SO_2	200 mg/ Nm³
NO_x	400 mg/Nm³
Ammonia	75 mg/ Nm³
TOC	20 mg/ Nm³

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

PM_{10}	5 mg/m³ TWA * (PEL)
Naphthalene	50 mg/m³ TWA* (PEL)
Coal tar pitch volatile (benzene soluble (PEL) fraction), anthracene, BaP, phenanthrene, acridine, chrysene, pyrene	0.2 mg/m³ TWA* (PEL)
Ammonia	35 mg/m³ TWA* (PEL)
Carbon Monoxide	55 mg/m³ TWA* (PEL)

**PEL. Permissible Exposure Limit*

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

3) Emission from vent attached with condenser and product receiving tank shall comply with standard of Total Organic Carbon (TOC) i.e. 20 mg/ Nm^3.

4) 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 ISO 17025 accredited or EPA approved laboratories and the results shall be submitted to the concerned SPCB/PCC on a quarterly basis.

1.8 Siting of Industry

Facilities for utilization of tarry residue or coal tar sludge 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. Further, such facilities shal1 be located at least 500 meters away from the residential area.

1.9 Size of plant & Efficiency of Utilization

(i) 13.05 MT of Coal Tar Pitch, 7.48 MT of Creosote Oil and 0.225 MT of Crude Naphthalene may produce from 20.935 MT & 1 .130 MT of Crude Coal Tar & Coal Tar Sludge respectively in the ratio of 95:5 percentages.

(ii) 15 MT of Tarry residue may produce 13.05 MT of Coal Tar Pitch and & 1.5 MT of Creosote Oil.

Therefore, requisite facilities of adequate size of storage shed and other plant & machineries as given in para 1.11 below shall be installed accordingly

1.10 On-line detectors / Alarms / Analysers

Online emission monitoring system for TOC emission should be installed in vent and online emission data be connected to server of the concerned SPCB/PCC within the timeline stipulated by the concerned SPCB/PCC. Smoke detector and fire alarm system shall be installed at Tarry Residue and coal tar sludge storage and handling area.

1.11 Checklist of Minimal Requisite Facilities

S. No	Particulars
1	MS tanks for receiving and storage of tarry residue and coal tar sludge
2	Connection of vent to the tanker with tarry residue and coal tar sludge storage tanks during loading and unloading.
3	Cover over tarry residue and coal tar sludge storage tank, transfer pump, etc. so as to eliminate any contact with rain water.
4	Firefighting system (i.e. fire extinguisher and water hydrant) in storage area, pre- treatment tank, vacuum distillation unit and product receiving tank.
5	Smoke detector and fire alarm system.
6	Heating system with automatic cut-off system for heating of coal tar blend.
7	Vacuum distillation unit attached with product condenser and product receiving tanks.
8	Vent with VOC absorption media 1ike activated carbon of height as prescribed by SPCB/PCC.
9	Height of stack be at least 30 meters or as prescribed by SPCB/PCC.
10	Common suction system with vacuum trap pot and water circulating arrangement.
11	Cooling tower.
12	ETP for proper treatment for CN, Phenol, O&G, COD, TKN and TDS and single or multiple effect evaporator/ Zero Liquid Discharge (ZLD) to be maintained.
13	Dedicated covered shed for storage of hazardous wastes generated (leaks/spills/debris containing tarry wastes, used oils ETP sludge/residue, spent carbon, condensate water, etc.) and its disposal as per authorization condition.

Utilization of Spent TiO_2 -NaCl cake generated from process residue/ waste containing chloride from the catalyst manufacturing industries for recovery of Titanium Dioxide

SOP - 55

Spent TiO_2 -NaCl cake from process residue

(Category: 21.1 of Schedule I of HOWM Rules, 2016)

1.0 Utilisation of spent TiO_2 -NaCl cake

Type of Hazardous Waste	Source of generation	Recovery/Product
Spent TiO_2 -NaCl Cake	Process Residue/waste containing chloride from Catalyst Manufacturing industries	Recovery of Titanium Dioxide

1.1 Source of Waste

The spent TiO_2 -NaCl Cake is generated from Process Residue/waste containing chloride from Catalyst manufacturing industries and is categorized as Hazardous waste listed at 21.1 in Schedule I of HOWM Rules, 2016 which are required to be disposed off in authorized hazardous waste disposal facility in accordance with authorization condition, when not utilized as resource recovery

Table 1 - Typical characteristics of spent TiO_2 - NaCl cake

S. No	Properties/Parameters	Unit	Typical characteristics
1	Appearance	-----	Off White Coloured
2	TiO_2	%	78.5
3	Salt	%	6.30
4	Moisture	%	15.2
5	Specific Gravity	gm/cm^3	4.2
6	pH	--	7.0

1.2 Utilization Process

The TiO_2 -NaCl cake generated from Process Residue/waste containing chloride from Paralysis manufacturing industries. The recovery of Titanium Dioxide flow spent TiO_2 -NaCl cake mainly includes washing, filtration, drying to remove moisture, calcination with oxidation and pulverization.

Spent TiO_2 -NaCl cake is fed in the HDPE tank fitted with stirrer for preparation of slurry. Spent TiO_2 -NaCl cake contains about 15-16% moisture content. Washing of spent TiO_2 -NaCl cake is followed by filtration. Material is transferred to filter press through transfer pump.

The wastewater generated from filtration process is collected in the collection tank; then pumped to evaporator. The evaporator (shell and tube type) evaporates the wastewater using thermic fluid heater. Thermic fluid is circulated in the outer and opening is provided on top of the evaporator. After few batches of operations of evaporator, the side covers of the evaporator shall be opened and the residues from the evaporator are scrapped out from time to time, collected and stored in designated place before disposal to CHWTSDF.

After, filtration, the wet cake is allowed for drying. Provision of Centrifuge (optional) for removal of moisture from the washed cake is in place of/or in addition of natural drying of washed cakes. Provision of monsoon covers for the drying platform shall be provided in case of natural drying of washed cake.

The dry cake is calcined in the rotary dryer, which shall be provided with two suction hoods at the mouth of the rotary dryer for the collection of fumes escaping from the dryer during the calcination process and for the collection of dust arising during charging and unloading of rotary dryer. Both the hoods shall be provide with adequate air pollution control device (APCD) and proper stack with ID fan as prescribed by SPCB/PCC.

Dry cake is heated up to 850^{o}C. Pure oxygen is purged for 30 to 45 minutes duration for whitening purpose. Calcined mass is discharged after the desired temperature by tilting SS batch types rotary and recharge the same for next batch.

Calcined mass is transferred to SS trolley and spread on natural cooling platform for cooling be same up to room temperature.

Cooled lumps are pulverized in puJveriser and 250 to 300 mesh powder recovered as the final product (Titanium Dioxide) which is packed in a plastic inner liner bags.

Typical flow diagram for utilization of spent TiO_2 -NaCl cake for recovery of Titanium Dioxide is shown in Figure below:

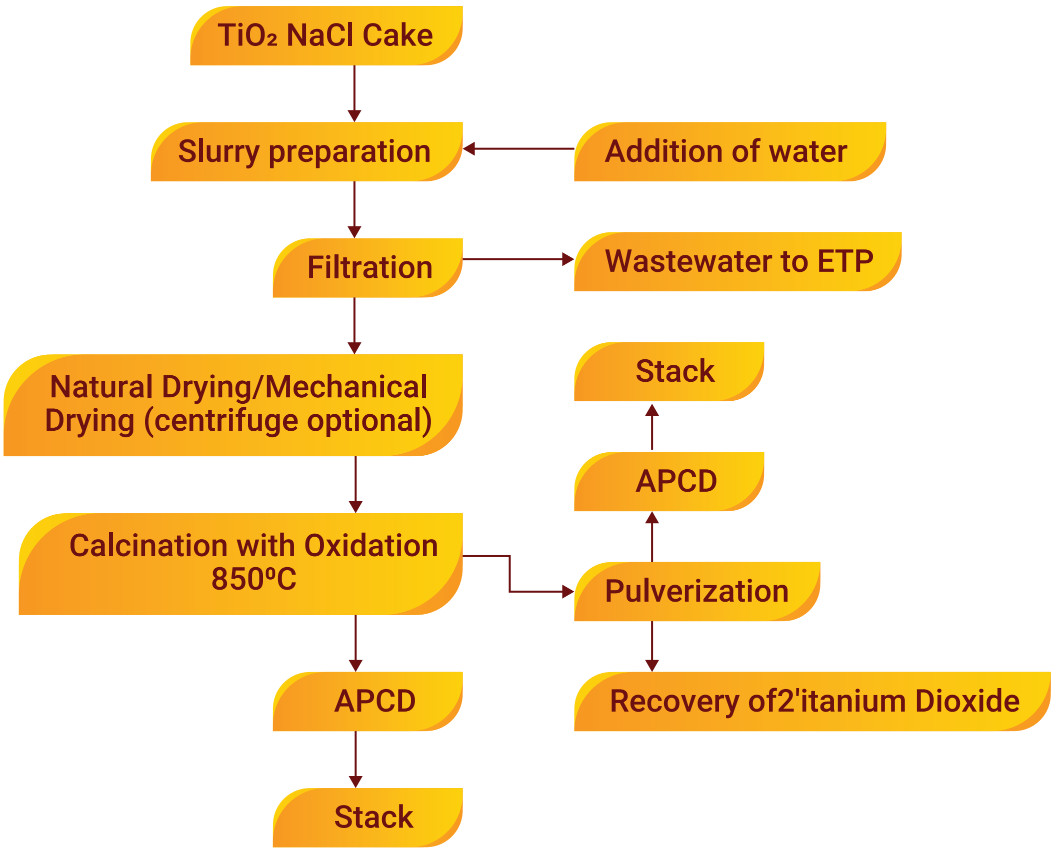


Fig 1: Process flow diagram for utilization of TiO2 -NaCl Cake

1.3 Product Usage/Utilization

The Product Titanium Dioxide shall comply as per Bureau of Indian Standards of further respective utilization.

The unit shall label its product (i.e. Titanium Dioxide) manufactured by utilizing aforesaid hazardous waste as "This Titanium Dioxide has been manufactured by utilising spent TiO_2-NaCl cake generated from Process Residue/waste containing chloride from Catalysts Manufacturing industries".

1.4 Standard Operating Procedure for Utilization

This SoP is applicable only for utilization of spent TiO_2-NaCl cake generated from Process Residue/waste containing chloride from Catalysts Manufacturing industries, for recovery of Titanium dioxide.

1. The unit shall .provide separate storage area at designated place with proper cover for storage or spent TiO_2- NaCl cake.

2. The entire process area shall have dedicated leak-proof floor tiles with adequate slope to collect spillage if any, into a collection pit. The spilages from collection pit shall be transferred to ETP.

3. It shall be ensured that spent TiO_2-NaCl is procured from the industries that have valid authorization for the same from the concerned SPCBs/PCCs as required under Hazardous and Other Wastes (Management & trans-boundary Movement) Rules, 2016. TiO_2,-NaCl cake shall be transported in SPCB/PCC authorized container mounted on vehicles fitted with requisite safeguards ensuring no spillage.

4. The TiO_2,-NaCl cake shall be packed in plastic bags with inner lines.

5. Transportation of spent TiO_2,-NaCl cake shall be carried out by sender or receiver (utilizer) only after obtaining authorization from the concerned SPCBS/PCCs under the Hazardous and Other Wastes (Management & Trans-boundary Movement) Rules, 2016.

6. The unit shall provide fixed pipeline connection for transferring the wastewater.

7. Treatment and disposal of wastewater: Following are the sources of wastewater from the utilization process;

   a. Wastewater (generated from floor washing/reactor wash/vehicle wash/spillages, etc.)

   b. Washing of spent TiO_2,-NaCl cake

   c. Filtrate from filter press

   Source of wastewater shall be interconnected with ETP for Physico-chemical treatment so as to comply with the prescribed standards; in case of CETP or be treated in captive ETP having adequate treatment facilities to comply with surface water discharge standards as stipulated in the Consent issued by the. SPCBs/PCCs.

   In case of zero discharge condition by SPCB/PCC, the treated wastewater from ETP may be managed as per the conditions stipulated by the SPCBs/PCCs.

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

9. There shall be provision of centrifuge (optional) for efficient removal of moisture from the washed cake in place of/or in addition to natural drying of washed cake.

10. The unit shall provide proper suction system for the hoods provided for the rotary dryer with proper stack and adequate stack monitoring facility.

11. The unit has to provide adequate Air Pollution Control Device (APCD) (i.e. like proper bag filter with casing) for the pulverizer and rotary dryer and proper slack with adequate stack monitoring facility.

12. The stack attached to the dust extraction system shall be dispersed into atmosphere through minimum stack height of 6 m above the roof top or as prescribed by the concerned SPCB/PCC, whichever is more.

13. The unit shall maintain proper ventilation in the won zone and process areas. All personnel involved in be plant operation shall wear proper personal protective equipment (PPE) specific to the process operations involved and type of chemicals handled as per Material Safety Dan Sheet (MSDS). The safety precautions of the worker shall be in accordance with the Factory Act, 194B, as amended from time to time.

14. SPCBs/PCCs shall ensure synchronization of generation and utilization of spent TiO_2-NaCl cake and the same shall be reflected in respective authorization specifying name and quantity.

15. Prior to utilization of spent TiO_2-NaCl cake; the unit shall obtain authorization for generation, storage and utilization of spent TiO_2-NaCl cake from the concerned SPCB/PCC under the Hazardous and Other Wastes (Management and Trans-boundary Movement) Rules, 2016.

16. The unit shall submit quarterly and annual information on hazardous wastes consumed, its sources, products generated or resources conserved (specifying the details like type and quantity of resources recovered) to SPCB/ PCC.

17. The hazardous wastes generated (namely the filter residue, ETP sludge, Evaporation residue generated from dryer/forced evaporator, product spillages, damaged filter liners, etc.) shall be collected and temporarily stored in non-reactive drums/bags under a dedicated hazardous waste storage area and be sent to authorized common TSDF or other authorized facility within 90 days from generation of the waste in accordance with the authorization issued by the concerned SPCB/PCC. Such storage area shall be covered with proper ventilation.

18. In case of environmental damages arising due to improper handling of hazardous wastes including accidental spillage during generation, storage, processing, transportation and disposal, the unit sham 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.

19. The unit shall ensure that the said utilization process and its associated activities shall be demarcated separately within the unit.

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

21. The unit shall provide personal protective equipment like aprons, safety hand gloves, and safety shoes, helmets to the persons involved in production activities and in Candling hazardous wastes.

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

1.5 Record/Returns Filing

1) The unit shall maintain a passbook issued by concern SPCB, wherein the following derails of each procurement of spent TiO_2-NaCl cake shall be entered:
   - Address of the sender
   - Date of dispatch
   - Quantity procured
   - Seal and signature of the sender
   - Date of Receipt in the premises

2. A log book with information on source and date of procurement of spent TiO_2-NaCl cake, quantity, date wise utilization of the same, hazardous waste generation and its disposal, etc. shall be maintained including analysis report of fugitive emission monitoring & effluent discharged, as applicable.

3. The unit shall maintain record of hazardous waste utilized, hazardous waste generated end disposed as per Form 3 A 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.

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

1.6 Standards

1. Source Emissions from the stack attached to dust extraction system of rotary dryer (Calcination process) and pulverizer shall comply with the following standards or as prescribed by the concerned SPCB/PCC, whichever is stringent;

Parameters	Unit	Prescribed Limit
Particulate Matter	mg/Nm^3	50
NO_x	ppm	50
SO_x	ppm	100
CO	mg/Nm^3	100

2. Fugitive emission in the rotary dryer and pulverizer area shall comply with the following standards

PM_{10}	5 mg/m^3 TWA* (PEL}
TiO_2 dust	15 mg/m° TWA* (PEL)

PEL: Permissible exposure limit

**time-weighted average (TWA): measured over a period of 8 hours of operation of (Reference: Occupational Safety and Health Standards 1910: 1000);*

3. The monitoring shall be carried out by NABL or ISO 17025 accredited /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.

1.7 Siting of Industry

Facilities for utilization of TiO_2-NaCl cake shall be located in a notified industrial area or industrial park/estate/cluster and in accordance with Content to Establish issued by the concerned SPCB/PCC.

1.8 Size of Plant and Efficiency of Uiilization

1. About 0.794 MT of Dry TiO_2 would be recovered from 1MT of spent TiO_2-NaCl cake in batch process.
2. About 0.845 MT of Dry TiO_2 would be recovered from 1 MT of yield of filtered cake from the filter press,
3. About usage of 170 liters of water in washing of 1 MT of TiO_2-NaCl cake and about 325 Liters of wastewater would be generated (filtrate) per 1 MT of TiO_2-NaCl cake.

Therefore, requisite facilities of adequate size of storage shed and other plant and machineries as given in 1.10 below shall be installed accordingly.

1.9 On-line detectors / Alarme / Analysers.

Online emission monitoring system shall be installed with the data transmission to CPCB and SPCBs server in case of continuous process operations for PM.

1.10 Check List of Minimal Requisite Facilities

S. No	Particulars
1.	Covered Hazardous Waste storage space for storage of spent TiO_2-NaCl cake.
2.	Scrubber [With Vessel of Slurry Preparation)
3.	Filter press
4.	Centrifuges (optional)
5.	Rotary Dryer/Calcination Kiln (Dryer of adequate size operated electrically or by fuel as permitted by the concerned SPCB/PCC.
6.	Pulverizer with adequate APCD and stack as permitted by the concerned SPCB/PCC.
7.	Adequate Effluent treatment plant with fixed pipeline connection followed by Evaporator in case of in-house ETP treatment to maintain zero discharge. In case of CETP discharge conditions as prescribed by the concerned SPCB/PCC shall met.

8.	Stacks to have 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/20/2013- 14.
9.	Dedicated separate covered Hazardous waste (Filter press etc.) storage area to store hazardous waste generated during utilization process.

Resin

Utilization of Resin Waste generated during Resin Impregnation of Electrical Coils

SOP - 27

Resin waste from Resin Impregnation of Electrical Coils

(Category: 23.1 of Schedule I of HOWM Rules, 2016)

1.0 Utilization of Resin Waste

Type of HW	Source of generation	Recovery/Product
Resin Waste (mixture of Bisphenol A and Epichlorohydrin)- Category 23.1 of schedule-I of HOWM Rules, 2016	During Resin impregnation of electrical coils in power/hydro equipment manufacturing industries	Utilization as raw material for resin mix (to be used as insulation coat/coveron High Tension/Low Tension electrical Components or articles)

1.1 Source of Waste

Resin waste (mixture of Bisphenol A and Epichlorohydrin) is generated during impregnation of electrical coils by vacuum pressure impregnation process. When the viscosity of resin increases (around 50-60 centipoise) it is not suitable for impregnation, hence discarded as hazardous waste (Categorised under S.No.23.1 of schedule-I of HOWM Rules, 2016).

1.2 Utilization Process

The utilization process involves mixing of resin waste with amine based hardener (1%) and colour pigment (2%) followed by coating the ferrous or non-ferrous rods/bars with resin mix to get the insulation coating/cover. After coating or wrapping the resin-mix dipped fibre-glass filament over the surface of the material to desired thickness on a lathe machine, a shrink tape (made of polyester) is wrapped and kept in the oven at 120-140°C for 2-3 hours for curing. The oven dried material is further subjected to lathe machine for surface finishing so as to obtain desired insulation over the HT/LT electrical components.

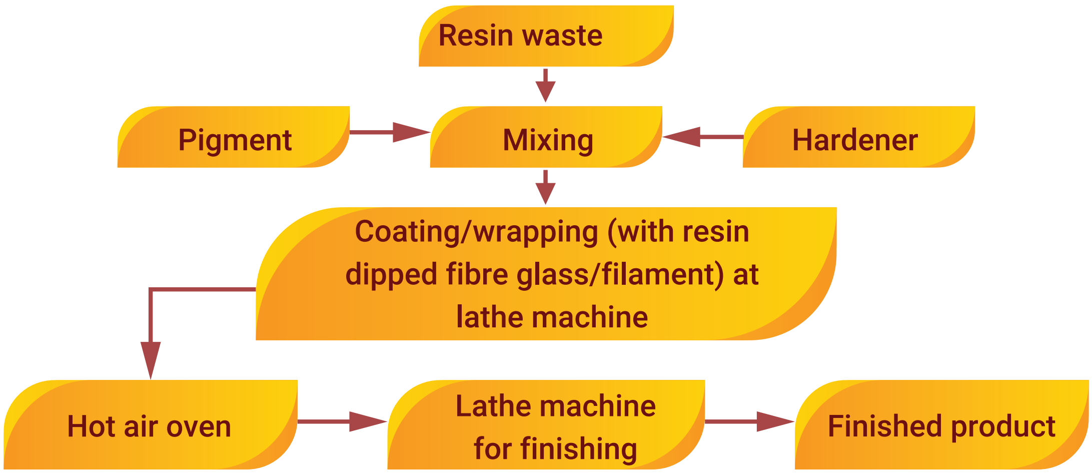


Fig 1: Process flow diagram for utilization of resin waste as raw material for resin mix

1.3 Product Usage/ Utilization

The resin was te along with amine based hardener is used for providing insulation coat over ferrous and non-ferrous rods/bars used on High Tension/Low Tension Insulation electrical components.

1.4 Standard Operating Procedure (SoP) for utilization

This SoP is applicable only for the utilization of resin waste (containing mixture of Bisphenol A and Epichlorohydrin), generated during manufacturing of electrical coils in power/hydro equipment manufacturing industry (by vaccum pressure impregnation process).

1) The resin waste shall be transported in non-reactive drum/ container mounted on vehicles fitted with requisite safeguards, ensuring no spillage of waste in accordance with provisions stipulated under Hazardous and Other Wastes (Management & Trans boundary Movement) Rules, 2016.

2) Transportation of resin waste shall be carried out by the sender (generator) or receiver (utilizer) as per the authorization issued by concerned SPCB under the Hazardous and Other Wastes (Management & Transboundary Movement) Rules, 2016.

3) There shall be a designated space for unloading of resin waste container. The receiving storage area shall be placed above the ground and be contained with low raise bund wall & concrete floor with slope to collect spillages, if any, into collection pit.

4) The unit shall store resin waste under cool, dry and well-ventilated covered storage shed(s) within premises, as authorized by the concerned State Pollution Control Board/Pollution Committee under Hazardous and Other Wastes (Management & Transboundary Movement) Rules, 2016, so as to eliminate rain water intrusion.

5) The entire process area shall have leak-proof and tiled floor with adequate slope to collect spillages, if any, into a collection pit and send to TSDF for disposal.

6) Resin waste along with amine based hardener and pigment shall be mixed in closed vessel with mechanized stirring system. The mixer shall be kept under covered shed with adequate safety gadgets provided to workers, as well as ensuring proper ventilation in the process area.

7) Resin waste from drums shall be transferred using mechanical means such as mechanically operated drumtilter. Further, coating of resin mix over the HT/LT electrical components shall be done using mechanical system.

8) After coating or wrapping the resin dipped fibre-glass filament to desired thickness on a lathe machine, a shrink tape (made of polyster) is wrapped and kept in the oven at 120—1400°C for 2-3 hours for curing. The oven dried material is further subjected to lathe machine for finishing so as obtaining desired insulation over the HT/LT insulator.

9) The unit shall maintain proper ventilation in the work zone and process areas (preferably with ventilation ducts above the process units connected to ID fan with exhaust above roof level). All personnel involved in the plant operation shall wear proper personal protective equipment such as Safety glasses with side shields or chemical splash goggles; wear liquid-proof, chemical resistant gloves (such as nitrile- butyl rubber, neoprene, butyl rubber or natural rubber) and full body covered clothing.

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

11) It shall be ensured that resin waste is procured from the industries who have valid authorization for generation/storage of the same from the concerned SPCB/PCC as required under Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016.

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

13) The waste generated (such as waste resin mix, waste generated during cutting / finishing cuttings and used chemical drums) shall be collected and temporarily stored in non-reactive drums/container in a dedicated hazardous waste storage area and sent to TSDF within 90 days from generation of the waste. Such storage area shall be covered with proper ventilation.

14) The unit shall maintain a passbook issued by concerned SPCB wherein the following details of each procurement of resin waste shall be entered:

   - Address of the sender
   - Date of dispatch
   - Quantity procured
   - Seal and signature of the sender
   - Date of receipt in the premises

15) A log book shall be maintained within formation on source and date of procurement of resin waste, quantity, date wise utilization of the same, hazardous waste generation and its disposal, etc.

16) The unit shall maintain record of hazardous waste utilised, hazardous waste 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.

17) Prior to utilization of resin waste, the unit shall obtain authorization for generation, storage and utilization of resin waste from the concerned State Pollution Control Board under the Hazardous and Other Wastes (Management &Transboundary Movement) Rules, 2016.

18) In case of environmental damages arising due to improper handling of hazardous wastes including accidental spillage during generation, storage, processing, transportation and disposal, the unit 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.

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

1.5 Standards

1) Fugitive emissions in the work zone for MDA (4, 4- Methylenedianiline) shall comply with 10 ppb TWA. Reference: Occupational Safety and Health Standards 1910:1000);

   TWA —Time-weighted average

   The Permissible Exposure Limit is 8-hour TWA.

2) Monitoring of the specified parameters for fugitive emission shall be carried out by NABL accredited or EPA approved laboratories quarterly and the results shall be submitted quarterly to the concerned SPCB/PCC. Facilities for processing of resin.

1.6 Siting of Industry

Facilities for processing of resin waste shall preferably be located in a notified industrial area or industrial park / estate/ cluster.

1.7 Size of Plant & Efficiency of utilisation

Maximum 970 kg of resin waste would be required to produce 1 ton of resin mix which will be used in insulation of HT/LT electrical components. Therefore requisite facilities of adequate size of storage shed and other plant & machineries as given in section 1.9 below shall be installed accordingly.

1.8 Online detectors/Alarms/Analaysers

Smoke detector and fire alarm system shall be installed at resin waste storage and handling area.

1.9 Checklist of Minimal Requisite Facilities

S. No	Requisite Facilities
1	Storage shed(s) for storage of resin waste in steel container only under cool, dry, well- ventilated covered storage shed(s) within premises.
2	Mechanized system for - transfer of resin waste from drums (such as drum tilters) - mixing of resin waste with hardener (closed vessel with stirrer)
3	Lathe machine (s)
4	The process units shall have proper ventilation (preferably with ventilation ducts above the process units connected to ID fan with exhaust above roof level).
5	Closed Hot Air Oven with provision of vent over roof top
6	Covered hazardous waste storage space to store hazardous generated during utilization process
7	Smoke detector and fire alarm system at resin waste storage and handling area.

Utilization of Spent ion exchange resin generated from Demineralization (DM) plant

SOP - 29

Resin from Demineralization Plant

(Category: 35.2 of Schedule I of HOWM Rules, 2016)

1.0 Utilization of Spent Ion Exchange Resin (Captive):

Type of HW	Source of generation	Recovery/Product
Spent Ion Exchange Resin-listed at Sl. No.35.2 of Schedule-I of HOWM Rules, 2016	Demineralization (DM) plant	For energy recovery in Captive Boiler.

1.1 Source of Waste

De-mineralised water is required in thermal power plant. The same is generated in Demineralization plant, where treatment of water is carried out through ion exchange process. In the ion exchange process, water is passed through resin beds. The anion and cation resins loose their ion exchange efficiency in resin beds in due course of time and needs to be replaced. These discarded ion exchange resin is known as "Spent ion exchange resin",categorized as hazardous waste at S. No.35.2 of schedule-I of HOWM Rules, 2016 which are required to be disposed in authorized disposal facility in accordance with authorization condition, when not utilized as energy/resource recovery.

1.2 Proposed Process

The captive utilisation process involves mixing of Spent ion exchange resin with coal in a hopper and feeding the mixed material into stoker fired / fluidized bed / Pulverized fire coal (PFC) boiler as supplementary energy resource. The flue gases from the boiler is treated in Electrostatic precipitator (ESP) and then dispersed into atmosphere through stack.

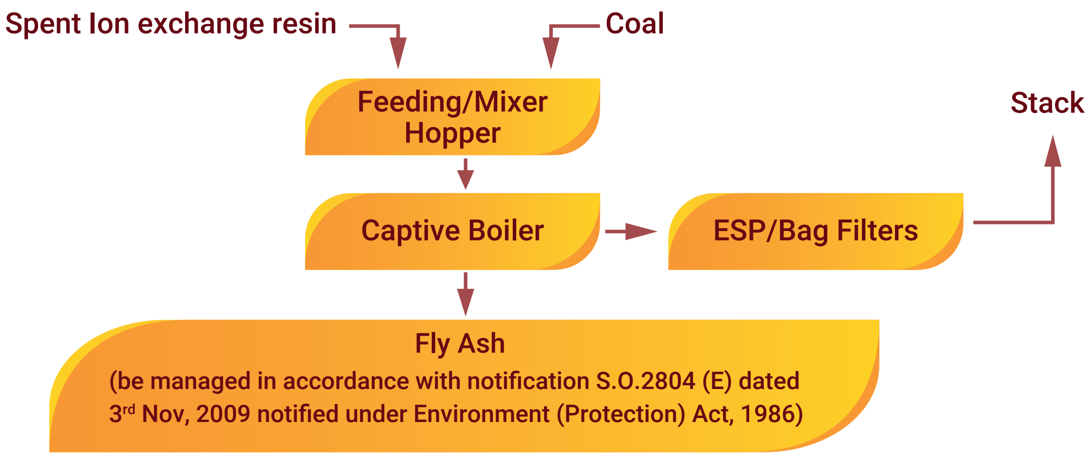


Fig 1: Process flow diagram for utilization of resin waste for energy recovery in Captive boiler

1.3 Product Usage/ Utilization

The Spent ion exchange resin mixed with coal is used as a supplementary energy resource in captive stoker fired / fluidized bed / pulverized fire coal boiler of power plant.

1.4 Standard Operating Procedure for utilization

This SoP is applicable only for captive utilization of spent ion exchange resin generated from Demineralization (DM) plant, as a supplementary energy resource in captive stoker fired / fluidized bed / pulverized fire coal boiler.

1) The Spent ion exchange resin generated from its own Demineralization (DM) plant shall be collected and stored in non-reactive containers/drums/bags in accordance with the provisions stipulated in Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016.

2) There should be a designated space for storage of Spent ion exchange resin under cool, dry, well ventilated and covered storage shed as authorized by the concerned SPCB/PCC under the HOWM Rules, 2016 so as to eliminate water intrusion. Such shed shall have impervious lined floor, adequate slope, seepage collection pit. The loading/unloading space for Spent Resin shall also be under the covered shed.

3) Spent ion exchange resin from the storage shed shall be transferred through mechanised conveyor system to the mixing chute/hopper unit, where coal is mixed in the ratio of 99.95:0.05 (Coal : Spent ion exchange resin).

4) The Spent ion exchange resin mixed with coal from chute shall be transferred to the boiler through mechanised conveyor system.

5) Utilisation of Spent ion exchange resin shall not exceed 0.05 % of the coal consumed in stoker fired Boiler.

6) The stoker fired / fluidized bed / pulverized fire coal boiler shall maintain a temperature not less than 1100°C.

7) Utilization of Spent ion exchange resin shall not be carried out during unstable/breakdown conditions in the boiler.

8) The hot flue gases shall be treated in Electrostatic Precipitator (ESP) or bag filters (dust collectors) house followed by stack of height as prescribed by SPCB.

9) The unit shall ensure that, all personnel involved in handling of spent resin shall wear proper personal protective equipment such as masks, gloves, goggles, shoes etc. for safety.

10) Prior to utilization of spent ion exchange resin, the unit shall obtain authorization for generation, storage and utilization of Spent ion exchange resin from the concerned State Pollution Control Board under the Hazardous and Other Wastes (Management & Transboundary Movement) Rules, 2016.

11) In case of environmental damages arising due to improper handling of hazardous wastes including (viz. accidental spillage during generation, storage, processing, transportation and disposal), the unit shall be liable to implement immediate corrective 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 and Disposal of Hazardous Wastes and Penalty"* published by CPCB.

12) 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.

1.5 Record / Returns Filing

1) The unit shall maintain a passbook issued by concern SPCB wherein the following details of each generation of Spent ion exchange resin shall be entered:
    - Date of Spent ion exchange resin generation
    - Quantity produced
    - Date of Receipt in the storage area for utilization
    - Quantity utilised per day

2) The unit shall submit quarterly and annual information on Spent ion exchange resin generated, consumed, quantity utilised, resources conserved (specifying the details like, type and quantity of resources conserved) to the concerned SPCB.

3) A log book shall be maintain with information on source, quantity, quality, date wise utilization of Spent ion exchange resin and record of analysis report of emission monitoring & effluent discharged, as applicable shall be maintained.

4) The unit shall maintain record of hazardous waste utilised 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 SPCB.

1.6 Standards

1) Source emissions standards shall comply with following:

   i. PM : 100 mg/Nm^3

   ii. SO_2: 200 mg/Nm^3

   iii. NO_x : 400 mg/Nm^3

   iv. CO : 100 mg/Nm^3

   (as notified under the Environment (Protection) Act, 1996 Notification No.G.S.R. 481(E) dated 26/06/2008 for Common Hazardous Waste Incinerators) or stringent standards as prescribed by SPCB/PCC

2) Monitoring of the specified source emission shall be carried out quarterly. The monitoring shall be carried out by NABL/EPA accredited laboratories and the results shall be submitted to the concerned SPCB quarterly.

1.7 Siting of the industry

This SoPs is applicable only for captive utilization of spent ion exchange resin in an existing captive boiler and cited in accordance with Consent to Establish issued by the concerned SPCB/PCC.

1.8 Size of plant & Efficiency of utilization

Utilization of spent ion exchange resin shall not exceed 0.05 % of the coal consumed in stole fired boiler. Hence, requisite facilities of adequate size shall be installed accordingly as mentioned under section 1.10 below.

1.9 On-line detectors/ Alarms/ Analysers

Online emission analysers for PM, SO_2 and CO in the stack shall be installed and the online data be connected to the server of the concerned SPCB/PCC and CPCB Server.

1.10 Checklist of Minimal Requisite Facilities:

S. No	Particulars
1.	Designated space for storage of spent ion exchange resin under cool, dry, well ventilated and covered storage shed, so as to eliminate water intrusion.
2.	Storage shed with impervious lined floor, adequate slope, seepage collection pit
3.	The loading/unloading space for spent ion exchange resin with covered shed.
4.	Mechanised systems for handling & transfer of Spent ion exchange resin and coal
5.	Mixing chute/hopper unit for mixing coal and Spent ion exchange resin
6.	Stoker fired / fluidized bed / Pulverized fire coal Boilers
7.	Electrostatic precipitators/ Bag filters house
8.	Stack of height as prescribed by SPCB/PCC with easy access to port hole, for conducting stack monitoring
9.	Flue-Gas Desulphurization (FGD) for treatment of SO_2 in the emissions (in case of PFC boilers)
10.	Online analyzers for PM and CO emission monitoring in the stack and the online data be connected to the server of the concerned SPCB/PCC and CPCB.

Captive utilization of Spent ion exchange resin generated from Demineralization (DM) plant in DRI Kiln of Sponge Iron

SOP - 30

Resin from Demineralization (DM) plant

(Category: 35.2 of Schedule I of HOWM Rules, 2016)

1.0 Captive Utilization of Spent Ion Exchange Resin

Type of HW	Source of generation	Recovery/Product
Spent ion exchange resin-Category 35.2 of schedule-I of HOWM Rules, 2016	Demineralization (DM) plant	For energy recovery in Direct Reduced Iron (DRI) kiln of Sponge Iron Industry

1.1 Source of Waste

De-mineralised water is required in DRI kiln. The same is generated in Demineralization plant, where treatment of water is carried out through ion exchange process. In the ion exchange process, water is passed through resin beds. The anion and cation resins loose their ion exchange efficiency in resin beds in due course of time and needs to be replaced. These discarded ion exchange resin is known as "Spent ion exchange resin", categorized as hazardous waste at S.No.35.2 of schedule-I of HOWM Rules, 2016.

1.2 Utilisation Process

The utilisation process involves mixing of Spent ion exchange resin with iron ore, coal and dolomite in a hopper and feeding the mixed material into its own Direct Reduced Iron (DRI) kiln of Sponge Iron Industry, as supplementary energy resource. The flue gas from DRI Kiln is passed through the After Burning Chamber followed by Waste Heat Recovery Boiler and treated in Electrostatic precipitator (ESP)/Bag filter house and then dispersed into atmosphere through stack. The steam generated from the Waste Heat Recovery Boiler is used for captive power generation.

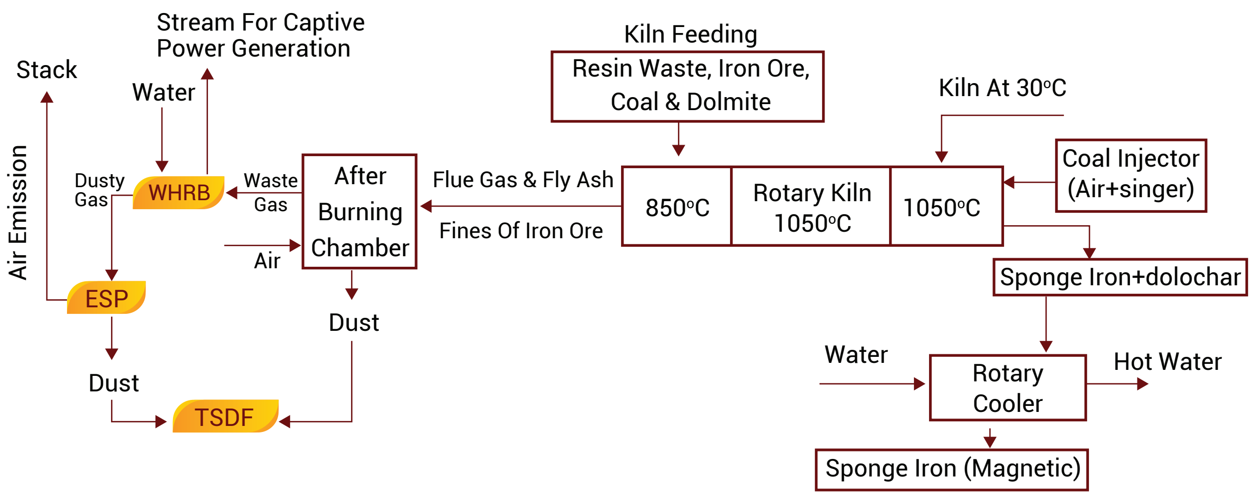


Fig 1: Process flow diagram for utilization of spent ion exchange resin for energy recovery in DRI kiln of Sponge Iron Industry

1.3 Product Usage / Utilization

The Spent ion exchange resin mixed with iron ore, coal and dolomite is used as energy resource in its own DRI Kiln of Sponge Iron Industry.

1.4 Standard Operating Procedure for utilization

This SoP is applicable only for captive utilization of spent ion exchange resin generated from its own Demineralization (DM) plant, as a supplementary energy resource in the DRI Kiln. The steam generated from the Waste Heat Recovery Boiler is used in captive power generation.

1) The Spent ion exchange resin shall be collected and stored in non-reactive containers/drums/bags in accordance with the provisions stipulated in Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016.

2) There should be a designated space for storage of Spent ion exchange resin under cool, dry, well ventilated and covered storage shed, as authorized by the concerned SPCB/PCC under the HoWM Rules, 2016 so as to eliminate water intrusion. Such shed shall have impervious lined floor, adequate slope, seepage collection pit. The loading/unloading space for Spent Resin shall also be under the covered shed.

3) Spent ion exchange resin from the storage shed shall be transferred through mechanised conveyor system to the mixing chute/hopper unit where coal is uniformly mixed in the ratio of 0.002: 99.998 (Spent ion exchange resin : Coal) along with other raw material i.e. iron ore & dolomite.

4) Uniform mixing of coal and Spent ion exchange resin alongwith other raw material i.e. iron ore & dolomite shall be achieved using appropriate mechanized mixing units.

5) Uniformly mixed Spent ion exchange resin, coal and other raw material i.e. iron ore & dolomite shall be transferred to the DRI Kiln through mechanized conveyor system.

6) Utilisation of Spent ion exchange resin shall not exceed 0.002 % of the coal consumed in the DRI Kiln.

7) The DRI Kiln shall maintain the temperature not less than 850°C

8) Utilization of Spent ion exchange resin shall not be carried out during unstable/breakdown conditions in the DRI Kiln.

9) The hot flue gases transferred through After Burning chamber, Waste Heat Recovery Boiler shall be finally treated in Electrostatic Precipitator (ESP) or Bag filter house followed by stack of height as prescribed by SPCB. The steam generated from the Waste Heat Recovery Boiler shall be used for captive power generation.

10) The unit shall ensure that all personnel involved in the plant operation shall wear proper personal protective equipment such as masks, gloves, goggles, shoes etc. for safety.

11) The unit shall obtain authorization for generation, storage and utilisation of Spent ion exchange resin from the concerned State Pollution Control Board under the Hazardous and Other Wastes (Management & Transboundary Movement) Rules, 2016

12) In case of environmental damages arising due to improper handling of hazardous wastes (viz., accidental spillage during generation, storage, processing, transportation and disposal), the unit shall be liable to implement immediate corrective 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.

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

1.5 Record/Return Filing

1) The unit shall submit quarterly and annual information on Spent ion exchange resin generated, quantity utilized, resources conserved (specifying the details like type and quantity of resources conserved) to the concerned SPCB.

2) A log book shall be maintained with information on source, quantity, date wise utilization of Spent ion exchange resin and record of analysis report of emission monitoring & effluent discharged, as applicable shall be maintained.

3) The unit shall maintain record of hazardous waste generated/utilised 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 SPCB.

1.6 Standards

1) Source emission standards for Particulate Matter shall comply with the standards notified vide notification no. S.O. 414 (E) dated 30/05/2008 for Sponge Iron Industry or as prescribed by the concerned SPCB/PCC, whichever is stringent.

2) Monitoring of the above specified source emission parameter shall be carried out quarterly. The monitoring shall be carried out by NABL accredited / EPA approved

laboratories and the results shall be submitted to the concerned SPCB quarterly.

1.7 Siting of Industry

This SOP is applicable only for captive utilization of spent ion exchange resin in the DRI Kiln of Sponge Iron Industry already in operation.

1.8 Size of Plant & Efficiency of utilisation

This SOP is applicable for captive utilisation of Spent Ion Exchange Resin in all the DRI Kiln of the Sponge Iron Industry irrespective of size of plant, however, the unit shall utilise spent ion exchange resin: Coal in the ratio of 0.002: 99.998. Hence, requisite facilities of adequate size shall be installed accordingly as mentioned under section 1.10 below.

1.9 On-line detectors / Alarms / Analysers

Online emission analysers for Particulate Matter in the stack shall be installed and the online data be connected to the server of the concerned SPCB/PCC and CPCB.

1.10 Checklist of Minimal Requisite Facilities:

S. No	Requisite Facilities
1	Designated space for storage of Spent ion exchange resin under cool, dry, well ventilated and covered storage shed, so as to eliminate water intrusion.
2	Storage shed with impervious lined floor, adequate slope, seepage collection pit
3	Loading/unloading space for Spent ion exchange resin with covered shed.
4	Mechanised systems for handling & transfer of Spent ion exchange resin, iron ore, dolomite and coal
5	Appropriate mechanised system for mixing of Spent ion exchange resin and coal alongwith other raw materials i.e. iron ore and dolomite

6	Direct-reduced iron (DRI) kiln
7	Dust Settling Chamber connected to DRI Kiln
8	After Burning Chamber
9	Waste Heat Recovery Boiler with arrangement for utilising the steam generated for captive power generation
10	Electrostatic Precipitator/Bag filter house
11	Stack of height as prescribed by SPCB with easy access to port hole and arrangement of platform, ladder, etc. for conducting stack monitoring
12	Online analyzers for Particulate Matter emission monitoring in stack and connection of emission data to the server of SPCB/PCC and CPCB.

Utilization of Resin & Glue waste as a Supplementary Fuel in Tile Manufacturing Industry

SOP - 70

Resin & Glue waste Tile Manufacturing Industry

(Category: 23.1 of Schedule I of HOWM Rules, 2016)

1.0 Utilization of Resin & Glue waste:

Type of HW	Source of generation	Recovery/Product
Resin & Glue waste, Category 23.1, Schedule I (of HOWM Rules, 2016)	Generated during manufacturing of Wind mill blades.	As a supplementary fuel (Energy recovery) along with coal in Chain stove of Ceramic tile manufacturing industry

1.1 Source of Waste:

The Resin and Glue waste is generated during manufacturing of Wind Mill blades, falls under the Category 23.1, Schedule I of HOWM Rules, 2016.

Table 1. Typically characteristics of resin & Glue waste are given below;

Sr. No.	Parameter	Unit	Result
1.	Arsenic as As	mg/L	0.290
2.	Barium as Ba	mg/L	25.44
3.	Nickel as Ni	mg/L	0.401
4.	Zinc as Zn	mg/L	1.113
5.	Manganese as Mn	mg/L	8.7
6.	Cadmium as Cd	mg/L	BLQ (LOQ:0.1)
7.	Chromium as Cr	mg/L	BLQ (LOQ:0.1)
8.	Lead as Pb	mg/L	BLQ (LOQ:0.1)
9.	Mercury as Hg	mg/L	BLQ (LOQ:0.1)
10.	Copper as Cu	mg/L	BLQ (LOQ:0.1)

1.2 Utilization Process

Resin and glue waste is utilized as supplementary fuel along with coal in the chain stove for hot air generation. This hot air is supplied to the spray dryer chamber through hot air distributor. The slip (wet slurry of the ground mix of raw materials i.e. clay, minerals etc.) is sprayed and dried in the spray dryer to make fine sieved particles/powder for the tile manufacturing.

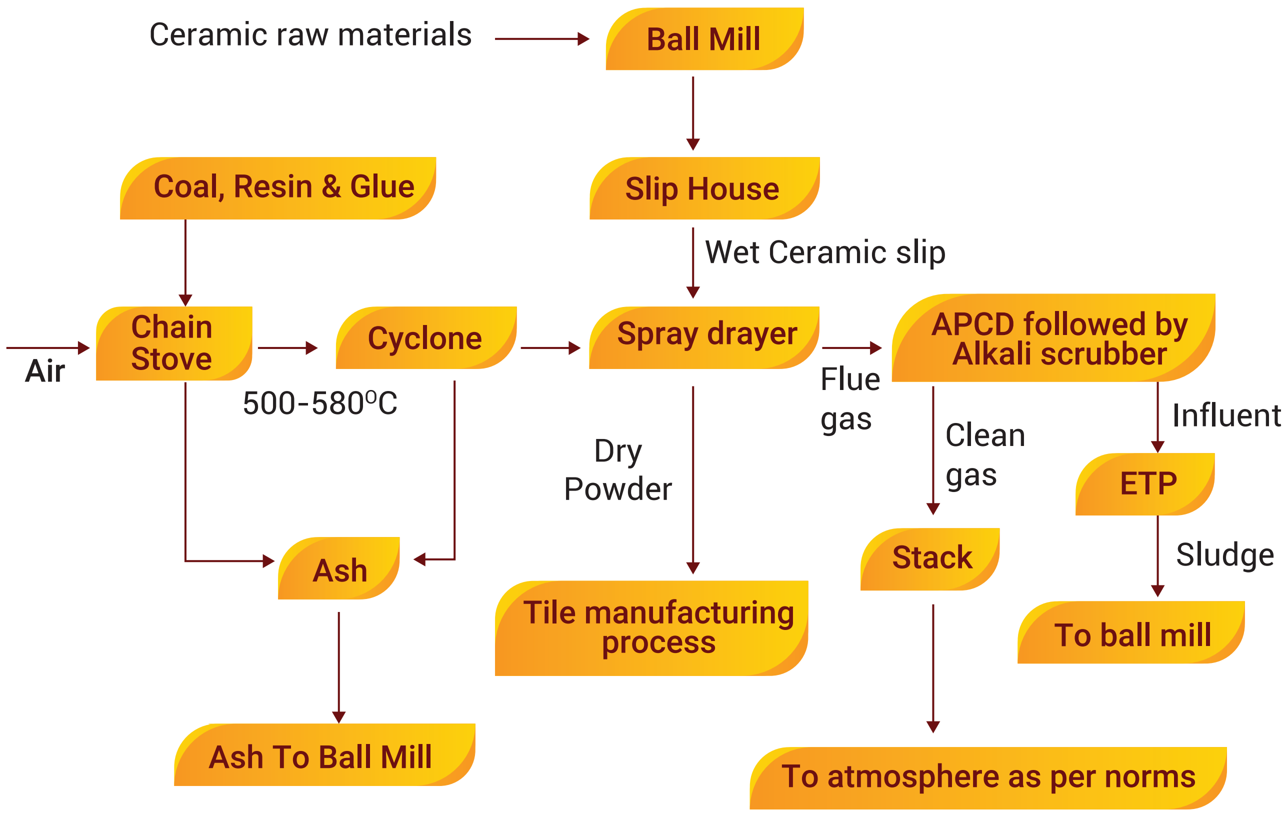


Fig 1: Process flow diagram for utilization of resin & glue waste as supplementary fuel in tile manufacturing industry.

1.3 Product Usage / Utilization

Resin and glue waste mixed with coal is used as a supplementary energy resource in Chain stove of Ceramic tile manufacturing industry which will conserve the natural resource i.e. coal.

1.4 Standard Operating Procedure for utilization

This SoP is applicable only for utilization of Resin & Glue waste (generated during manufacturing of Wind mill blades) as a supplementary fuel along with coal in Chain stove of Ceramic tile manufacturing industry.

1) The unit shall ensure the removal of plastics (PVC / polythene) from the Resin & Glue waste through proper dismantling and segregation and plastics contents shall not exceed 5 % of the Resin & Glue waste.

2) The unit shall not use Fibre Reinforced Plastics (FRPs) that are generated along with Resin & Glue waste as hazardous waste from Wind mill blades manufacturing industry.

3) Utilisation of Resin & Glue waste shall not exceed 15 % of the fuel consumption in Chain stove. The fuel shall be uniformly mixed in the ratio of 85:15 (Coal: Resin & Glue waste) by using appropriate mechanized mixing units and transferred to the Chain stove through mechanized system.

4) Resin & Glue waste shall be allowed to utilized with only coal as a supplementary fuel for energy recovery.

5) The unit shall ensure Resin & Glue waste to be crushed and sized down to less than 50 mm before utilization.

6) The unit shall ensure minimum temperature of 900°C in chain stove after which Resin & Glue waste can be utilized. There must be provision for minimum automation in the process such as temperature sensor with chain stove.

7) Utilization of Resin & Glue waste shall not be carried out during un-stable/breakdown conditions in the Chain stove units.

8) The unit shall ensure excess Air to fuel ratio for proper combustion of the materials.

9) The gases from spray dryer chamber shall pass through Air Pollution Control Device like Electro static precipitators/ Bag filters/ Cyclone and further followed by Alkali scrubbing system.

10) The treated gases shall comply with emission norms prior to dispersion into atmosphere through stack. The stack height shall be minimum of 30m from ground level or as prescribed by the concerned SPCB/PCC, whichever is higher.

11) The unit shall ensure control of fugitive emissions through dust extraction system near Coal crushing and Spray dryer area.

12) The unit shall carryout intermittent water sprinkling in the working area (especially coal, raw material handling and spray dryer sections etc.) to avoid fugitives and dust emissions.

13) Treatment and disposal of wastewater:

    Wastewater generated from floor-washings, spillages, reactor washing, scrubber bleed shall be treated Physico-Chemically in an Effluent Treatment Plant (ETP) or may be sent to Common Effluent Treatment Plant (CETP) for final disposal or be treated further in a captive facility to comply with surface water discharge standards.

    In case of zero discharge, the treated waste water from ETP may be managed as per conditions stipulated by the concerned SPCB/PCC.

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

15) The unit shall install storage area under cool, dry, well ventilated covered storage shed(s) within premises, as authorized by the concerned SPCB/PCC under HOWM Rules, 2016. Resin & Glue waste generated from manufacturing of Wind Mill blades shall be collected and stored under covered storage shed(s) with impervious floor within premises, so as to eliminate rain water intrusion.

    Further, the storage sheds shall have proper slope and seepage collection pit so as to collect seepage/floor washings. The collected seepage/floor washings shall be channelized to ETP for treatment.

16) 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.

17) The wastes generated during utilization of Resin & Glue waste (namely ash, APCD dust, ETP sludge etc.) during manufacturing process of unit shall be captively utilized with in the process as mentioned in figure-1 or collected and temporarily stored in non-reactive drums/ bags under a dedicated hazardous waste storage area and be sent to authorized common TSDF or other authorized facility within 90 days from generation of the waste in accordance with the authorization issued by the concerned SPCB/PCC.

18) The unit shall ensure that the Resin & Glue waste procured from the industries, which have valid authorization from the concerned SPCB/PCC as required under HOWM Rules, 2016.

19) Transportation of Resin & Glue waste shall be carried out by sender (generator) or receiver (utilizer) only after obtaining authorization from the concerned SPCB/PCC under HOWM Rules, 2016. Requisite manifest document shall be followed as laid down under the said Rules.

20) Prior to utilization of Resin & Glue waste, the unit shall obtain authorization for storage, utilization and disposal of Resin & Glue waste from the concerned SPCB/PCC under HOWM Rules, 2016.

21) 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.

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

23) 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.

1.5 Record/Returns Filing

1) The unit shall maintain a passbook issued by concern SPCB/PCC and maintain details of each procurement of Resin & Glue waste as mentioned below:
   - Address of the sender
   - Date of dispatch
   - Quantity procured
   - Seal and signature of the sender
   - Date of Receipt in the premises

2) A log book with information on source and date of procurement of Resin & Glue waste, date wise utilization of the same, hazardous waste generation and its disposal, etc. shall be maintained including analysis report of fugitive emission monitoring & effluent discharged, as applicable.

3) The unit shall maintain record of hazardous waste generated, utilized and disposed as per Form 3 & also file annual returns in Form 4 as per Rule 20 (1) and (2) of the HOWM Rules, 2016, to concerned SPCB/PCC.

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

1.6 Standards

I) Source emissions from the stack connected to spray dryer shall comply with the following Emission standards or as prescribed by the concerned SPCB/PCC, whichever is stringent;

Particulate Matter	150 mg/Nm^3
NO_x	400 mg/Nm^3
SO_2	200 mg/Nm^3
HCl Mist	50 mg/Nm^3
Total Dioxins and Furans	0.1mgTEQ/Nm^3
Sb+As+Pb+Co+Cr+Cu+ Mn+Ni+V+their compounds	0.50 mg/Nm^3

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

PM_{10}	5 mg/m^3 TWA* (PEL)
NO_2	9 mg/m^3 Ceiling limit
SO_2	13 mg/m^3 TWA* (PEL)
HCl mist	7 mg/m^3 Ceiling Limit
Arsenic as As	0.5 mg/m^3 TWA* (PEL)
Chromium as Cr	1 mg/m^3 TWA* (PEL)
Copper as Cu	1 mg/m^3 TWA* (PEL)
Lead as Pb	1 mg/m^3 TWA* (PEL)
Manganese as Mn	5 mg/m^3 Ceiling Limit
Nickel as Ni	1 mg/m^3 TWA* (PEL)

**PEL-Permissible Exposure Limit*

**TWA-Time Weighted Average- measured over a period of 8 hours of operation of process. A ceiling limit is one that may not be exceeded for any period of time, and is applied to irritants and other materials that have immediate effects*

**TEQ-Toxic Equivalents*

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 ISO 17025 accredited or EPA, 1986 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 concerned 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 CETP, zero discharge shall be met.

1.7 Siting of Industry

Facilities for utilization of Resin & Glue waste shall be preferably located in a notified industrial area or industrial park/estate/cluster and in accordance with Consent to Establish issued by the concerned SPCB/PCC.

1.8 Size of Plant and Efficiency of Utilisation

This SoP is applicable for utilization of coal and Resin & Glue waste in the ratio of 85:15 for energy recovery. Therefore, requisite facilities of adequate size of storage shed and other plant & machineries shall be installed accordingly.

1.9 On-line Detectors / Alarms / Analyzers

In case of continuous process operations, online emission analyzers for PM, SO_2, NO_x in the stack shall be installed and the online data be connected to the server of the concerned SPCB/PCC.

1.10 Checklist of Minimal Requisite Facilities

S. No	Particulars
1.	Cool, dry well-ventilated covered sheds for Resin & Glue waste and process activities within premises and dedicated hazardous storage area for temporary storage of hazardous waste generated during utilization process.
2.	Mechanized systems for handling & transfer of coal and Resin & Glue waste.

3.	Chain stove, feeders, cyclone and ETP
4.	APCD like Electra static precipitators/ Bag filters/ Cyclone followed by Alkali scrubber
5.	Stack to have 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.
6.	Online analyzers for PM, SO_2 & NO_x emission monitoring in the stack, in case of continuous process operations.

Salt

Utilization of Magnesium Chloride Salts Generated from DEMP (Diethyl Methyl Phosphonite reaction) in the Magnesium Ammonium Phosphate (MAP) Process in CETP

SOP - 60

Magnesium Chloride Salts from DEMP

Salts from CETP

1.0 Utilization of Magnesium Chloride Salts Generate from Diethyl Methyl Phosphonite reaction (DEMP):

Type of HW	Source of generation	Recovery/Product
Spent Magnesium Chloride Salt	Generated from the Diethyl methyl phosphonite (DEMP) preparation process.	Spent Magnesium Chloride utilize in the MAP process of CETP as a raw material for waste water treatment

1.1 Source of Waste

The Spent Magnesium Chloride salt is generated during the Diethyl methyl phosphonite (DEMP) reaction process. DEMP is an intermediate product manufactured for production of certain pesticides or chemicals. Magnesium Chloride solution is generated during the DEMP-process which is converted into flakes before it is bagged.

Table 1: Typical characteristics of spent Magnesium Chloride salt Generated in the DEMP reaction process.

S.No	Parameter	Unit	Result
1.	Appearance	--	Off white flakes
2.	$MgCl_2 .6H_2O$	% w/w	89
3.	pH (10% solution)	--	5.26
4.	Water Content	% w/w	48.5
5.	Chloride	% w/w	31.1
6.	MgO	% w/w	1.5
7.	TOC (Total Organic Carbon)	%	6.96

1.2 Utilization Process

The Magnesium Ammonium Phosphate (MAP) process has been developed mainly for the removal of Ammonical Nitrogen in the effluent. The high Ammonical Nitrogen containing effluent are segregated and treated with Sodium salt, Magnesium Chloride and Di Sodium Hydrogen Phosphate or mixture of Caustic Soda and Phosphoric Acid to precipitate Magnesium Ammonium Phosphate (Struvite). MAP is insoluble compound and can be separated.

MAP (Struvite): Struvite or magnesium ammonium phosphate (MAP) is a fertiliser, precipitates in the presence of Mg^{+2}(M), NH_4^+ (N) and PO_4^{3-} (P) according to following reaction :

$$Mg^{2+} + NH_4 + PO_4^{3-} + 6H_2O \longrightarrow MgNH_4PO_4 . 6H_2O$$

The MAP crystals are separated out and the clear effluent is sent to the primary clarifier of the CETP and subject to further treatment in the secondary and tertiary treatment units of the CETP.

The high ammonical nitrogen stream from equalization tanks are pumped to MAP treatment unit where suitable dose of spent magnesium chloride and Sodium di-ammonium phosphate is added. The pH adjustment will be done by NaOH solution. The MAP crystal is separated out using tube settler and further dewatered in filter press. The clear effluent from Tube settler is sent to the primary clarifier of the CETP and subject to further treatment in the secondary and tertiary treatment units of the main CETP.

For removal of 1Kg Ammonical Nitrogen from effluent, the requirement of Magnesium salt of 94.2% purity will be approximately 14.8 kg. The proportional MAP (Struvite) production will be 48 Kg.

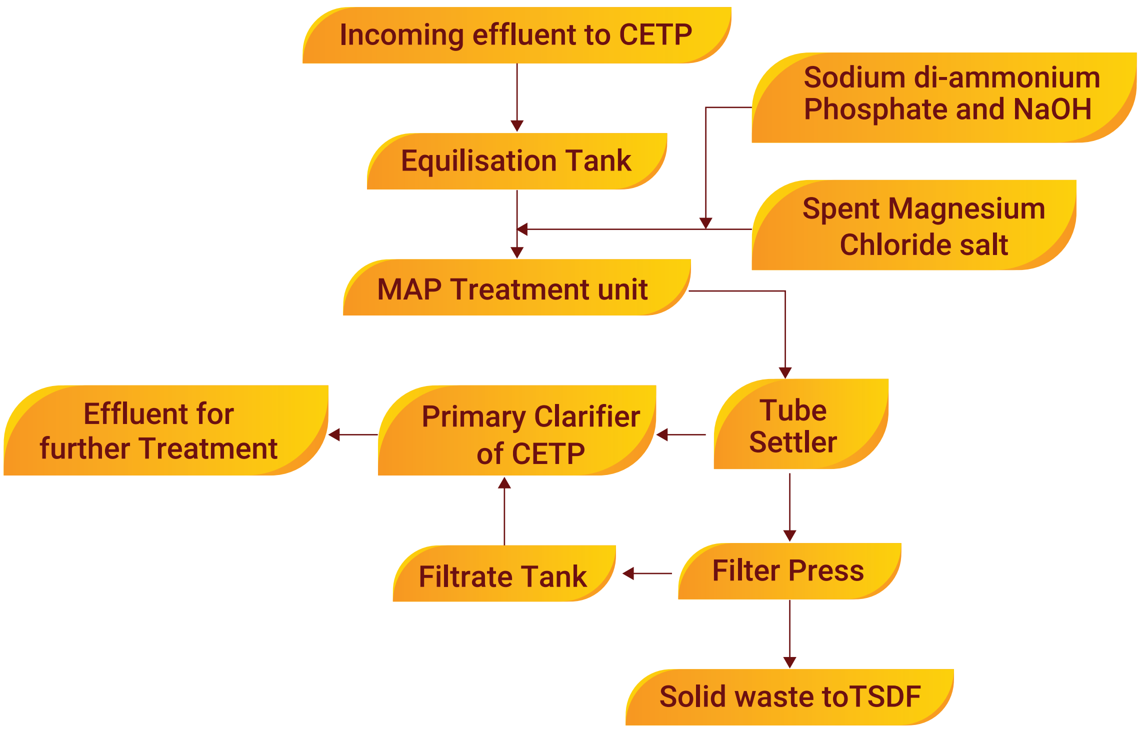


Fig 1: Process flow diagram for utilization of Spent Magnesium Chloride salt

1.3 Product Usage / Utilization

The spent magnesium chloride is used for removal of High Ammonical nitrogen from waste water during Primary treatment of Common Effluent Treatment Plant.

1.4 Standard Operating Procedure for utilization

This SoP is applicable only for the utilization of the Spent Magnesium Chloride salt generated during the DEMP reaction process, for removal of high Ammonical Nitrogen from wastewater in primary treatment of common effluent treatment plant.

1) The handling and transportation of Magnesium Chloride salt from the source of generation to the utilization area Shall be done in environmentally safe manner.
2) The unit shall provide separate storage area at designated place with proper cover for storage of spent Magnesium Chloride.
3) The unit shall ensure that spent Magnesium Chloride is procured from the industries that have valid authorization for the same from the concerned SPCBS/PCCs as required under Hazardous and Other Wastes (Management & Trans boundary Movement) (HOWM) Rules, 2016.
4) The Spent Magnesium Chloride shall be transported in SPCBs/PCCs authorized vehicles with requisite safeguards.
5) Transportation of spent Magnesium Chloride shall be carried out by sender or receiver (utilizer) only after obtaining authorization from the concerned SPCBs/PCCs under (HOWM) Rules, 2016.
6) The unit shall maintain proper ventilation in the work zone and process areas. All personnal involved in the plant operation shall wear proper personal protective equipment (PPE) specific to the process operations. The unit shall provide personal protective equipment like aprons, safety hand gloves and safety shoes, helmets to the person involved in production activities and in handling hazardous wastes. The safety precautions of the worker shall be in accordance with the Factory Act, 1948, as amended from time to time.
7) Prior to utilization of spent Magnesium Chloride, the unit shall obtain authorization for generation, storage, and utilization of spent Magnesium Cholride from the concerned SPCB/PCC under (HOWM) Rules, 2016.
8) Treatment and disposal of wastewater;

Following are the sources of wastewater from utilization process (MAP).

a) Wastewater (generated from floor washing/ Spillages, etc.)

b) Filtrate from filter press

Wastewater generated from above mentioned shall be treated Physico- Chemically in an ETP or may be sent to CETP for final disposal (as per the prescribed standards) or be treated further in a captive facility to comply with surface water discharge standards or sent to CETP/ETP as stipulated in the Consent issued by the SPCBs/PCCs.

In case of zero discharge condition by SPCBs/PCCs, the treated waste water from ETP may be managed as per conditions stipulated by the SPCBS/PCCs.

9) The hazardous waste generated (Sludge from filter press after the tube settler), if any, shall be collected and stored in dedicated hazardous waste storage area and dispose of the sludge in accordance with HOWM, Rules, 2016. Such storage area shall have proper ventilation.

10) In case of environmental damages arising due to improper handling of hazardous wastes including accidental spillage during generation, storage, processing, transportation, and disposal, the unit 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.

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

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

1.5 Record/ Returns Filing

1) The unit shall maintain a passbook issued by concern SPCB wherein the following details of each procurement of Spent Magnesium Chloride shall be entered:
   - Address of the sender
   - Data of dispatch
   - Quantity procured
   - Seal and signature of the sender
   - Date of Receipt in the premises

2) A log book with information on source and date of procurement of Spent Magnesium Chloride quantity, date wise utilisation of the same, hazardous waste generation and its disposal, etc. shall be maintained including analysis report of fugitive emission monitoring & effluent discharged, as applicable.

3) The unit shall maintain record of hazardous waste utilized, hazardous waste generated and disposed as per Form 3 & shall file annual returns in Form 4 as per Rule 20 (I) and (2) of the (HOWM) Rules, 2016, to concerned SPCB/PCC.

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

1.6 Standards

1) Fugitive emission in the work zone area shall comply with the following standards:

PM_{10} : 5 mg/ m³ TWA* (PEL)

SO_2 : 13 mg/ m³ TWA* (PEL)

NO_X : 1.8 mg/ m³ TWA* (PEL)

NH_3 : 35 mg/ m³ TWA* (PEL)

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

2) Fugitive emission and effluent monitoring for specified parameter shall be carried out quarterly. The monitoring shall be carried out by ISO17025 accredited or EPA approved laboratories and the results shall be submitted to the concerned SPCB/PCC on a quarterly basis.

3) Treated effluent shall comply with comply with prescribed CETP standards notified under the Environmental (Protection) Act, 1986. Vide notification no. S.O.4(E) dated 01/01/2016 or standard prescribed in Consent to Operate issued under the Water (Prevention and Control and Pollution) Act, 1974 by the respective SPCB/PCC. whichever is stringent.

1.7 Siting of the industry

Facilities for utilization of spent Magnesium Chloride shall be located in a notified industrial area or industrial park/estate/cluster or independent and in accordance with Consent to Establish issued by the concerned SPCB/PCC.

1.8 Size of plant & Efficiency of utilization

Requisite facilities of adequate size of storage shed and other plant & machineries as given in section 1.9 shall be installed accordingly.

1.9 Checklist of Minimal Requisite Facilities

S. No	Particulars
1.	Cool, dry well – ventilated covered storage shed for spent Magnesium Chloride
2.	The process units shall have proper ventilation.
3.	Pumps, pipes, feeders and other equipment for mechanical handling of Spent Magnesium Chloride & its solution.
4.	Adequate system like preparation tank, mixing tank, holding tank, etc. to prepare dosing solution and feeding.
5.	Sludge separation system like tube settler, clarifiers or as permitted by SPCB/PCC.

Utilization of waste salts generated from CETPs/ETPs of Textile manufacturing/ processing industries for recovery of salts for industrial use

SOP - 68

Waste salts from CETPs/ETPs of Textile manufacturing / processing industries

(Category: 35.3 of Schedule I of HOWM Rules, 2016)

1.0 Utilization of Mixed/Waste salts:

Type of HW	Source of generation	Recovery/Product
Mixed/Waste salts (Category 35.3 of Schedule I of HOWM Rules, 2016)	Reject Management System installed for treatment of concentrated saline liquor in CETPs / ETPs of Textile manufacturing / processing industries.	Recovery of salts for industrial use.

1.1 Source of Waste

The mixed/waste salts generated from Reject Management System installed for treatment of concentrated saline liquor in CETPs / ETPs of Textile manufacturing / processing industries is categorized as Hazardous waste at S. No. 35.3 of Schedule I of HOWM Rules, 2016, that can be utilise as resource in recovery of salts for industrial use.

Table 1: Characteristics of waste salt are given below

SI. No.	Characteristics	Mixed salt Collected From CETPs	Mixed salt collected from ETPs	Blended salts of Both
1.	Bulk density gm/cc	1.34	1.34	1.34
2.	pH	9.78	9.78	9.78
3.	Reactive Cyanide (mg/kg)	<1	<1	<1
4.	Reactive Sulfide (mg/kg)	<1	<1	<1
5.	Total Phenols (mg/L)	<1	<1	<1
6.	Ammonia as N (mg/L)	24.70	24.70	24.70
7.	Cyanide (mg/L)	<0.2	<0.2	<0.2
8.	Fluoride as F (mg/L)	<1	<I	<1
9.	Nitrate Nitrogen as N (mg/L)	22.50	22.50	22.50
10.	Arsenic (Total) mg/kg	<10	<10	<10
11.	Cadmium (Total) mg/kg	<5	<5	<5
12.	Total Chromium (Total) mg/kg	2.0	14.40	7.20
13.	Hexavalent Chromium (Total) mg/kg	<3	<5	<5
14.	Copper (Total) mg/kg	7.4	64.80	36.10
15.	Lead (Total) mg/kg	7.50	25.2	25.2
16.	Nickel (Total) mg/kg	6.50	18.0	10.10
17.	Zinc (Total) mg/kg	90.40	112.4	112.40
18.	Mercury (Total) mg/kg	Nil	Nil	Nil

1.2 Utilization Process

Waste Salts generated from various CETPs and ETPs are collected and mixed together and called mixed salts.

The mixed/waste salts is received in a collection cum equalization tank and mixed with sea water. The solution is to be prepared upto 1,00,000 mg/litre TDS value. In this tank, coagulating chemicals such as lime, floc 1, floc 2 and poly electrolyte were dosed, after mixing it is allowed to settle. The supernatant from the collection tank is further treated through series of pleated cartridge filters followed by membrane filtration with specialised membrane (i.e. Nano filtration) to reject bi valent ions like calcium, magnesium and sulphate salts and increases the concentration of NaCl salt in the permeate. The reject from the membrane contains high concentration of sulphate, calcium and magnesium. The permeate from membrane being taken to salt pans and the rejects being taken to separate salt pans for natural evaporation and crystallization. After drying the salt is scooped out. The permeate forms the Sodium Chloride is to be called as Grade-I salt and rejects forms sodium sulphate salts with calcium and magnesium which is to be called as Grade-II salts.

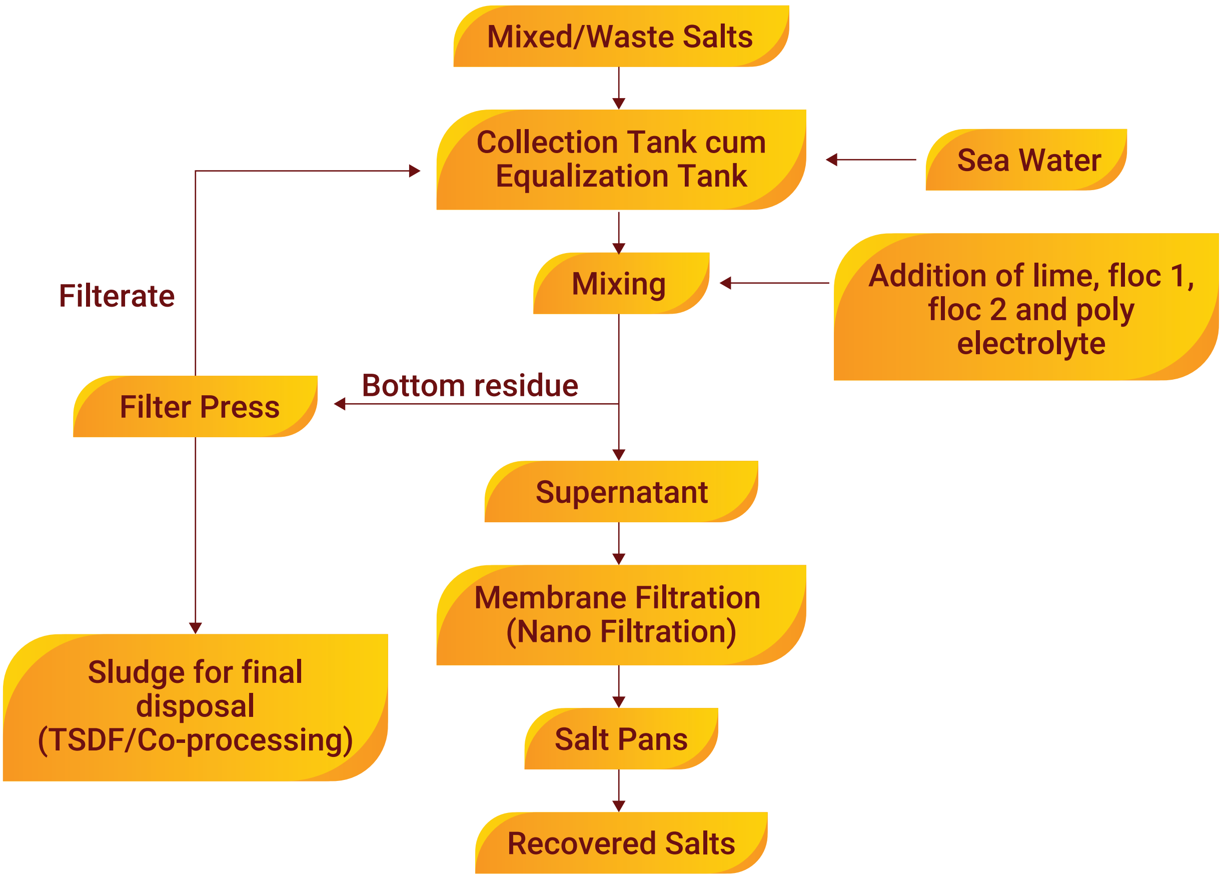


Fig 1: Process flow diagram for utilization of waste salts for recovery of salts for industrial use.

1.3 Product Usage / Utilization

The recovered salts manufactured using mixed/waste salts generated from CETPs/ETPs of Textile manufacturing/processing industries shall be applicable for industrial use only.
The unit shall label its product (salts) manufactured by utilizing aforesaid hazardous waste as "These salts have been manufactured by utilizing mixed/waste salts generated from CETPs/ETPs of Textile manufacturing/processing industries"

1.4 Standard Operating Procedure for utilization

This SoP is applicable only for utilization of mixed/waste salts generated from Reject Management System installed for treatment of concentrated saline liquor in CETPs/ETPs of Textile manufacturing/processing industries.

1) Hazardous waste i.e. mixed/waste salts generated from CETPs/ ETPs of Textile manufacturing/processing industries shall be collected in drums or leak-proof bags and transported in SPCB/PCC authorized covered vehicles with requisite safeguards.

2) Mixed/waste salts shall be stored under 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 shall have adequate slope to collect spillage, if any, and the spillage shall be collected in a pit and transferred to collection cum equalization tank or Evaporator/ETP, as applicable.

3) The handling of hazardous waste as well as chemicals (lime, floc, poly electrolyte, etc.) shall be carried out using mechanical means with minimal manual intervention.

4) There shall be a designated storage for chemicals to be used in utilization process.

5) Transfer of mixed/waste salts as well as other chemicals from their respective storage shed shall be transferred preferably through pump system, to eliminate the possibility of fugitive emission.

6) The fugitive emission anywhere near the work zone shall be extracted through APCD i.e., Pulsejet Bag Filter and stack of adequate height, if required.

7) Uniform mixing of mixed/waste salts with sea water and other chemicals shall be achieved using mechanised mixing unit (such as paddle type mixer) in equalization tank.

8) The collection tank shall be constructed with hopper bottom so as to enable to collect the settle able sludge and to pump the same for further treatment. This chemical sludge collected at bottom of the tank shall be dewatered in the Filter Press. The filtrate to be recycled back in collection cum equalization tank. The sludge shall be sent in cement plant for co-processing or TSDF for final disposal and/or in accordance of authorization condition.

9) The unit shall provide adequate area of salt pans as per requirement of recovery of salts as given below in Section 1.8.

10) The unit shall ensure the quality of recovered salt of Grade-I and Grade-II for suitable industrial use and its suitability from recognized Institute/Organization. Quality report of salts shall be submitted alongwith quarterly analysis reports to concerned SPCB/PCC.

11) No Objection Certificate/statutory permissions (such as coastal regulatory zone approval & others) shall be obtained prior to the utilization of mixed/waste salts, as applicable.

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 mixed/waste salts, the unit shall obtain authorisation for collection, transportation, storage and utilization of hazardous 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.

1.5 Record/ Returns Filing

1) A log book with information on source, quantity, date wise utilization of mixed / waste salts generated from CETPs / ETPs of Textile manufacturing / processing industries 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 waste utilized, hazardous waste 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 wastes consumed, its source, products generated or resources conserved (specifying the details like, type and quantity of resources conserved) to the concerned SPCB.

1.6 Standards

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

PM_{10}	5 mg/m^3 TWA*(PEL)
Ammonia	35 mg/m^3

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

2) 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.

3) 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.

1.7 Siting of Industry

Facilities for utilization of mixed/waste salts generated from generated from CETPs/ETPs of Textile manufacturing/processi ng industries shall be established in accordance with Consent to Establish issued by the concerned SPCB/PCC.

1.8 Size of Plant and Efficiency of Utilisation

1 MT of mixed/waste salts in 15,000 litres of sea water along with 60-70 kg of chemicals shall produce 1450 Kg salts. Chemicals required for 1 MT of mixed/waste salts is lime (15-20 Kg), Ferrous sulphate (20-25 Kg), Floc 1 & 2 (1 5-20 Kg each) and Polyelectrolyte (0.25-0.50 Kg).

Therefore, requisite facilities of adequate size of storage shed and other plants and machineries as given in para 1.9 given below shall be installed accordingly

1.9 Checklist of Minimal Requisite Facilities

S.No	Particulars
1.	Covered storage shed of adequate capacity to store hazardous waste and chemicals.
2.	Cool, dry well-ventilated covered storage shed(s) for hazardous waste and chemicals storage, product storage and process activities with completely paved area within premises.
3.	Mechanized conveyer or pumping system for handling and transfer of mixed/waste salts and chemicals to collection cum equalization tank.
4.	Collection cum equalization tank of adequate capacity.
5.	Membrane filtration with specialised membrane (i.e. Nano filtration)
6.	Evaporator (Solar/Single or Multiple Effect) and/or Effluent treatment plant, as applicable, to treat wastewater/spillages.
7.	Collection pit for collection of spillages from the working, storage and unloading area.
8.	Imperviously lined Salt Pans of adequate capacity verified by SPCB/PCC.
9.	Pulse Jet Bag Filters (APCD) for fugitive emission, if required.
10.	No Objection Certificate/statutory permissions (such as coastal regulatory zone approval & others), as applicable.

COMPONENTS OF SALT PURIFICATION PLANT

Filtration Plant

Mixing Tank

Salt Recovery Plant

Salt Pan

Sludge
(Generated from Manifacturing Process & ETP)

Utilization of process sludge and primary ETP sludge generated from Pulp & Paper Industries for producing Paper Board/ Mill Board/ Card Board

SOP - 13

ETP sludge from Pulp & Paper Industries

(Category: 35.3 of Schedule I of HOWM Rules, 2016)

1.0 Utilization of Process Sludge and Primary Sludge of ETP

This SoP is applicable only for utilization of Process Sludge & Primary Sludge of ETP as described below:

Type of HW	Source of generation	Recovery/Product
Process and primary sludge of ETP – Pulp and Paper	Paper & Pulp Industry	Paper Board/ Mill Board / Card Board

The utilization of waste pulp from process sludge & primary sludge from ETP of Pulp & Paper Industry to produce Paper board/Mill board shall involve any of the following steps;

(a) Dewatered primary ETP Sludge → mix waste pulp from process along with recycled water in mixer → pressing & cutting in Board Machine → sun drying → Paper Board/Card Board/Sun Dry Paper Board.

Or

(b) Beating of paddy/wheat straw/ jute bag → mix with primary ETP sludge in mechanical agitator along with recycled water → pressing & cutting in board machine → sun drying → Paper Board/Card Board/Sun Dry Paper Board.

1.1 Standard Operating Procedure

1) Collection Storage & Handling of Process and primary sludge of ETP of Pulp & Paper industry

- The dewatered primary ETP Sludge & Process Sludge shall be procured in trucks/ trolleys.
- The unit shall store the primary ETP Sludge & Process Sludge in covered storage shed(s) within premises, so as to eliminate rain water intrusion. Further, the sheds shall have proper slope and spillage collection pit so as collect spillages/floor washings. The collected spillages/floor washings shall be channelized to Effluent Treatment Plant for their treatment/recycling.
- Transportation of primary ETP Sludge & Process Sludge shall be carried out by sender or receiver (utilizer) after obtaining authorization from the concerned SPCB under the Hazardous and Other Wastes (Management & Transboundary Movement) Rules, 2016.

- It shall be ensured that primary ETP Sludge & Process Sludge is procured from the industries who have valid authorization for the same from the concerned SPCB as required under Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016.

2) Use of secondary ETP sludge generated from Pulp & Paper Industry is not permitted.

3) Handling/transfer of primary ETP Sludge & Process Sludge is required to be done using mechanized system (such as trolley, loader, etc.).

4) The entire process area shall have boundary wall or fencing with proper slope, periphery drainage and collection pit followed by channelization to Effluent Treatment Plant for treatment. Sun drying of board shall be done within the premises.

5) The unit shall ensure that all personnel involved in the plant operation shall wear proper personal protective equipment such as masks, safety gloves, goggles, safety shoes etc.

6) The effluent generated during the utilization process shall be recycled back to beater/pulper ensuring zero liquid discharge, else the treated wastewater generated shall meet wastewater discharge standards stipulated in the consent issued by concerned SPCB.

7) The monitoring of the effluent for the parameters specified in the Consent issued by the concerned SPCB shall be carried out quarterly through NABL/EPA accredited laboratory and report shall be submitted quarterly to the concerned the SPCB.

8) The unit shall submit quarterly and annual information on quantity of ETP Sludge & Process sludge procured & utilized and its source, quantity of waste water generated, treated & recycled or resources conserved (specifying the details like type and quantity of resources conserved) to the concerned SPCB.

9) The unit shall maintain a passbook issued by concerned SPCB wherein the following details of each procurement of Process sludge & Primary Sludge (of pulp & paper industry) shall be entered:

   - Address of the sender
   - Date of dispatch
   - Quantity procured
   - Seal and signature of the sender
   - Date of receipt in the premises

10) The unit shall maintain record of Process sludge & Primary Sludge utilized, residues 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 SPCB.

11) A log book with information on source of procurement, quantity, date wise utilization of the same, quantity of products manufactured, hazardous waste generation and its disposal etc. shall be maintained including analysis report of emission monitoring & effluent discharged, as applicable.

12) In case of environmental damages arising due to improper handling of hazardous wastes including accidental spillage during generation, storage, processing, transportation and disposal, the unit 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.

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

1.2 Checklist of Minimal Requisite Facilities

S. No	Requisite Facilities
1.	Storage shed(s) for dewatered primary ETP Sludge & waste pulp (Process sludge) of adequate size to store 7 days of consumption
2.	Beater/Mechanical Agitator/Mixer
3.	Board Machine with stainer mesh and roller press
4.	Mechanized handling system for Process Sludge & ETP Sludge
5.	Fencing/ boundary wall around the drying area
6.	Provision for collection and transfer of spillage water to ETP or for recycling

Components / Machineries involved in the Production of Paper Board from ETP Sludge

Sludge as raw material

Squeezers machines

Paper pulp in settling tank

Press Machines

Utilization of Vanadium Sludge Generated from Alumina Refineries

SOP - 22

Vanadium Sludge from Alumina Refineries

(Category: 11.7 of Schedule I of HOWM Rules, 2016)

1.0 Utilization of Vanadium Sludge:

Type of HW	Source of generation	Recovery/Product
Vanadium Sludge-Category 11.7 of schedule-I of HOWM Rules, 2016	Alumina refineries	Vanadium metal

1.1 Source of Waste

i. Vanadium sludge is generated in Bayer's process in production of alumina from bauxite, which involves treating bauxite with alkali under high pressure forming Bayer's liquor that contains substantial amount of vanadium salts as impurities. Vanadium sludge gets precipitated, when vanadium containing bayer's liquor is cooled down or air is blown through. Vanadium sludge contains 10-20% vanadium as vanadium pentoxide.

ii. Vanadium sludge contains about 38-45% moisture, 10-20% vanadium pentaoxide, 8-15% sodium oxide and 2.5-3.0% alumina.

1.2 Proposed Process

The utilization process involves mixing of vanadium sludge with water followed by neutralization of solution with hydro chloric acid. Then solution is filtered through filter press and mother liquor containing dissolved V_2O_5 reacts with ammonium chloride powder resulting into precipitation of ammonium meta vanadate (AMV) in the solution, which is centrifuged and washed for recovery of vanadium pentaoxide from mother liquor. The centrifuged precipitate is dried in hot air oven dryer and recovers the vanadium metal after thermite process.

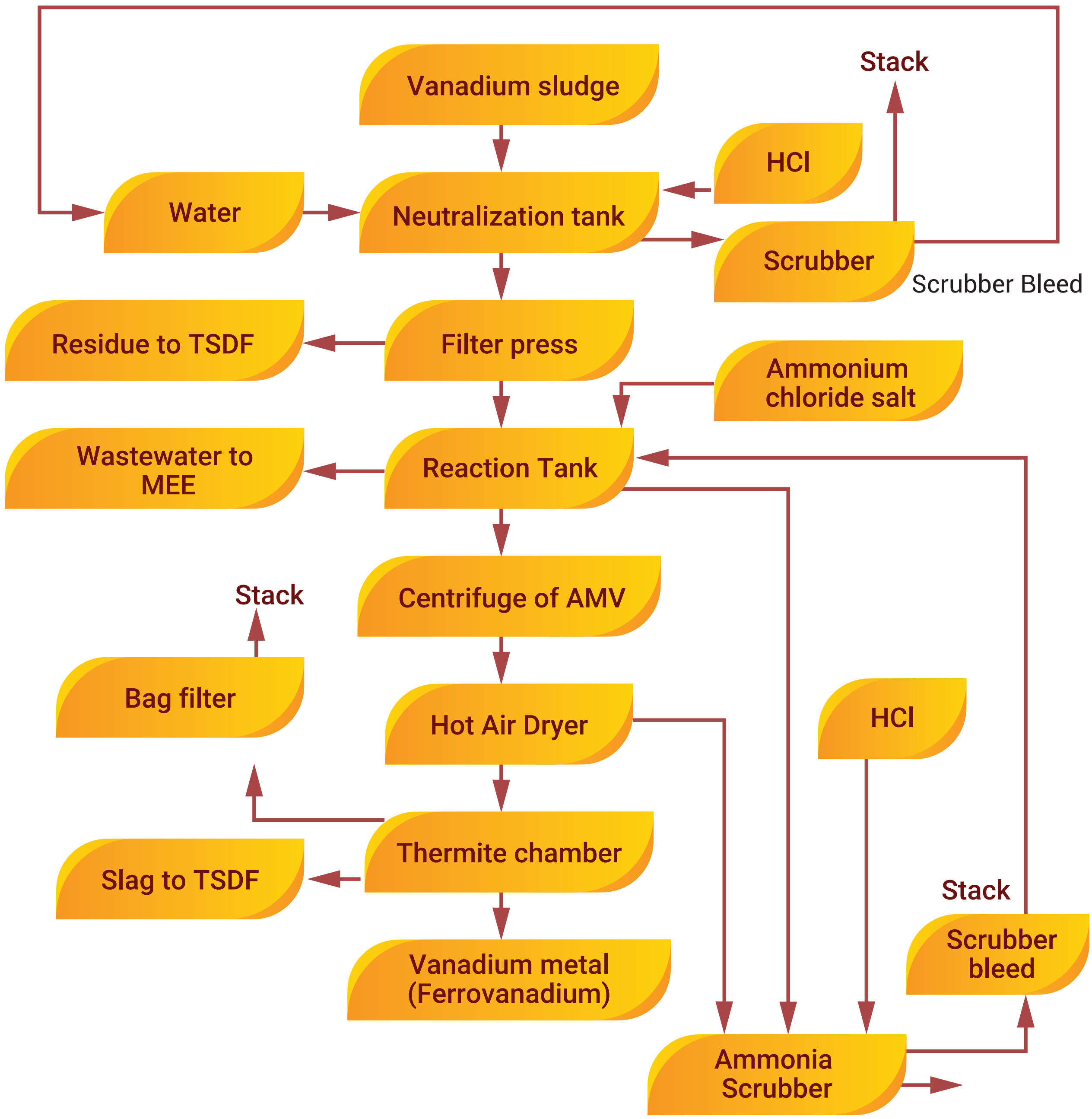


Fig 1: Process Flow Diagram

1.3 Product Usage/ Utilization

The recovered vanadium metal is used in steel industry as additive. It is used for the production of rust resistant, spring and high speed tool steels. It is also added to steels to stabilise carbides.

1.4 Standard Operating Procedure (SoP) for utilization

This SoP is applicable only for the utilization of vanadium sludge generated from Alumina refineries industries during Bayer's process in production of alumina from bauxite to produce vanadium metal suitable for utilization in steel industry.

1) The vanadium sludge should be transported in HDPE/jambo bags mounted on vehicles fitted with requisite safeguards ensuring no spillage of waste.

2) There should be a designated space for unloading of vanadium sludge jambo bags. The receiving storage area shall be placed above the ground and contained with low raise bund wall & acid-alkali proof floor with slope to collect spillages, if any, into collection pit.

3) The unit shall store hazardous waste as well as ammonium chloride salt under cool, dry and well-ventilated covered storage shed(s) within premises, as authorized by the concerned State Pollution Control Board/Pollution Committee under Hazardous and Other Wastes (Management &Transboundary Movement) Rules, 2016 so as to eliminate rain water intrusion.

4) There shall be no manual handling of vanadium sludge and ammonium chloride salt. Mechanical loading or bucket elevator shall be used for transfer of vanadium sludge and ammonium chloride salt to the reaction tank.

5) The entire process area shall have leak-proof and acid-alkali proof floor tiles with adequate slope to collect spillages, if any, into a collection pit. The spillages from collection pit shall be transferred to reaction tank, as the cases may be, through chemical process pump.

6) Neutralization tank should be connected with scrubber followed by stack of minimum height of 06 m above the roof top or as prescribed by the concerned SPCB/PCC, whichever is higher. Stack shall have easy access to port hole for conducting stack emission monitoring. If water alone is used as scrubbing medium in the scrubber, the bleed water from scrubber shall be used as water for mixing vanadium sludge.

7) Transfer of hydrochloric acid shall be done only through separate chemical pipeline to reaction tanks.

8) There shall be separate storage area for HCl tank in HDPE tank or acid proof tank above the ground with low raise bund wall & acid/alkali proof floor with slope to collect spillages, if any, into collection pit.

9) The neutralized liquid from neutralization tank shall be filtered through filter press to remove particles from the liquid prior to transfer of the same to the reaction tank.

10) This mother liquor shall be transferred to reaction tank through mechanized / chemical process pump.

11) Transfer of ammonium chloride salt to reaction tank shall be carried out through bucket/mechanized system.

12) Precipitated ammonium meta vanadate shall be separated from mother liquor by gravity separation and the slurry transferred to centrifuge through slurry pump or any other mechanical process.

13) The recovered ammonium meta vanadate (AMV) from centrifuge after washing can be transferred to dryer unit manually.

14) 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 such as Chemical goggles, impervious gloves of chemically resistant material (rubber or neoprene), Body suits, aprons, and/or coveralls of chemical resistant material and impervious boots of chemically resistant material.

15) Ammonia gas, release during oxidation of ammonium meta vanadate in hot air dryer at temperature of around 350°C to produce vanadium pentoxide, shall be channelized through duct to a scrubber (preferable with venture scrubber) and released through stack of minimum height of 06 m above the roof top or as prescribed by the concerned SPCB/PCC, whichever is higher. HCl shall use as an absorbing media for recovery of ammonium chloride, shall be reused in the reaction tank, if possible.

    The reaction tank should be covered with FRP (or any suitable acid/alkali proof) lid connected to the aforesaid common scrubber through a suction duct with isolation valve.

16) Vanadium pentoxide along with aluminium powder, iron chips and CaF_2 shall be charged in thermite furnace for exothermic reaction at temperature of about 1800°C-1900°C. Thermite furnace shall be connected with bag filters which shall be connected to stack of minimum 30 meters height above the ground.

17) The slag generated during thermite process shall be stored in designated area and shall be sent to TSDF for disposal.

18) Treatment and disposal of waste water:

    The following are the sources of waste water from utilization process;

    a) Spent mother liquor

    b) Scrubber bleed from Neutralization tank, if not used in utilization process

    c) Floor washing/reactor wash/vehicle wash/spillages, etc.

    The Spent mother liquor, after reuse during the utilization process, shall be collected in separate tank for treatment with sodium hydroxide or calcium hydroxide followed by further treatment in Multiple Effect Evaporator (MEE). MEE salt should be sent to TSDF for encapsulation and secured land filling. Depending upon waste water quality generated from Floor washing/reactor wash/vehicle wash/spillages Scrubber bleeds and Scrubber bleed from Neutralization tank, if any, there may be requirement of effluent treatment plant if the same cannot be directly treated in MEE.

The condensate of MEE and treated waste water shall be used for neutralization in its HW utilization process/ floor washing/ reactor wash/ vehicle wash/ spillages etc. and there shall not be any discharge of treated waste water.

19) It shall be ensured that vanadium sludge is procured from the industries who have valid authorization for the same from the concerned SPCB/PCC as required under Hazardous and Other Wastes(Management and Transboundary Movement) Rules, 2016.

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

21) The residue generated from filter press, ETP sludge (if any), residue from scrubber and bag filter, MEE residue, product spillages etc. shall be collected and temporarily stored in HDPE drums / bags in a dedicated hazardous waste storage area and sent to TSDF within 90 days from generation of the waste. Such storage area shall be covered with proper ventilation.

22) The unit shall maintain a passbook issued by concerned SPCB wherein the following details of each procurement of vanadium sludge waste shall be entered:
    - Address of the sender
    - Date of dispatch
    - Quantity procured
    - Seal and signature of the sender
    - Date of receipt in the premises

23) A log book with information on source and date of procurement of each type of the said hazardous wastes, quantity, date wise utilization of the same, quantity of vanadium metal manufactured, hazardous waste generation and its disposal, etc. shall be maintained including analysis report of emission monitoring & effluent discharged, as applicable.

24) Transportation of vanadium sludge and filter press & MEE residues generated during utilisation shall be carried out by the sender or receiver (utilizer/TSDF operator) as per the authorization issued by concerned SPCB under the Hazardous and Other Wastes (Management &Transboundary Movement) Rules, 2016.

25) The unit shall maintain record of hazardous waste utilised, residues 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.

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

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

1.5 Standards

1) Emissions from stack connected to neutralization tank followed by scrubber shall comply with the following:

   i. PM - 150 mg/Nm^3

   ii. HCl vapour & mist – 35 mg/Nm^3

2) Emission from stack attached to reaction vessel and thermite chamber reaction vessels shall comply with the following:

   i. PM – 150 mg/Nm^3

   ii. Ammonia – 5 mg/Nm^3

   (Ammonia standard has been arrived based on emission of ammonia measured during trial utilization study)

3) Emission from stack connected to Bag Filters shall comply with PM emission of 150 mg/Nm^3.

4) Stringent emission standards may be prescribed by the concerned SPCB/PCC. Other emission/ discharge standard shall be as per norms prescribed by concerned SPCB/PCC.

5) Fugitive emissions in the work zone shall comply with following standards (Reference: OCCUPATIONAL SAFETY AND HEALTH STANDARDS 1910.1000):

Ammonia - 25 ppm (18 mg/m^3) TWA*

Respirable dust (PM_{10}) – 5000 µg/m^3 TWA

**TWA-Time-weighted average*
The Permissible Exposure Limit is 8-hour TWA.

A ceiling limit is one that may not be exceeded for any period of time, and is applied to irritants and other materials that have immediate effects.

6) Monitoring of the specified parameters for source emission and work zone shall be carried out by NABL/EPA/ISO 17025 accredited laboratories quarterly and the results shall be submitted quarterly to the concerned SPCB/PCC.

1.6 Siting of Industry

Facilities for processing of vanadium sludge should preferably be located in a notified industrial area or industrial park/estate/cluster.

1.7 Size of Plant & Efficiency of utilization

1000 kg of vanadium sludge may yield 175 kg of vanadium metal. Other raw materials required are 3000 litre water, 363 litre HCl, 240 kg ammonium chloride salt, 79 kg iron chips, 95 kg aluminium and 11 kg calcium fluoride. Requisite facilities of adequate size shall be installed accordingly.

1.8 On-line detectors/Alarms/Analyzers

Online detectors/alarms/analyzers are not recommended for batch type processing units. However, in case of continuous process operations, SPCB/PCC may recommend online stack monitoring for PM emission in stack attached to thermite process.

1.9 Check list of Minimal Requisite Facilities

S.No.	Requisite Facilities
1.	Storage shed(s) for storage of vanadium sludge in jambo bags or bags suitable for alkaline salt only under cool, dry, well-ventilated covered storage shed(s) within premises.
2.	Covered hazardous waste storage area to store residues generated from ETP (if any), scrubber residues, MEE salt, slag, product spillages etc. in HDPE bags/drums.
3.	Acid-alkali proof flooring in process area including the areas of reception, storage and handling of vanadium sludge, ammonium chloride salt and HCl.
4.	Chemical pumps for transfer of acidic liquids and slurry pump (optional) for transfer of reaction mass from reaction vessel.
5.	Neutralization tank adequate size with suction hood connected to scrubber followed by stack of minimum height of 06 m above the roof top or as prescribed by the concerned SPCB/PCC, whichever is higher.
6.	Chemical pumps for transfer of mother liquor and leached liquid solution.
7.	Reaction vessels of adequate size covered with FRP (or any suitable acid-alkali proof) lid with suction hood connected to scrubber followed by stack of minimum height of 06 m above the roof top or as prescribed by the concerned SPCB/PCC, whichever is higher.
8.	Hot Air Dryer with fume / dust extraction system with suction ducts and may have common scrubber and stack of Reaction vessel or separate scrubber followed by stack of minimum height of 06 m above the roof top or as prescribed by the concerned SPCB/PCC, whichever is higher.
9.	Centrifuge for recovery and washing of ammonium meta vanadate precipitate.
10.	Filter press unit for removal of silica and other particles.
11.	Separate storage tank and pipeline for HCl.
12.	Multi effect evaporator (MEE) for treatment of neutralized mother liquor/ floor washing/ tank and vehicle washing so as to achieve zero liquid discharge.

13.	Thermite chamber with pollution control device equipped with bag filters attached to stack of 30 m height above ground level.
14.	Buffer storage tank with adequate capacity to store minimum one week of spent mother liquor/floor washing/tank and vehicle washing generated so as to store the same in case of unforeseen circumstance/breakdown of MEE.
15.	First aid and appropriate fire fighting equipment.

Utilization of ETP Sludge generated from Pulp & Paper Industry

SOP - 24

ETP sludge from Pulp & Paper Industries

(Category: 35.3 of Schedule I of HOWM Rules, 2016)

1.0 Utilization of ETP Sludge

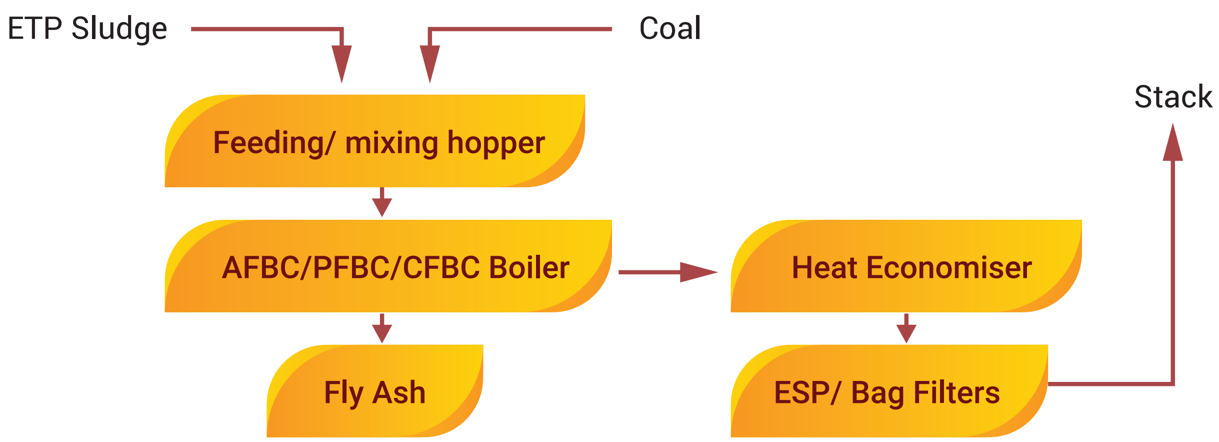
Type of HW	Source of generation	Recovery/Product
Chemical Sludge (Primary sludge) of ETP including sludge from secondary clarifier	Paper & Pulp Industry	For energy recovery in Atmospheric Fluidised Bed Combustion (AFBC) Boiler/ Pressurized Fluidized Bed Combustion (PFBC) Boiler/ Circulating Fluidized Bed Combustion (CFBC) Boiler for steam or electricity generation

1.1 Source of Waste

Sludge in pulp and paper industry during treatment of wastewater from the primary clarifier and secondary clarifier. The Chemical sludge of primary clarifier is categorized as hazardous waste as per S.No 35.3 of schedule-I of HOWM Rules, 2016, that can be utilise as energy resource in AFBC boiler.

1.2 Proposed Process

The utilisation process involves mixing of ETP sludge (we weight) with coal (in the ratio of 20: 80) and feeding this mixture in AFBC boiler as energy resource. The flue gases from the boiler after passing through heat economiser is cleaned in Electrostatic precipitator (ESP) or bag filters and dispersed into atmosphere through stack.



1.3 Product Usage / Utilization

The mixed ETP Sludge with coal is used as supplementary energy resource in AFBC/PFBC/CFBC boiler of power plant which will conserve the natural resource i.e. coal or other conventional fuels (permitted by concerned SPCB under Air Act, 1981).

1.4 Standard Operating Procedure for utilization

This SoP is applicable only for utilization of ETP Sludge generated from primary and secondary clarifier units of Effluent Treatment Plant as a supplementary energy resource in AFBC /PFBC/CFBC boiler.

1) The dewatered primary ETP Sludge & Secondary Sludge (with moisture not more than 40 %) generated from its own Effluent treatment Plant shall be collected and stored in pits under covered storage shed(s) within premises, so as to eliminate rain water intrusion. Further, the storage sheds shall have proper slope and seepage collection pit so as collect seepage/floor washings. The collected seepage/floor washings shall be channelized to Effluent Treatment Plant for further treatment.
2) Utilisation of primary ETP Sludge & Secondary Sludge shall not exceed 20 % of the coal consumed in AFBC boiler.
3) Transfer of ETP Sludge from the storage shed shall be carried out through mechanical conveyor system to storage hopper/mixing unit.
4) Uniform mixing of coal and ETP sludge in the ratio of 20: 80 (ETP Sludge: Coal) shall be achieved using appropriate mechanized mixing units
5) The uniformed mixture shall be transfer to the AFBC/PFBC/CFBC boiler through mechanised system.
6) The AFBC boiler shall maintain the temperature not less than 850°C.
7) Utilization of ETP Sludge shall not be carried out during un-stable/breakdown conditions in the boiler.
8) The hot flue gases shall be passed through heat economiser and treated in Electrostatic Precipitator (ESP) or bag dust collectors connected to stack of height as prescribed by SPCB.
9) The unit shall ensure that all personnel involved in the plant operation shall wear proper personal protective equipment such as masks, safety gloves, goggles, safety shoes etc. suitable for power plant operations.
10) The unit shall obtain authorization from the concerned State Pollution Control Board under the Hazardous and Other Wastes (Management & Transboundary Movement)

Rules, 2016, for generation, storage and utilisation of ETP Sludge.

11) The unit shall submit quarterly and annual information on ETP Sludge generated, consumed, quantity utilised or resources conserved (specifying the details like type and quantity of resources conserved) to the concerned SPCB. Further, the unit shall also submit quarterly analysis report of fly ash generated during utilisation of ETP sludge for initial one year.

12) A log book with information on source, quantity, quality, date wise utilization of ETP Sludge shall be maintained including analysis report of emission monitoring & effluent discharged, as applicable.

13) The unit shall maintain record of hazardous waste utilised 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 SPCB.

14) In case of environmental damages arising due to improper handling of hazardous wastes including accidental spillage during generation, storage, processing, transportation and disposal, the unit 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.

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

1.5 Standards

(1) Source emission standards shall comply with following :

(i)	PM	As per the standards notified vide notification no. S.O. 3305 (E) dated 07/12/2015
(ii)	SO_2	
(iii)	NO_x	
(iv)	CO : 100 mg/Nm^3	Or any stringent standards as prescribed by SPCB
(v)	TOC : 20 mg/Nm^3	
(vi)	HCl: 50 mg/Nm^3	

(2) Monitoring of the specified source emissions shall be carried out quarterly. The monitoring shall be carried out by NABL/EPA accredited laboratories and the results shall be submitted to the concerned SPCB quarterly.

1.6 Siting of Industry

This SOP is applicable only for utilization of ETP sludge in power plant or captive boiler already in operation, hence siting is not applicable.

1.7 Size of Plant & Efficiency of utilisation

This SOP is applicable to all AFBC/PFBC/CFBC boiler irrespective of size of plant. The unit shall utilise ETP sludge in the ratio of 20: 80 along with coal (i.e. (ETP Sludge: Coal)). Hence, requisite facilities of adequate size shall be installed accordingly.

1.8 On-line detectors / Alarms / Analysers

Online emission analysers for PM, SO_2 and NO_x in the stack shall be installed and connect the online emission data to the concerned State Pollution Control Board and CPCB server.

1.9 Check list of Minimal Requisite Facilities

S. No	Requisite Facilities
1.	Covered Storage shed (s) for dewatered primary ETP Sludge & secondary sludge of adequate size to store 07 days of consumption
2.	Mechanised systems for handling & transfer of ETP Sludge and coal
3.	Appropriate mechanised system for mixing of coal and ETP sludge.
4.	Boiler base on Atmospheric Fluidised Bed Combustion (AFBC) / Pressurized Fluidized Bed Combustion (PFBC)/ Circulating Fluidized Bed Combustion (CFBC)
5.	Flue gas heat economiser
6.	Electrostatic Precipitators or Bag filters
7.	Stack of height as prescribed by SPCB with easy access to port hole, for conducting stack monitoring
8.	Online analyzers for PM & CO emission monitoring in stack

Utilization of ETP sludge generated from Textile Industries to use as a Supplementary fuel along with Coal in Thermic Fluid Heater (TFH) / Boiler

SOP - 57

ETP sludge from Textile Industries

(Category: 35.3 of Schedule I of HOWM Rules, 2016)

1.0 Utilization of ETP Sludge

Type of HW	Source of generation	Recovery/Product
ETP Sludge generated from secondary treatment of waste water generated from Textile Industry ETP (Category 35.3 of Schedule I of HOWM Rules, 2016)	Effluent Treatment Plant of Textile Industry	For energy recovery in Captive Thermic Fluid Heater (TFH) / Boiler.

1.1 Source of Waste

Sludge generated during secondary treatment of wastewater generated from textile industries is categorized as Hazardous waste as per Schedule – 1 Category – 35.3 of HOWM Rules, 2016 which are required to be disposed in authorized disposal facility in accordance with authorization condition, when not utilized as resource/energy recovery. The said waste can be utilized as energy resource in Thermic Fluid Heater / Boiler.

Table 1- Typical Characteristics of Textile ETP Sludge

Sl. No	Properties / Parameters	Unit	Typical Characteristics
1.	pH	--	7.36
2.	Moisture	%	17.1
3.	Gross Calorific Value (GCV)	Kcal/Kg	4442
4.	Sulphur	%	0.66
5.	Halogenated Aromatic Compounds	mg/kg	Absent
6.	Total Halogens (C1+Br+I)	mg/kg	98.2
7.	Heavy Metals	mg/kg	BDL

1.2 Utilization Process

The utilization process involves the mixing of ETP sludge (dry weight) with coal (in the ratio of 20:80) and feeding this mixture in Thermic Fluid Heater /Boiler as energy resource. The flue gas from TFH/ Boiler after passing through heat economiser followed by Electro Static Precipitator (ESP) or Bag filters or wet scrubber and dispersed through stack to the atmosphere.

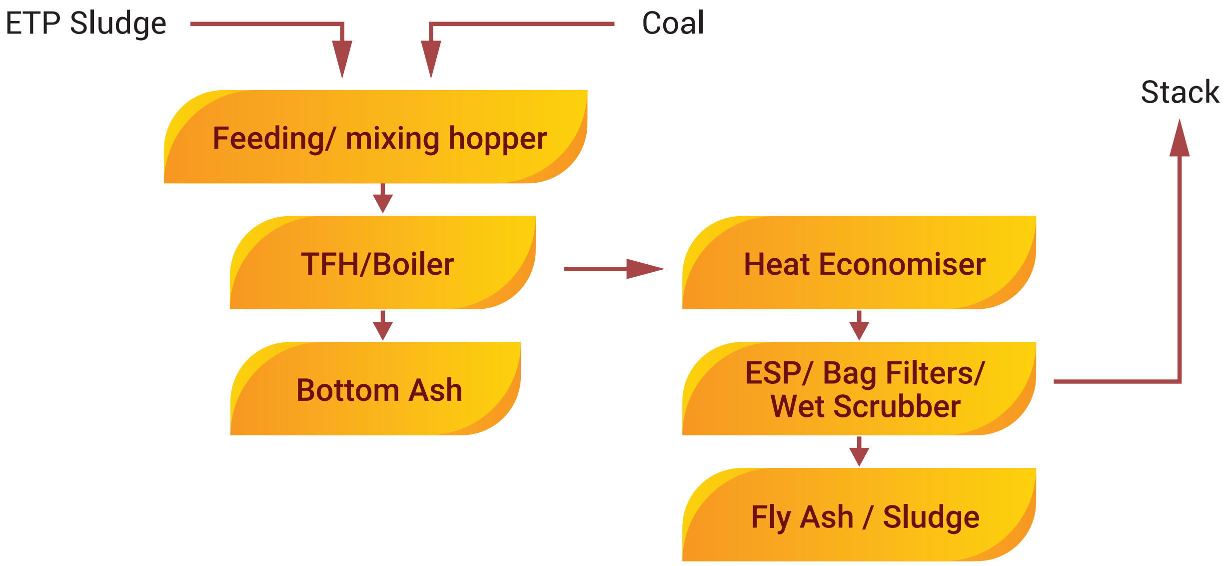


Fig 1: Process flow diagram for utilization of ETP Sludge.

1.3 Product Usage / Utilization

The dried ETP sludge mixed with coal is used as a supplementary energy resource in TFH/ Boiler which will conserve the natural resource i.e. coal or conventional fuels (permitted by concerned SPCB under the Air Act, 1981).

1.4 Standard Operating Procedure for utilization

This SoP is applicable only for the utilization of ETP sludge generated from the secondary clarifier unit of Effluent Treatment Plant (ETP) in Textile Industry, as a supplementary energy resource in TFH/Boiler.

1) The dewatered Secondary ETP Sludge (with moisture not more than 20%) generated from its own Effluent treatment Plant of textile industries shall be collected and stored under covered storage shed(s) within premises, so as to eliminate rain water intrusion. Further, the storage sheds shall have proper slope and seepage collection pit so as collect seepage/floor washings. The collected seepage/ floor washings shall be channelized to Effluent Treatment Plant for further treatment.

2) Utilisation of Secondary ETP Sludge shall not exceed 20% of the coal consumed in TFH/Boiler.

3) Transfer of ETP Sludge from the storage shed shall be carried out through mechanical conveyor system to storage hopper/mixing unit.

4) Uniform mixing of coal and ETP sludge in the ratio of 20:80 (ETP Sludge: Coal) shall be achieved using appropriate mechanized mixing units.

5) The uniformed mixture shall be transfer to the TFH/Boiler through mechanised system.

6) The TFH/boiler shall maintain the temperature not less than 1000^{o}C.

7) Utilization of ETP Sludge shall not be carried out during un-stable/breakdown conditions in the TFH/boiler.

8) The hot flue gases shall be passed through heat economizer and treated in Electrostatic Precipitator (ESP) or bag filters (dust collectors) or wet scrubber, connected to stack with height as prescribed by SPCB.

9) The treated gases shall comply with emission norms and prior to dispersion into atmosphere through stack. The height of stack shall be a minimum of 6 m above the roof top or as prescribed by the concerned SPCB/PCC, whichever is higher.

10) The unit shall obtain authorization from the concerned State Pollution Control Board under the Hazardous and Other Wastes (Management & Transboundary Movement) Rules, 2016, for generation, storage and utilization of ETP Sludge.

11) The unit shall submit quarterly and annual information of ETP Sludge generated, consumed, quantity utilized or resources conserved (specifying the details like type and quantity of resources conserved) to the concerned SPCB. Further, the unit shall also submit quarterly analysis report of ash/ sludge generated during utilization of ETP sludge for initial one year.

12) A log book with information on source, quantity, quality, date wise utilization of ETP Sludge shall be maintained including analysis report of emission monitoring & effluent discharged, as applicable.

13) The unit shall maintain record of hazardous waste utilized and disposed as per From 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 SPCB.

14) Temporary storage of the ash/ sludge should be done inside closed shed/ on HDPE lined platform.

15) Utilization/disposal of ash/sludge should be carried out as per HOWM Rules, 2016.

16) Treatment and disposal of wastewater:

Wastewater generated from floor-washings, spillages, reactor washing, including the wastewater from filtration shall be treated Physico-Chemically in an ETP or may be sent to CETP for final disposal or be treated further in a captive facility to comply with surface water discharge standards.

In case of zero discharge condition by SPCB/PCC, the treated waste water from ETP may be managed as per conditions stipulated by the SPCB/PCC.

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

18) 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.

19) 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. The safety precautions of the worker shall be in accordance with the Factory Act, 1948, as amended from time to time.

1.5 Record/Returns Fillings

The unit shall maintain a passbook issued by concern SPCB wherein the following details of each generation of ETP Sludge shall be entered:

- Date of ETP sludge generation
- Quantity produced

- Date of Receipt in the storage area for utilization
- Quantity utilized per day

1) A log book with information on date of generation of ETP Sludge along with quantity, date wise utilisation of the same, hazardous waste generation and its disposal, etc. shall be maintained including analysis report of fugitive emission monitoring & effluent discharged, as applicable.

2) The unit shall maintain record of hazardous waste utilised., hazardous waste 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 wastes consumed, its source, products generated or resources conserved (specifying the details like, type and quantity of resources conserved) to the concerned S PC B.

1.6 Standards

1) Source emissions from the stack connected to reactors/process stack shall comply with the following standards or as prescribed by the concerned SPCB/PCC. whichever is stringent:

PM SO_2 NO_x		As per the standards notified vide notification no. S.O. 3305 (E) dated 07/12/2015
CO TOC HCl Mist	: 100 mg/Nm^3 : 20 mg/Nm^3 : 50 mg/Nm^3	Or any stringent standards as prescribed by SPCB

2) 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 emissions for specified parameters shall be carried out quarterly. The monitoring shall be carried out by ISO17025 accredited or EPA approved laboratories and the results shall be submitted to the concerned SPCB/PCC on a quarterly basis.

1.7 Siting of the industry

This SOP is applicable only for captive utilization of ETP sludge in a TFH/ boiler of same textile industry already in operation, hence siting is not applicable.

1.8 Size of plant & Efficiency of utilization

This SOP is applicable to TFH/ boiler irrespective of size of plant. The unit shall utilise ETP sludge in the ratio of 20:80 along-with coal (i.e. ETP Sludge: Coal in ratio 20:80). Hence, requisite facilities of adequate size shall be installed accordingly.

1.9 On-line detectors/ Alarms/ Analysers

In case of continuous process operations, online emission analysers for PM, SO, and NOx in the stack shall be installed and the online data be connected to the server of the concerned SPCB/PCC and CPCB Server.

1.10 Checklist of Minimal Requisite Facilities

S. No	Requisite Facilities
1.	Covered Hazardous Waste Storage shed (s) for dewatered Secondary sludge of adequate size.
2.	Mechanised systems for handling & transfer of ETP sludge & Coal
3.	Appropriate mechanised systems for mixing of ETP sludge & Coal
4.	Thermic fluid heater / Boiler
5.	Flue gas heat economizer

6.	APCB like Electro static precipitators/ Bag filters/ Wet scrubber
7.	Stack of height prescribed by SPCB with easy access to porthole, for conducting stack monitoring
8.	Stack to have 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.
9.	Online analysers for PM, SOx & NOx emission monitoring in the stack, in case of continuous process operation.

Utilization of Sludge (generated from spent acid neutralization facility of CETP) for manufacturing of bricks

SOP - 58

Sludge from spent acid neutralization facility

(Category: 35.3 of Schedule I of HOWM Rules, 2016)

1.0 Utilization of ETP Sludge

Type of HW	Source of generation	Recovery/Product
CETP sludge (Category 35.3 of Schedule I of HOWM Rules, 2016)	Spent acid neutralization facility of CETP	For manufacturing of bricks

1.1 Source of Waste

The sludge generated from spent acid neutralization facility of CETP is categorized as Hazardous waste at S.No. 35.3 of Schedule I of HOWM Rules, 2016, that can be utilise as resource in manufacturing of bricks.

Characteristics of sludge form spent acid neutralization facility of CETP are given below:

Parameters	Results	Unit	TCLP Study Unit (mg/l)
Moisture Content	38.7	% by mass	----
Arsenic	0.93	mg/kg	ND
Mercury	ND	mg/kg	BDL
Manganese	10297	mg/kg	16.4
Copper	1563	mg/kg	5.9
Nickel	1173	mg/kg	3.9
Lead	BDL	mg/kg	0.01
Cadmium	BDL	mg/kg	BDL
Chromium	12477	mg/kg	5.6
Zinc	23	mg/kg	0.1
Iron	17.3	% by mass	4.2
Nitrate	2621	mg/kg	36
Fluoride	27	mg/kg	7

1.2 Utilization Process

Sludge generated from spent acid neutralization facility of CETP is added into pan mixer with lime, cement/gypsum and fly ash. The composition of CETP sludge, lime, cement/gypsum and fly ash will be 30 to 60%, upto 15%, 10 to 20% and upto 45% respectively in one brick. The materials, together in proposed composition will be added into Pan Mixer for about 5 minutes for making a homogenous mixture. The homogenous mixture is carried from pan mixer to brick making machine on a conveyor belt. Sludge bricks manufactured will be kept for 3 days under sun drying process and then 28 days for curing by sprinkling water on stacks of bricks.

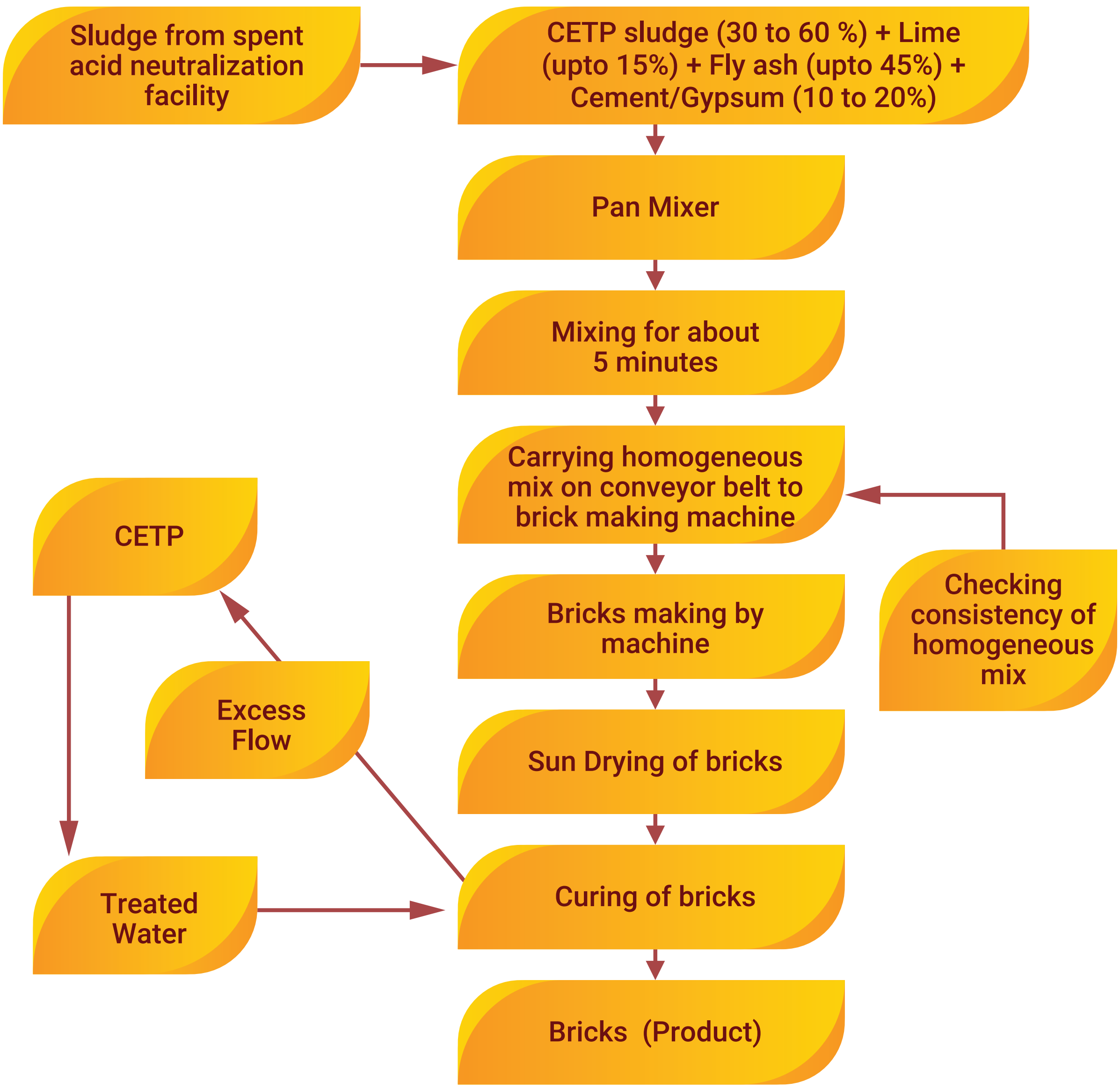


Fig:1 Process flow diagram for utilization of sludge generated from spent acid neutralization facility of CETP

1.3 Product Usage / Utilization

The bricks manufactured using sludge generated from spent acid neutralization facility of CETP shall meet IS 12894:2002 and these bricks shall be used in construction activity like boundary walls, load bearing walls, partition walls and foundation/footing work. Final product shall be TCLP/STLC tested for heavy metals before selling.

The unit shall label its product (bricks) manufactured by utilizing aforesaid hazardous waste as "These bricks has been manufactured by utilizing sludge generated from spent acid neutralization facility of CETP".

1.4 Standard Operating Procedure for utilization

This SoP is applicable only for utilization of Sludge generated from spent acid neutralization facility of CETP for manufacturing of bricks.

1) Sludge generated from spent acid neutralization facility of CETP shall be collected and stored in pits under 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 shall have adequate slope to collect spillage, if any, and the spillage shall be transferred to ETP inlet.

2) The handling of hazardous waste as well as other raw materials shall be carried out using mechanical means with minimal manual intervention.

3) Transfer of sludge as well as other raw materials from their respective storage shed shall be transferred through mechanical conveyor system, to eliminate the possibility of fugitive emission.

4) The fugitive emission anywhere near the work zone shall be extracted through APCD i.e., Pulsejet Bag Filter and stack of adequate height.

5) Uniform mixing of sludge and raw materials shall be achieved using mechanised mixing unit (such as pan mixer) for keeping the consistency of mixture.

6) The hazardous waste i.e. CETP sludge and other raw materials shall be stored in separate pits or rooms covered with shed and properly paved floor with ventilation.

7) The storage area shall be of proper capacity, atleast 30 days storage capacity of per day requirement for each raw materials and hazardous waste.

8) Bricks manufactured by utilizing CETP sludge shall be stored for sun drying curing on a leak proof floor. In case, effluent treated water is being use for curing then proper slope shall be provided with a drain to collect excess water and it should be sent back to CETP for treatment.

9) The unit shall be allowed to use CETP treated water for making quick lime slurry, curing of bricks, etc, in utilization process only if, the treated water meet permissible treated effluent quality standards issued by MoEF&CC vide notification dated 1st January, 2016.

10) 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 form time to time.

11) 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.

12) Prior to utilization of CETP sludge, the unit shall obtain authorization for generation, storage and utilization of CETP sludge from the concerned State Pollution Control Board under Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016.

13) 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 Waste and Penalty”* published by CPCB.

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

15) 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.

1.5 Record / Returns Filing

1) A log book with information on source, quantity, date wise utilization of sludge generated from spent acid neutralization facility of CETP 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 waste utilised, hazardous waste generated and disposed as per Form 3 & shall file annual returns in Form 4 as per Rules 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 wastes consumed, it source, products generated or resources conserved (specifying the details like, type and quantity of resources conserved) to the concerned SPCB.

1.6 Standards

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

   PM_{10} : 5 mg/m^3 TWA*(PEL)

   **PEL: Permissible Exposure Limit*

   **time-weighted average (TWA) measured over a period of 8 hours of operation of process*

2) 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.

3) CETP treated water (in case, used in utilization process) monitoring shall be carried out quarterly for parameters as mentioned in CETP outlet standard issued by MoEF & CC vide notification dated 1st January, 2016 and the results shall be submitted to the concerned SPCB/PCC.

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.

1.7 Siting of Industry

Facilities for utilization of sludge generated from spent acid neutralization facility shall be located within CETP premises and/or in accordance with Consent to Establish issued by the concerned SPCB/PCC.

1.8 Size of Plant and Efficiency of Utilisation

30 tons of sludge with raw materials in the ratio of CETP sludge, lime, cement/ gypsum and fly ash will be 30 to 60% upto 15%, 10 to 20% and upto 45% respectively shall produce 30,000 bricks per day.

Therefore, requisite facilities of adequate size of storage shed and other plants and machineries as given in para 1.9 given below shall be installed accordingly.

1.9 Checklist of Minimal Requisite Facilities

S. No	Requisite Facilities
1.	Covered storage shed of adequate capacity to store hazardous waste and raw materials of at least 30 days requirement.
2.	Cool, dry well-ventilated covered storage shed(s) for hazardous waste and raw materials storage, product storage and process activities with completely paved area within premises.
3.	Mechanized conveyer system for handling and transfer of Sludge (generated from spent acid neutralization facility of CETP).
4.	Pan Mixer, Brick manufacturing machine.
5.	Leak-proof flooring at drying and curing area with drain from excess water collection connected to CETP.
6.	Pulse Jet Bag Filter (APCD) for fugitive emission (if required).

Utilization of ETP Sludge (from secondary clarifier) as fuel in recovery boiler

SOP - 59

Sludge from secondary clarifier

(Category: 35.3 of Schedule I of HOWM Rules, 2016)

1.0 Utilization of ETP sludge from secondary clarifier

Type of HW	Source of generation	Recovery/Product
ETP/ Process sludge (Category 35.3 of Schedule I of HOWM Rules, 2016)	Secondary clarifier of ETP	As a fuel in recovery boiler.

1.1 Source of Waste

The sludge is generated from secondary clarifier of ETP is categorized as Hazardous waste at S. No. 35.3 or Schedule I of HOWM Rules, 2016, that can be utilise as energy resource in Recovery Boiler.

Characteristics of sludge from secondary clarifier are given below:

Parameters	Results	Unit
Total Moisture	78.3	(% by mass)
Ash	30.5	(% by mass)
Volatile Matter	69.1	(% by mass)
Chlorine	0.03	(% by mass)
Carbon	7.65	%
Hydrogen	0.51	%
Sulphur	0.13	%
Nitrogen	0.11	%
Oxygen	2.30	%

1.2 Utilization Process

The utilization process of ETP Sludge involves pumping from secondary clarifier to Centrifuge for thickening. To increase the consistency or to promote thickening, polymer may be added at the inlet of centrifuge along with secondary sludge. The thickened sludge (consistency upto 20%) shall mixed with black liquor and agitated in intermediate mixing tank (IMT), Temperature of IMT shall be maintain at around 100°C. This IMT tank liquor of 52% dry solids at around 100°C is partly transferred Recovery boiler ash mixing tank where ESP dust, salt cake (Na_2SO_4) are added and sent back to IMT and partly going to feed at Finisher effect (1st Effect) inlet as existing procedure to achieve the final Heavy Black Liquor (HBL) concentration i.e., 75% dry solids at temperature of about 120°C. This HBL is stored for 3-4 hours of retention time at 120°C. From storage tank. HBL, shall be send to Recovery boiler for firing purpose through pumping system. HBL is fired in the Liquor fired boiler furnace through liquor spray guns.

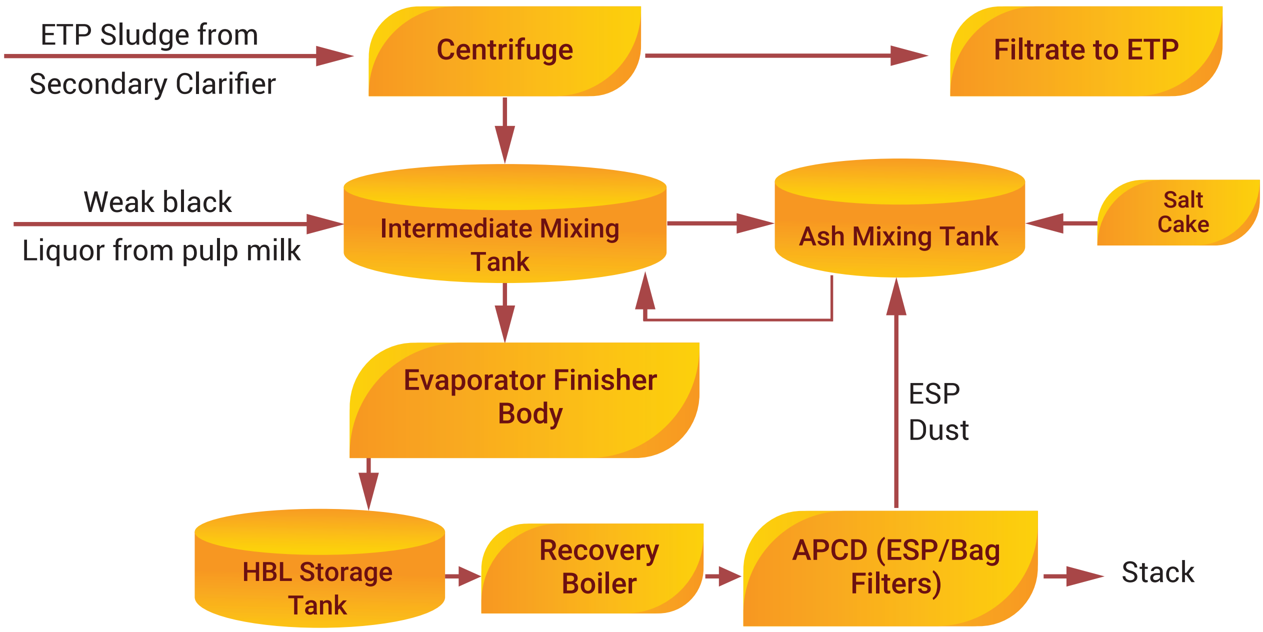


Fig: 1 Process flow diagram for utilization of ETP sludge from secondary clarifier.

1.3 Product Usage / Utilization

The secondary sludge of 2 Tons dry solids/1300 Tons of HBL per day shall be used as energy resource in Liquor fired recovery boiler, which will avoid landfilling of secondary sludge.

1.4 Standard Operating Procedure for utilization

This SoP is applicable only for utilization of ETP sludge generated from secondary clarifier unit of ETP with black liquor generated from pulp and paper industry as energy resource in Liquor fired Recovery boiler.

1) The dewatered ETP sludge from secondary clarifier shall be collected and stored in pits under 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 shall have adequate slope to collect spillage, if any, and the spillage shall be transferred to ETP inlet.

2) The handling of hazardous waste shall be carried out using mechanical means with minimal manual intervention.

3) Transfer of secondary sludge from storage shed or directly from secondary clarifier and Black liquor shall be transferred through completely enclosed pumping/mechanical conveyor system, to eliminate the possibility of fugitive emission.

4) Utilization of secondary sludge shall not exceed 0.15% of the black liquor consumed in recovery boiler.

5) Polymer may be used for the thickening of sludge.

6) Uniform mixing of secondary sludge and black liquor shall be achieved using mechanised mixing unit (such as intermediate mixing tank) where appropriate temperature of around 100°C shall be maintained for keeping the consistency of mixture.

7) ESP Dust of boiler furnace shall be reused and salt cake (Na_2SO_4) be mixed in separate mixing unit by partly transferring previous mixing tank liquor of 50% dry solids.

8) Multiple Effect Evaporator shall he used to achieve final 75% of dry solids concentration i.e. Heavy Black Liquor.

9) This Heavy Black liquor shall be stored in a storage tank at 120°C provided that 3-4 hours of retention time shall be allowed in storage tank.

10) The Heavy Black liquor shall have gross calorific value equal or more than 3000 Kcal/Kg.

11) The Recovery Boiler shall maintain the temperature not less than 1100°C.

12) Utilization of secondary sludge shall not be carried out during un-stable/breakdown conditions in the boiler.

13) The hot flue gases shall be passed through heat economiser (optional) and treated in Electrostatic Precipitator (ESP) or bag dust collectors connected to stack of height as prescribed by SPCB

14) 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 or the worker shall be in accordance with the Factory Act. 1948, as amended from time to time.

15) 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.

16) Prior to utilization of ETP secondary sludge, the unit shall obtain authorisation for generation, storage and utilization of ETP secondary sludge from the concerned State Pollution Control Board under Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016.

17) 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.

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

19) 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.

1.5 Record /Returns Filing

1) A log book with information on source, quantity, date wise utilisation of ETP secondary sludge 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 waste utilized, hazardous waste 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 wastes consumed, its source, products generated or resources conserved (specifying the details like type and quantity of resources conserved) to the concerned SPCB.

1.6 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;

   PM : 100 mg/Nm^3

   SO_2 : 200 mg/ Nm^3

   NO_x : 400 mg/ Nm^3

   CO : 100 mg/ Nm^3

   Or any stringent standards as prescribed by SPCB/PCC

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

   PM_{10} : 5mg/m^3 TWA*(PEL)

   HCL : 35mg/m^3 TWA*(PEL)

   **PEL: Permissible Exposure 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.

1.7 Siting of Industry

This SoP is applicable only for captive utilization of ETP secondary sludge in an existing recovery boiler of pulp and paper industry and cited in accordance with Consent to Establish issued by the concerned SPCB/PCC.

1.8 On-line detectors / Alarms / Analysers

In case of continuous process operations, online emission analysers for PM, SO_2, and NO_x in the stack shall be installed and the online data be connected to the server of the concerned SPCB/PCC.

1.9 Checklist of Minimal Requisite Facilities

S. No	Particulars
1.	Covered storage shed of adequate capacity to store ETP secondary sludge of at least two weeks requirement but preferably for 30 days.
2.	Cool, dry well-ventilated covered storage shed(s) for ETP secondary sludge storage, other raw materials/chemical storage and process activities within premises.
3.	Enclosed pumping/mechanized conveyer system for handling and transfer of ETP secondary sludge from storage arcs to centrifuge and mixing unit.
4.	Centrifuge, Mixing Units & Evaporators.
5.	Storage tank for Heavy Black Liquor.
6.	Recovery Boiler furnace with liquor spray gun.
7.	Electrostatic Precipitators or 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.

Utilization of Brine Sludge (generated from Caustic Soda Unit) for manufacturing of bricks

SOP - 61

Sludge from Caustic Soda Unit

(Category: 16.3 of Schedule I of HOWM Rules, 2016)

1.0 Utilization of Brine Sludge:

Type of HW	Source of generation	Recovery/Product
Brine sludge (Category 16.3 of Schedule I of HOWM Rules, 2016)	Caustic Soda manufacturing plant	For manufacturing of bricks

1.1 Source of Waste:

The brine sludge generated from Caustic Soda plant is categorized as hazardous waste at S.No. 16.3 of Schedule 1 of HOWM Rules, 2016 that can be utilized as resource in manufacturing of bricks.

Table 1. Characteristics of Brine sludge from caustic soda plant are given below:

Sl. No	Parameter	Results	Unit
1.	$BaSO_4$	24.12	%
2.	$CaCO_3$	12.80	%
3.	$Mg(OH)_2$	5.8	%
4.	Total Chloride as NaCl	1.80	%
5.	Moisture	30.7	%
6.	Acid insoluble's (Sand & Silica)	16.3	%
	TCLP Extract Test		
1.	pH (1:25 Extract)	8.02	-
2.	Lead	<0.05	mg/L
3.	Cadmium	<0.05	mg/L
4.	Copper	<0.05	mg/L
5.	Zinc	1.18	mg/L
6.	Nickel	1.62	mg/L
7.	Arsenic	<0.05	mg/L

8.	Hexavalent Chromium	<0.05	mg/L
9.	Trivalent Chromium	<0.05	mg/L
10.	Mercury	BDL	mg/L
11.	Free Barium as Ba except Barium Sulphate	3.60	mg/L
12.	Cobalt	<0.05	mg/L
13.	Fluoride as F	1.23	mg/L
14.	Manganese	<0.20	mg/L
15.	Selenium	<0.05	mg/L

1.2 Utilization Process

Brine sludge generated from brine purification process is added into pan mixer with lime, cement/gypsum, sand and fly ash. The materials, together in proposed composition (given in Figure 1) will be added into Pan Mixer for making a homogenous mixture using water. The homogenous mixture is carried from pan mixer to brick making machine on a conveyor belt. Bricks manufactured from the machine will be kept for 2-3 days for setting and then for curing before selling.

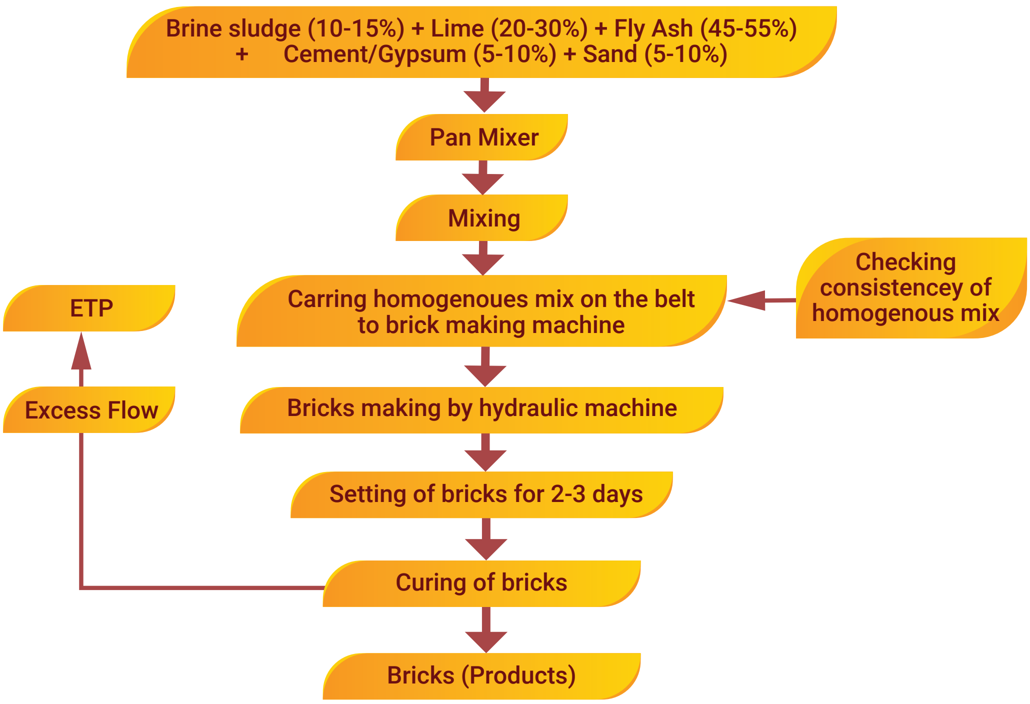


Fig: 1 Process flow diagram for utilization of sludge generated from caustic soda plant.

1.3 Product Usage I Utilization

The bricks manufactured using brine sludge generated from Caustic Soda Plant shall meet IS 12894:2002 and these bricks shall be used in construction activity like boundary walls, load bearing walls, partition walls and foundation/footing work. Final product shall be tested (TCPL /STLC) for heavy metals before selling.

1.4 Standard Operating Procedure for utilization

This SoP is applicable only for utilization of Brine sludge generated from Caustic Soda Plant for manufacturing of bricks.

1) Brine sludge generated from Caustic Soda Plant shall be collected and stored in pits or paved area under 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 shall have adequate slope to collect spillage, if any, and the spillage shall be transferred to ETP inlet.

2) The handling of hazardous waste as well as other raw materials shall be carried out using mechanical means with minimal manual intervention.

3) Transfer of brine sludge as well as other raw materials from their respective storage shed shall be transferred through mechanical conveyor system, to eliminate the possibility of fugitive emission.

4) The fugitive emission anywhere near the work zone shall be extracted through APCD i.e. Pulsejet Bag Filter and stack of adequate height (if required).

5) Uniform mixing of brine sludge and raw materials shall he achieved using mechanised mixing unit (such as pan mixer) for keeping the consistency of mixture.

6) The hazardous wastes i.e. brine sludge and other raw materials shall be stored in separate pits or rooms covered with shed and properly marked paved floor with ventilation.

7) The storage area shall be of proper capacity, atleast 30 days storage capacity of per day requirement for each raw materials and hazardous waste.

8) Bricks manufactured by utilizing brine sludge shall be stored for sun drying and curing on a leak proof floor. In case, effluent treated water is being use for curing then proper slope shall be provided with a drain to collect excess water and it should be sent back to ETP for treatment.

9) The unit shall be allowed to use ETP treated water for making quick lime slurry, curing of bricks, etc. in utilization process only if, the treated water meet discharge norms as prescribed for Caustic Soda Industry issued under The Environment (Protection) Rules, 1986 or as prescribed in Consent to Operate from concerned SPCBs/PCCS.

10) 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.

11) 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, l 974.

12) Prior to utilization of brine sludge (generated from Caustic Soda Plant), the unit shall obtain authorization for generation, storage and utilization of brine sludge (generated from Caustic Soda Plant) from the concerned State Pollution Control Board under Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016.

13) 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.

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

15) 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.

1.5 Record/Returns Filing

1) A log book with information on source, quantity, date wise utilisation of brine sludge generated from Caustic Soda Plant 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 waste utilised, hazardous waste 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/PC.

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

1.6 Standards

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

   PM10 : 5 mg/m³ TWA* (PEL)

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

2) 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/PC C on a quarterly basis.

3) ETP treated water (in case, used in utilization process) monitoring shall be carried out quarterly for parameters prescribed for Caustic Soda Industry issued under The Environment (Protection) Rules, 1986 or as prescribed in Consent to Operate granted and the results shall be submitted to the concerned SPCB/PCC.

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.

1.7 Siting of Industry

Facilities for utilization of sludge generated from Caustic Soda Plant shall be located in a notified industrial area and/ or in accordance with Consent to Establish issued by the concerned SPCB/PCC,

1.8 Size of Plant and Efficiency of Utilization

25 tons of Brine Sludge (generated from Caustic Soda Plant) with raw materials in the ratio sludge, lime, cement/gypsum, fly ash and sand will be 10 to 15%, upto 20%, 5 to 10%,

upto 55% and 10 to 15% respectively shall produce approximately 10,000 bricks per day Therefore, requisite facilities of adequate size of storage shed and other plants and machineries as given in para 1.9 given below shall be installed accordingly

1.9 Checklist of Minimal Requisite Facilities

S. No	Particulars
1	Covered storage shed of adequate capacity to store hazardous waste and raw materials of at least 30 days requirement
2	Cool, dry well-ventilated covered storage shed(s) for hazardous waste and raw materials storage, product storage and process activities with completely paved area within premises.
3	Mechanized conveyer system for handling and transfer of Brine Sludge (generated from Caustic Soda Plant).
4	Pan Mixer, Brick manufacturing machine.
5	Leak-proof flooring at drying and curing area with drain for excess water collection connected to ETP.
6	Pulse Jet Bag Filters (APCD) for fugitive emission (if required).

Utilization of ETP Sludge (generated from pickling process/ wastewater treatment) for manufacturing of Red/Chromium/Nickel Oxide & Gypsum

SOP - 62

Sludge from pickling process/ wastewater treatment

(Category: 13.2 & 35.3 of Schedule I of HOWM Rules, 2016)

1.0 Utilization of ETP Sludge:

Type of HW	Source of generation	Recovery/Product
ETP Sludge (13.2 & 35.3 of Schedule-I of HOWM Rules – 2016)	Sludge generated from pickling operation & chemical sludge generated from wastewater treatment of iron & steel industry	i. Gypsum for manufacturing of paver blocks ii. Red Oxide, Nickel Oxide, Chromium Oxide for manufacturing of pigments

1.1 Source of Waste:

ETP Sludge generated from pickling operation & chemical sludge generated from wastewater treatment of iron & steel industry is categorized as hazardous waste listed at 13.2 & 35.3 of Schedule-I of HOWM Rules - 2016 respectively.

Table 1.Typical Characteristics of ETP Sludge is given below

Sl. No.	Parameter	Results	Unit
1.	pH	7.9	--
2.	Moisture	50	%
3.	Cr	1.76	%
4.	Fe	20.9	%
5.	Ni	0.67	%
6.	Mn	0.29	%
7.	F	56	mg/L

1.2 Utilization Process

First Stage: ETP Sludge is mixed with fresh water & H_2SO_4 and stirred into liquefied solution. The liquefied solution is passed through hydraulic filter press, where the solid part is retained in form of filter cake & filtrate -1 is collected in the collection tank and processed in second stage. The filter cake is wet $CaSO_4$ (gypsum) and dried in muffle furnace to obtain dried $CaSO_4$ (gypsum), which contains substantial quantity of fluoride content. Fluoride content in dried $CaSO_4$ (gypsum) is minimized by using hot water washing method, in this method dried $CaSO_4$ (gypsum) is washed by addition of hot water followed by stirring. Fluoride salt in $CaSO_4$ reacts with hot water & form aqua hydro fluoride which is soluble in water. The liquefied solution is again passed through hydraulic filter press. $CaSO_4$ trapped in filter press along with CaO as filter cake and water with HF easily passes away and collected as filtrate. The filter cake (washed Gypsum) is collected and again dried in muffle furnace & grinded in ball mill to obtain fine consistency and it is used in paver block manufacturing as a binding agent. The Filtrate-2 (gypsum wash water) is collected separately and processed in second stage along with filtrate-1.

Second Stage: Filtrate - 1 & 2 from first stage is oxidized by addition of $NaNO_2$ and stirred in the agitated reaction vessel. Further, NaOH is added to increase the pH and stirred in the agitated reaction vessel. The liquefied solution is passed through hydraulic filter press where the solid part is retained in form of filter cake (Chromium & Iron) & filtrate-3 is collected in the collection tank and processed in third stage.

Third Stage: NaOH is added to the filtrate-3 (Nickel Sulphate solution) of second stage to increase the pH and stirred in the agitated reaction vessel. The liquefied solution is passed through hydraulic filter press where the solid part is retained in form of filter cake [$Ni(OH)_2$] & filtrate-4 ($Na_2S_2O_4$ solution) is collected in the collection tank and reused as cooling water in captive hot rolling mills or recycled in the same process.

Filter cake with 25-30% moisture (Chromium & Iron) of second stage is further processed by addition of Na_2CO_3 and stirred in the agitated reaction vessel. The liquefied solution ([$Fe(OH)_3$] & $Na_2Cr_2O_7$ mix solution) is further processed by addition of fresh water and stirred in the same agitated reaction vessel. The liquefied solution is passed through hydraulic filter press where solid part retained in form of filter cake [$Fe(OH)_3$] & filtrate-5 ($Na_2Cr_2O_7$ solution) is collected in the collection tank and processed in fourth stage. Filter cake [$Fe(OH)_3$] is collected and dried in the muffle furnace to obtain red oxide powder (value added by-product). Similarly, filter cake [$Ni(OH)_2$] of third stage is dried in the muffle furnace to obtain nickel oxide powder (value added by-product).

Fourth Stage: H_2SO_4 is added to the filtrate-5 ($Na_2Cr_2O_7$ solution) of third stage to decrease the pH and stirred, simultaneously $NaNO_2$ is added and stirred; further NaOH is added to increase the pH and stirred in the agitated reaction vessel. The liquefied solution is passed through hydraulic filter press where solid part retained in form of filter cake [$Cr(OH)_3$] & filtrate-6 ($Na_2S_2O_4$) is collected in the collection tank and reused as cooling water in captive hot rolling mills or recycled in the same process. Filter cake [$Cr(OH)_3$] is collected and dried in the muffle furnace to obtain Chromium oxide powder (value added by-product).

Paver block manufacturing: Automatic or Manual Paver Manufacturing Machine is used to produce paver block from slag (front scrap steel refining), gypsum (recovered in above process), cement, grit and water. Composition of above ingredients may be based on strength required & application of manufactured paver blocks.

1.3 Product Usage / Utilization

1 Recovered Red/Nickel/Chromium Oxide to be used as pigment in industrial grade, and Gypsum will be utilized for manufacturing of Paver Blocks.

2 The Products shall comply as per Bureau of Indian Standards (BIS) of further respective utilization. However the products manufactured utilizing the hazardous waste shall not be used in food, food processing, pharma industries and production of fertilizers.

3 The unit shall label its product i.e. Recovered Red/Nickel/Chromium Oxide & Gypsum manufactured by utilizing afore said ETP sludge as *"This Recovered Red/Nickel/Chromium Oxide & Gypsum has been manufactured by utilizing ETP sludge (generated from Pickling Process) for manufacturing of paver blocks & Red/Nickel/Chromium Oxide respectively".*

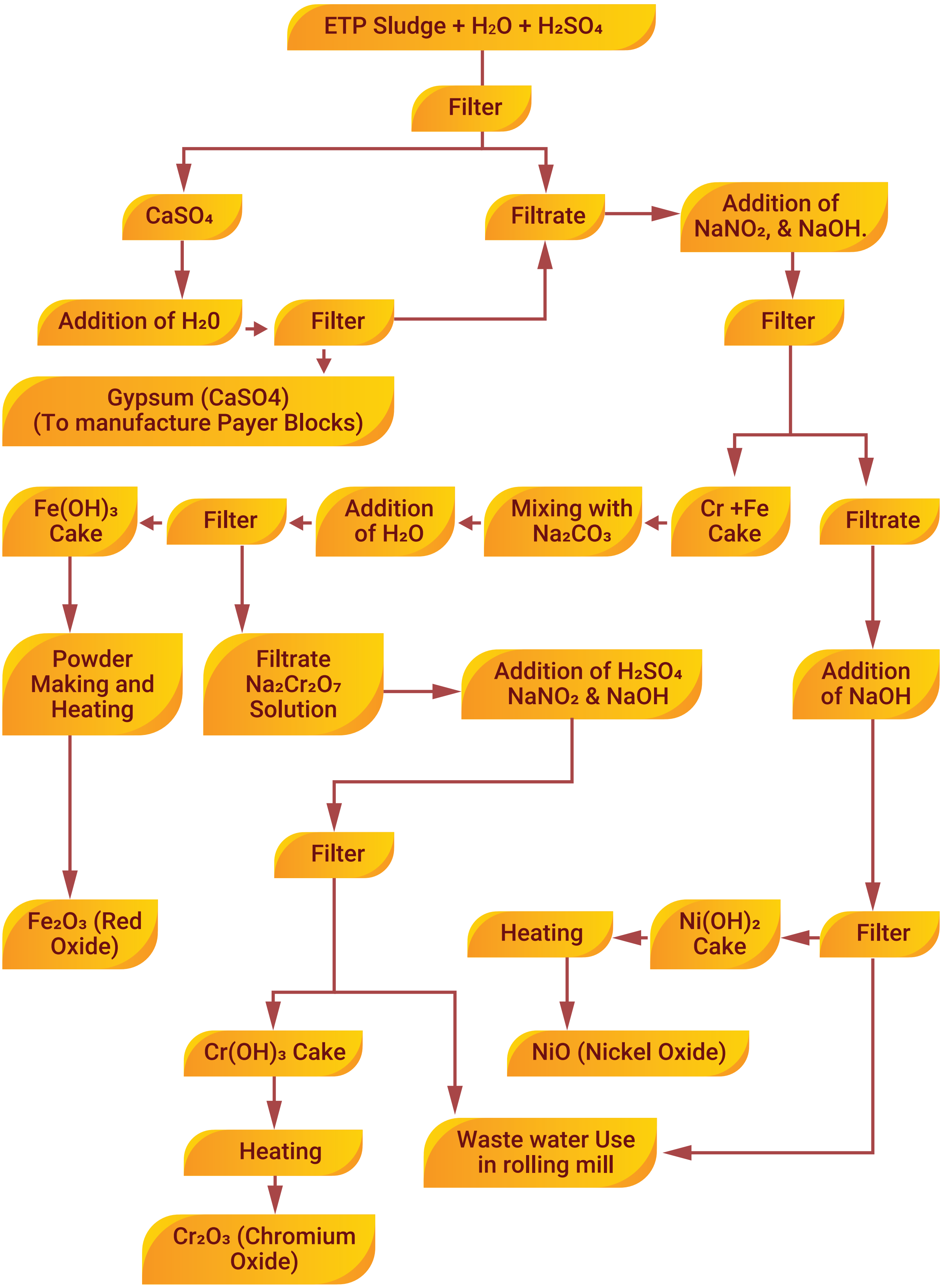


Fig: 1- Process flow diagram for utilization of ETP Sludge

1.4 Standard Operating Procedure for utilization

This SoP is applicable only for utilization of ETP Sludge generated from Pickling Process as Resource material for manufacturing of Red/Chromium/Nickel Oxide & Gypsum.

1) ETP sludge shall be procured through vehicles fitted with requisite safeguards ensuring no leakage.

2) ETP sludge shall be stored in acid proof brick lined area under covered storage shed within premises so as to prevent rain water instruction. Further, storage sheds shall have proper slope and seepage collection pit to collect seepage / floor washing. The collected seepage / floor washing shall be channelized to Effluent Treatment Plant for further treatment.

3) Transfer of ETP sludge from storage sheds shall be carried out through covered trolley or mechanical conveyor.

4) The unit shall provide separate storage tanks for storage of chemicals and the storage tanks should be at designated place with proper cover and with acid brick lining floors.

5) The treated gases shall comply with emission norms prior to dispersion into atmosphere through stack. The height of stack shall be a minimum of 30 m above the ground level or as prescribed by the concerned SPCB/PCC, whichever is higher.

6) 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 Factories Act, 1948, as amended from time to time.

7) Treatment and disposal of wastewater:

   Wastewater generated from floor-washings, spillages, reactor washing, scrubber bleed including the wastewater from filtration shall be treated Physico-Chemically in an ETP to comply with surface water discharge standards or may be sent to CETP for final disposal.

   In case of zero discharge condition by SPCB/PCC, the treated waste water from ETP may be managed as per conditions stipulated by the SPCB/PCC.

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

9) Dryer and ball mill shall be attached with a cyclone/ bag filter with a stack of adequate height or as prescribed by the concerned SPCB/PCC, whichever is higher.

10) Unit shall ensure that recovered Gypsum which is to utilized in the manufacturing of Paver block shall meet the prescribed limits of Schedule-II of HOWM Rules, 2016.

11) The hazardous wastes generated (namely the Filter cake, other chemical sludge etc.) shall be collected and temporarily stored in non-reactive drums/ bags under a dedicated hazardous waste storage area and be sent to authorized common TSDF or MEE or other authorized facility within 90 days from generation of the waste in accordance with the authorization issued by the concerned SPCB/PCC. Such storage area shall be covered with proper ventilation.

12) It shall be ensured that the ETP sludge is procured from the industries, which have valid authorization from the concerned State Pollution Control Board as required under HOWM Rules, 2016.

13) Transportation of ETP sludge shall be carried out by sender (generator) or receiver (utilizer) only after obtaining authorisation from the concerned SPCB under HOWM Rules, 2016. Requisite manifest document shall be followed as laid down under the said Rules.

14) Prior to utilization of ETP sludge, the unit shall obtain authorisation for generation, storage and utilization of ETP sludge from the concerned State Pollution Control Board under HOWM 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. The unit shall provide suitable fire safety arrangements and Name proof electrical fittings.

1.5 Record/Returns Filing

1) The unit shall maintain a passbook issued by concern SPCB wherein the following details of each procurement of ETP sludge shall be entered:
   - Address of the sender
   - Date of dispatch
   - Quantity procured
   - Seal and signature of the sender
   - Date of Receipt in the premises
2) A logbook with information on source and date of procurement of ETP sludge, date wise utilization of the same, hazardous waste generation and its disposal, etc. shall be maintained including analysis report of fugitive emission monitoring & effluent discharged, as applicable.
3) The unit shall maintain record of hazardous waste generated, utilized and disposed as per Form-3 & also file an annual return in Form-4 as per Rule 20(1) and (2) of HOWM Rules, 2016, to concerned SPCB/PCC.
4) The unit shall submit quarterly and annual information on hazardous wastes consumed, its source, products generated or resources conserved (specifying the details like, type and quantity of resources conserved) to the concerned SPCB/PCC.
5) The unit shall use NHWTS to manage the manifest, enter daily records of quantity generated, disposed, etc, once the portal is operational.

1.6 Standards

1) Source emissions from the stack connected to reactors/process stack shall comply with the following Emission standards or as prescribed by the concerned SPCB/PCC, whichever is stringent;

PM	150 mg/Nm^3
SO_2	100 ppm
NO_x	50 ppm
HCl	50 mg/ Nm^3
CO	100 mg/ Nm^3

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

PM_{10}	5 mg/m³
Cl_2	3 mg/m³
HCl	7 mg/m³
Acid Mist (H_2SO_4)	1 mg/m³

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 ISO 17025 accredited or EPA, 1986 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 concerned SPCB/PCC under the Water (Prevention and Control of Pollution) Act, 1974. In case of (i) zero discharge as per consent or (ii) non-availability of the common Effluent Treatment Plant (CETP), the unit shall achieve zero discharge by setting up adequate captive treatment facility.

1.7 Siting of Industry

Facilities for utilization of ETP sludge 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.

1.8 Size of Plant and Efficiency of Utilisation

100 kg ETP sludge was used for manufacturing 40 kg gypsum ($CaSO_4$) and 17 kg red oxide (Fe_2O_3). Hence, yield was 0.4 for gypsum ($CaSO_4$) & 0.17 Ferric oxide (Fe_2O_3). 8 Kg Chromium oxide (Cr_2O_3) & 5 Kg Nickel oxide (NiO) were also obtained as value added byproducts. Therefore, requisite facilities of adequate size of storage shed and other plants and machineries as given in section 8.10 given below shall be installed accordingly.

1.9 On-line Detectors / Alarms / Analyzers

In case of continuous process operations, online emission analyzers for PM, SO_2, NO_x in the Stack stack shall be installed and the online data be connected to the server of the concerned SPCB/PCC.

1.10 Checklist of Minimal Requisite Facilities

S. No	Particulars
1.	Covered Hazardous Waste storage area for storage of ETP sludge with acid proof brick lining and proper slope & seepage collection pit.
2.	Agitated Stirred Reactor with Alkali Scrubber as APCD and stack of adequate height.
3.	Filter Press
4.	Storage vessel for storage of ML / Filtrate.
5.	Dryer and, ball Mill for size reduction of recovered material after drying.
6.	Dryer and ball mill shall be attached with a cyclone/ bag filter with a stack of adequate height.
7.	Paver block manufacturing machine (Automatic / Manual).
8.	Stack to have 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.

Utilization of LD/GCP Sludge, LD/GCP Classifier Sludge and Blast Furnace Flue Dust for manufacturing of L.D. Sludge agglomerates

SOP - 73

Classifier Sludge and Blast Furnace Flue Dust

(Category: 35.1 of Schedule I of HOWM Rules, 201s)

1.0 Utilization of Brine Sludge:

Type of HW	Source of generation	Recovery/Product
Linz-Donawitz (L.D.)/ Gas Cleaning Plant (GCP) Sludge, L.D/GCP Classifier Sludge and Blast Furnace Flue Dust Category 35.1, Schedule I (of HOWM Rules, 2016)	Generated as a result of cleaning the off gases during steel manufacturing process.	For manufacturing of L.D. Sludge agglomerates (Used in steel making)

1.1 Source of H.W:

The LD/GCP Sludge, LD/GCP Classifier Sludge and Blast furnace flue dust of steel/ ferro alloy plants is categorized as hazardous waste Category 35.1, Schedule I of HOWM Rules 2016.

Table 1. Typical Characteristics of hazardous waste are given below:

Sl. No.	Parameter	Unit	LD sludge	LD/GCP classifier sludge	Blast Furnace Flue Dust
1	Iron as Fe	g/kg	206.4	257.9	143.82
2	Zinc as Zn	mg/kg	477.5	65.17	390
3	Manganese as Mn	mg/kg	290	806	184
4	Copper as Cu	mg/kg	<1.0	<1.0	<1.0
5	Cadmium as Cd	mg/kg	9.2	<1.0	<1.0
6	Cobalt as Co	mg/kg	<1.0	<1.0	<1.0
7	Lead as Pb	mg/kg	218.5	183.4	167.8
8	Nickel as Ni	mg/kg	<1.0	<1.0	<1.0
9	Arsenic as As	mg/kg	<0.5	<0.5	<0.5
10	Vanadium as V	mg/kg	18.6	19.2	10.7
11	Chromium as Cr	mg/kg	40.7	39.7	9.6
12	Moisture Content	%	11.81	5.81	6.1
13	Mercury as Hg	mg/kg	<1.0	<1.0	<1.0

1.2 Utilization Process

The LD/GCP Sludge, LD/GCP Classifier Sludge and Blast furnace flue dust collected from steel/ ferro alloy plants are mixed with other raw materials such as lime and cement in proportion. The mixed raw materials are fed in the Pelletizing Disc. The moisture content in the raw materials helps in binding and nodulizing the green agglomerates

The green agglomerates are loaded inside the chamber kiln and heated at 110° C for 3-4 hours. Then dry LD sludge agglomerates are pulled out from the chamber kiln and cooled in normal temperature under shed. After cooling the final product is ready for dispatching or stocking in stockyard.

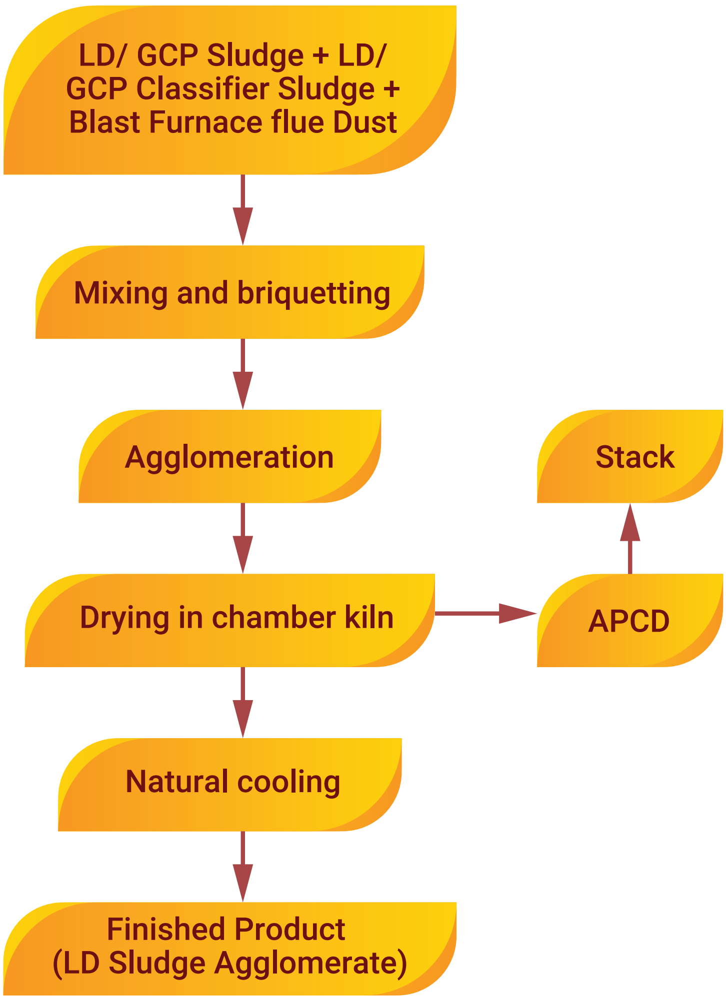


Fig 1: Process flow diagram for utilization of hazardous waste.

1.3 Product Usage / Utilization

LD/GCP Sludge, LD/GCP Classifier Sludge and Blast furnace flue dust is utilized in the manufacturing of L.D. Sludge agglomerates which is used in steel making.

1.4 Standard Operating Procedure for utilization

This SoP is applicable only for Utilization of LD/GCP Sludge, LD/GCP Classifier Sludge and Blast Furnace Flue Dust for manufacturing L.D. Sludge agglomerates.

1) LD/GCP Sludge, LD/GCP Classifier Sludge and Blast Furnace Flue Dust shall be procured only in wet form having moisture not less than 15% by weight so as to avoid fugitive dust emission during handling/ loading/ transportation/ unloading/ mixing etc. The said wastes shall, however, be not procured in slurry form.

2) LD/GCP Sludge, LD/GCP Classifier Sludge and Blast Furnace Flue Dust shall be procured only in SPCB/PCC authorized barrels/closed tanks mounted over vehicles fitted with requisite safeguards ensuring no emissions/spillages.

3) LD/GCP Sludge, LD/GCP Classifier Sludge and Blast Furnace Flue Dust shall be stored in dedicated storage area with impervious floor under covered storage shed within premises.

   Further, storage sheds shall have proper slope and seepage collection pit to collect seepage / floor washing. The collected seepage I floor washing shall be utilized in the process.

4) The unit shall ensure that while mixing with other raw materials, that no dust formation takes place by maintaining > 15% moisture in the LD/GCP Sludge, LD/GCP Classifier Sludge and Blast Furnace Flue Dust.

5) Material transfer / handling in entire utilization process shall be equipped with canopy /hood system or done in closed system. Manual handling shall be restricted.

6) The unit shall ensure control of emissions in process area through dust extraction system with APCD such as bag filter followed by stack.

7) The gases from kiln shall pass through APCD like Cyclone separator/ Bag filter/ Electra static precipitators to meet the prescribe standards.

8) The treated gases shall comply with emission norms prior to dispersion into atmosphere through stack. The stack height shall be minimum of 30m from ground level or as prescribed by the concerned SPCB/PCC, whichever is higher.

9) Treatment and disposal of wastewater: Wastewater generated from floor-washings, spillages, reactor washing, scrubber bleed shall be reused in the process while mixing raw materials or treated Physico-Chemically in an Effluent Treatment Plant (ETP) or may be sent to Common Effluent Treatment Plant (CETP) for final disposal or be treated further in a captive facility to comply with surface water discharge standards.

   In case of zero discharge, the treated waste water from ETP may be managed as per conditions stipulated by the concerned SPCB/PCC.

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

11) 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.

12) The hazardous wastes generated during utilization of LD/GCP Sludge, LD/GCP Classifier Sludge and Blast Furnace Flue Dust (namely APCD dust etc.) during manufacturing process of unit, shall be captively utilized with in the process or collected and temporarily stored in non-reactive drums/ bags under a dedicated hazardous waste storage area and be sent to authorized common TSDF or other authorized facility within 90 days from generation of the waste in accordance with the authorization issued by the concerned SPCB/PCC.

13) The unit shall ensure that the LD/GCP Sludge, LD/GCP Classifier Sludge and Blast Furnace Flue Dust is procured from authorized industries as required under HOWM Rules, 2016.

14) Transportation of LD/GCP Sludge, LD/GCP Classifier Sludge and Blast Furnace Flue Dust shall be carried out by sender (generator) or receiver (utilizer) only after obtaining authorization from the concerned SPCB/PCC under HOWM Rules, 2016. Requisite manifest document shall be followed as laid down under the said Rules.

15) Prior to utilization of LD/GCP Sludge, LD/GCP Classifier Sludge and Blast Furnace Flue Dust, the unit shall obtain authorization for storage, utilization and disposal of LD/GCP Classifier Sludge and Blast Furnace Flue Dust from the concerned SPCB/PCC under HOWM Rules, 2016.

16) In ease 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.

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

18) 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.

1.5 Record/Returns Filing

1) The unit shall maintain a passbook issued by concern SPCB/PCC and maintain details of each procurement of LD/GCP Sludge, LD/GCP Classifier Sludge and Blast Furnace Flue Dust as mentioned below:
   - Address of the sender
   - Date of dispatch
   - Quantity procured
   - Seal and signature of the sender
   - Date of Receipt in the premises

2) A log book with information on source and date of procurement of LD/GCP Sludge, LD/GCP Classifier Sludge and Blast Furnace Flue Dust, date wise utilization of the same, hazardous waste generation and its disposal, etc. shall be maintained including analysis report of fugitive emission monitoring & effluent discharged, as applicable.

3) The unit shall maintain record of hazardous waste generated, utilized and disposed as per Form-3 & also file an annual return in Form-4 as per Rule 20 (1) and (2) of HOWM Rules, 2016, to concerned SPCB/PCC.

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

1.6 Standards

1) Source emissions from the stack connected to reactors/process unit shall comply with the following Emission standards or as prescribed by the concerned SPCB/PCC, whichever is stringent;

Particulate Matter	50 mg/Nm^3
NO_x	150 mg/Nm^3
SO_2	250 mg/Nm^3

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

PM_{10}	40 mg/m^3
NO_x	150 µg/m^3
SO_2	200 µg/m^3

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 ISO 17025 accredited or EPA, 1986 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 concerned SPCB/PCC under the Water (Prevention and Control of Pollution) Act, 1974. In case of zero discharge or no discharge condition stipulated in the consent or non-availability of the common Effluent Treatment Plant (CETP), zero discharge shall be met.

1.7 Siting of Industry

Facilities for utilization of LD/GCP Sludge, LD/GCP Classifier Sludge and Blast Furnace Flue Dust shall be preferably located in a notified industrial area or industrial park/estate/cluster and in accordance with Consent to Establish issued by the concerned SPCB/PCC.

1.8 Size of Plant and Efficiency of Utilisation

The yield of the product is around 90 % by using the raw materials during the trial run (L.D. Sludge, L.D. Classifier Sludge and Blast Furnace Flue Dust in the proportion 40%, 30% and 25% respectively).

1.9 On-line Detectors / Alarms / Analyzers

In case of continuous process operations, online emission analyzers for PM, SO_2, NO_x in the stack shall be installed and the online data be connected to the server of the concerned SPCB/PCC.

1.10 Checklist of Minimal Requisite Facilities:

SI. No	Particulars
1.	Cool, dry well-ventilated covered sheds for LD/GCP Sludge, LD/GCP Classifier Sludge & Blast Furnace Flue Dust, process activities within premises and dedicated hazardous storage area for temporary storage of hazardous waste generated during utilization process
2.	Mixer, Pelletizer and Kiln.
3.	APCD like Bag filters/ Cyclone for fugitive emissions.
4.	APCD like Cyclone /Bag filter/ Electro static precipitators connected to kiln.
5.	Stack to have sampling port, platform, access to the platform etc. as per the laboratory Analysis Technique LATS / 80/ 2013-14 guidelines on methodologies for source emission monitoring published by CPCB under Laboratory Analysis Techniques LAT/80/2013-14
6.	Online analyzers for PM, SO_2,& NO_x emission monitoring in the stack, in case of continuous process operations.

Utilization of ETP Sludge of fertilizer industry in manufacturing of Di-Ammonium Phosphate (DAP)/NPK Fertilizer

SOP - 76

Sludge from fertilizer industry in manufacturing

(Category: 35.3 of Schedule I of HOWM Rules, 2016)

1.0 Utilization of ETP Sludge:

Type of HW	Source of generation	Recovery/Product
ETP sludge (Category 35.3 of Schedule I of HOWM Rules, 2016)	Effluent Treatment Plant (ETP) of Fertilizer industry	As a partial substitute for filler in manufacturing of Di-Ammonium Phosphate (DAP)/ NPK Fertilizer

1.1 Source of Waste

The ETP sludge is generated from sludge thickener during effluent treatment of fertilizer industry. The ETP sludge is categorized as hazardous waste as category 35.3 of Schedule I of HOWM Rules, 2016 which is required to be disposed in authorized disposal facility in accordance with authorization condition, when not utilized as resource recovery.

Table 1: Heavy metal analysis of ETP Sludge:

Parameters	Results	
	mg/Kg	**TCLP (mg/L)**
Arsenic	<1.0	<0.05
Barium	2.0 - 14.0	0.1 - 0.8
Cyanide	<1.0	<0.05
Cadmium	<1. 0	<0.05
Chromium	2.0 - 8.0	0.1 - 0.4
Lead	<1.0	<0.05
Copper	<0.05 - 1.60	<0.05 - 0.8
Nickel	2.40 - 3.60	0.12 - 0.18
Zinc	87.0 - 146.40	4.35 - 7.32
Mercury	<1.0	<0.05

1.2 Utilization Process

In dry sludge case, the ETP sludge required to be prepared in slurry form. Uniform slurry preparation achieved in sump pit with agitator. This slurry or ETP sludge from sludge thickener with 5 - 10% solid in slurry is transferred to Ammonia scrubber of both, DAP/NPK plants in a closed loop system by using pumps.

The Ammonia scrubber receives raw material i.e. Phosphoric acid and water which is further reacted with NH_3 for formation of product (DAP/NPK) in presence of sulfuric acid which maintains correct $N:P_2O_5$ of granular product.

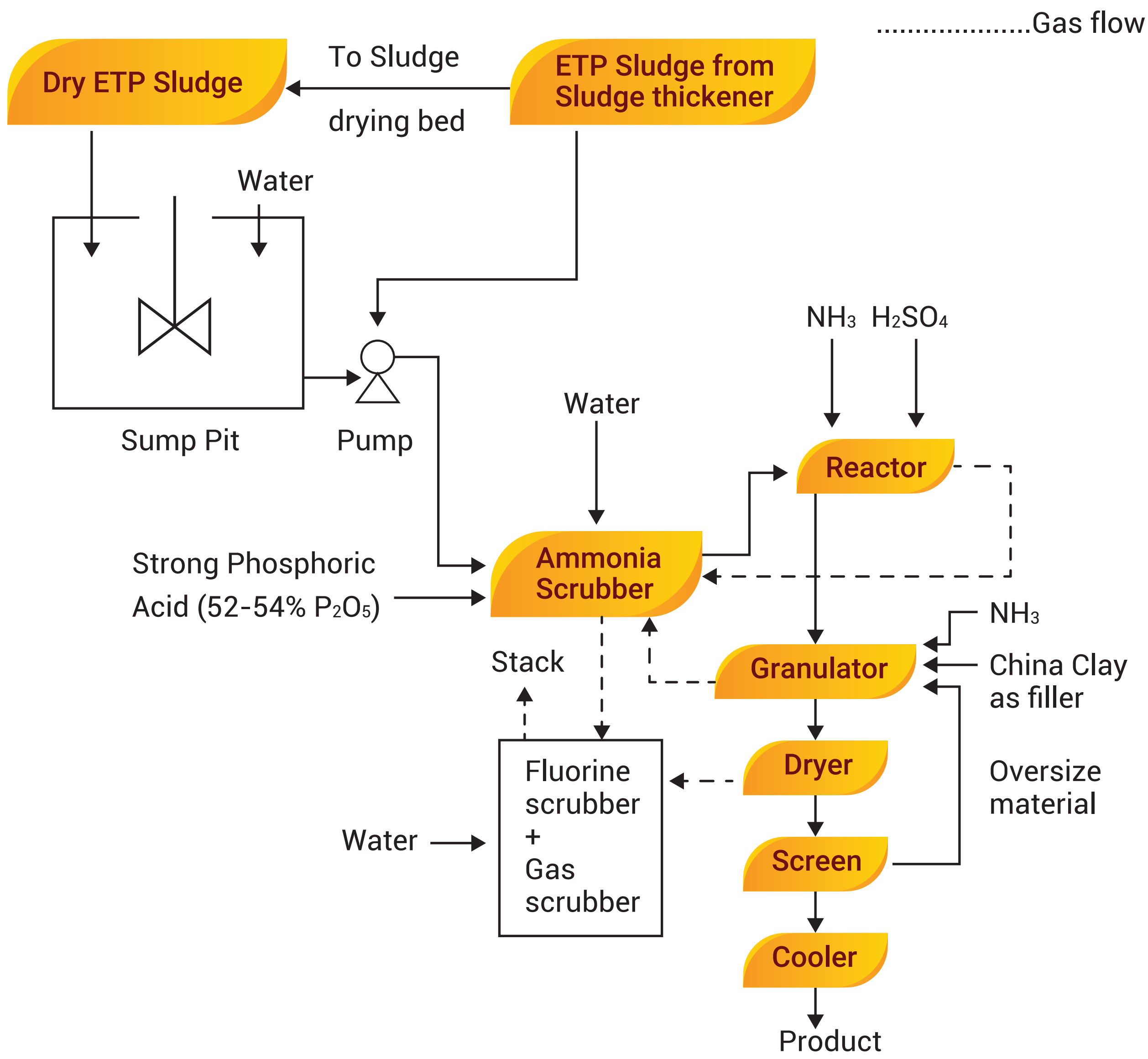


Fig 1: Process flow diagram for utilization of ETP sludge for manufacturing of DAP/NPK Fertilizer

1.3 Product Usage / Utilization

The ETP sludge will be utilized as partial substitute for the clay filler in the production of DAP/ NPK Fertilizer.

Final products manufactured utilizing above said hazardous waste shall meet the specifications mentioned in Fertilizer Control Order, 1985 and amendments thereof.

The unit shall label its product (i.e. DAP/NPK Fertilizer) manufactured by utilizing aforesaid Hazardous waste as "This Di-Ammonium Phosphate / NPK Fertilizer has been manufactured by utilizing ETP sludge, generated during effluent treatment of fertilizer industry."

1.4 Standard Operating Procedure for utilization

This SoP is applicable only for the captive utilization of ETP sludge generated during effluent treatment of fertilizer industry.

1) The ETP sludge (5-10% solid of slurry) generated from sludge thickener of ETP shall be transferred through pump to ammonia scrubber of DAP/NPK plant by pump ensuring no manual intervention.

2) In case of dry sludge, the waste shall be first sent to a sump pit with agitator for preparation of slurry. The uniform slurry once formed shall be transferred to ammonia scrubber of DAP/NPK plant by pump.

   There shall be a designated space for ETP sludge drying with concrete floor. The transfer of sludge to sump pit shall be through mechanized system i.e. conveyer belt with minimal manual intervention. In case of manual transfer of sludge to sump pit proper personal protective equipment (PPEs) such as mask, gloves, safety shoes and helmet shall be provided to the workers.

3) ETP sludge storage area shall be designated and provided with caution sign. Floor of storage area shall be acid proof brick lining to avoid any leachates to the ground with low raise bund wall and proper slope to collect spillages, if any, into a collection pit.

4) Utilization of ETP sludge shall not exceed 3.5 % of total raw material on dry basis as partial substitute of clay filler.

5) A scrubber shall be connected to reactor and granulator from where NH_3 may be liberated.

6) The other units such as dryer, cooler and dust collector system shall be connected with cyclones followed by scrubber.

7) The unit shall ensure segregation of oily and non-oil sludge and only non-oil sludge to be utilized.

8) The unit shall ensure final product meet the prescribed standards as per FCO, 1985 and amendments thereof.

9) The treated gases shall comply with emission norms prior to dispersion into atmosphere through stack. The stack height shall be a minimum of 30 m from ground level or as prescribed by the concerned SPCB/PCC, whichever is higher.

10) Treatment and disposal of wastewater:

    Waste water generated from floor-washings, spillages, reactor washing, etc. shall be treated Physico-Chemically in an ETP so as to comply with inlet standards prescribed in case of CETP or be treated in captive ETP having adequate treatment facilities to comply with surface water discharge standards as stipulated in the Consent issued by the SPCBs/PCCs.

    In case of zero discharge condition, the treated waste water from ETP may be managed as per conditions stipulated by the SPCB/PCC.

11) The hazardous wastes generated (if any) during utilization process shall be collected and temporarily stored in non-reactive drums under a dedicated hazardous waste storage area and be sent to authorized common TSDF or other authorized facility within 90 days from generation of the waste in accordance with the authorization issued by the concerned SPCB/PCC. Such storage shall be done under covered storage area with proper ventilation.

12) Prior to utilization of ETP sludge, the unit shall obtain authorization for generation, storage, and utilization from the concerned SPCB/PCC under HOWM Rules 2016.

13) The unit shall maintain proper ventilation in the work zone and process areas. All personnel involved in the plant operation shall wear proper PPEs specific to the process operations involved and type of chemicals handled as per MSDS. The safety precautions or the worker shall be in accordance with the Factory Act, 1948, as amended from time to time.

14) 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.

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

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

1.5 Record/Returns Filing

1) The unit shall maintain a passbook issued by the concern SPCB/PCC and maintain details of each procurement of ETP sludge as mentioned below:

- Address of the sender
- Date of dispatch
- Quantity procured
- Seal and signature of the sender
- Date of Receipt in the premises

2) A log book with information on source and date of generation/procurement of ETP sludge, quantity, date wise utilization of ETP sludge, quantity of DAP/ NPK Fertilizer manufactured, hazardous waste generation and its disposal, etc. shall be maintained including analysis report of emission monitoring & effluent discharged, as applicable.

3) The unit shall maintain record of hazardous waste generated, utilized and disposed as per Form 3 & also file annual returns in Form 4 as per Rule 20 (1) and (2) of HOWM Rules, 2016.

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

1.6 Standards

Source emission monitoring from the common stack attached to scrubber shall comply with the following emission standards or as prescribed by the concerned SPCB/PCC, whichever is stringent;

PM	150.0 mg/Nm^3
Ammonia	300.0 mg/Nm^3
Total Fluoride	<10 mg/Nm^3

2) Fugitive emission in the work zone shall comply with the following standards:

PM_{10}	5.0 mg/m^3 TWA*
Ammonia	35.0 mg/m^3 TWA*
H_2SO_4 mist	1.0 mg/m^3 #Ceiling limit
Fluoride	2.5 mg/m^3
SO_2	13 mg/m^3
NO_x	9 mg/m^3

**PEL - Permissible Exposure Limit; #-Ceiling Limit*
**time-weighted average (TWA) - measured over a period of 8 hours of operation of process.*
A ceiling limit is one that may not be exceeded for any period of time and is applied to irritants and other materials that have immediate effects.

3) Monitoring of the specified parameters for source emission shall be carried out quarterly for the 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 ISO 17025 accredited or EPA, 1986 approved laboratories and the results shall be submitted to the concerned SPCB/PCC on a quarterly basis.

4) Special Condition: Analysis of final products w.r.t. metals and other parameters, as prescribed for compost under Municipal Solid Waste (MSW) Rules, 2016, shall be carried out in every three months and be submitted to CPCB and concerned SPCB/PCC. In case, parameters exceed prescribed limit, utilization shall be stopped and intimate to CPCB and concerned SPCB/PCC.

1.7 Siting of Industry

Facilities for utilization of ETP sludge 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.

1.8 Size of Plant & Efficiency of utilization

Up-to maximum 3.5 % i.e. approximately 2.0 Kg ETP sludge per 25-40 Kg of clay filler as partial substitute along with other raw material may produce 1 Metric Tonne of DAP/ NPK Fertilizer. Therefore, requisite facilities of adequate size of storage shed and other plant & machinery as given in section 1.10 below shall be installed accordingly.

1.9 On-line detectors / Alarms / Analysers

Online emission monitoring systems shall be installed in case of continuous process operations for PM and F as prescribed by the SPCBs/PCCs.

1.10 Checklist of Minimal Requisite Facilities

S. No	Particulars
1.	Cool, dry, well-ventilated ETP sludge storage area with caution sign and low raise bund wall with slope to collect spillages, if any, into collection pit.
2.	Sump pit with agitator (in case of dry sludge utilization).
3.	Mechanized system for transfer of ETP sludge from storage area to sump pit and motor pump for transfer to DAP/NPK plant.
4.	Reactor, Granulator & Dryer
5.	Ammonia Scrubber, Gas and Fluorine scrubber
6.	De-dust system and cyclones for dust collection.
7.	Suction arrangement to channelize emissions from pre neutralization reactor, granulator, dryer, cooler and dust collector system to APCD and finally to the common stack of height as prescribed by the SPCBs/PCCs. Scrubber shall be install at all these units and cyclone prior to scrubber shall be install in case of dryer, cooler and dust collector system.
8.	Effluent treatment plant.
9.	Common Stack to have 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.
10.	Dedicated hazardous waste storage area for temporary storage of hazardous waste generated during utilization process.

Utilization of ETP Sludge generated from wastewater treatment of ceramic industries in manufacturing of Ceramic products

SOP - 81

Sludge from wastewater treatment of ceramic industries

(Category: 35.3 of Schedule I of HOWM Rules, 2016)

1.0 Utilization of ETP Sludge:

Type of HW	Source of generation	Recovery/Product
ETP sludge (Category 35.3 of Schedule I of HOWM Rules, 2016)	Wastewater treatment of ceramic industries	As partial raw material in manufacturing of ceramic products (i) Ceramic glaze mixture and (ii) Industrial ceramics

1.1 Source of Waste

The ETP sludge is generated from settling tank of ETP for treatment of wastewater generated during manufacturing process of ceramics industry. The ETP sludge is categorized as hazardous waste as category 35.3 of Schedule I of HOWM Rules, 2016 which is required to be disposed in authorized disposal facility in accordance with authorization condition, when not utilized as energy or resource recovery.

Table 1:- Characteristic of ETP Sludge generated from ceramic industries

S. No	Parameters	Results
1.	SiO_2	63.60 %
2.	Al_2O_3	20.7 %
3.	Na_2O	4.68 %
4.	CaO	3.96 %
5.	K_2O	2.66 %
6.	ZrO_2	1.16 %
7.	MgO	1.46 %
8.	ZnO	0.48 %
9.	Fe_2O_3	0.50 %
10.	TiO_2	0.25 %
11.	pH	8.40
12.	Ammonical Nitrogen	8.8 mg/kg
13.	Total Organic Carbon	0.36
14.	COD	1935 mg/l
15.	Total Chromiun	7.95 mg/kg
16.	Lead	12.92 mg/kg
17.	Copper	10.93 mg/kg
18.	Nickel	4.97 mg/kg
19.	Zinc	1516 mg/kg
20.	Cadmium	<0.2 mg/kg

1.2 Utilization Process of hazardous waste (ETP Sludge)

1.2.1 In manufacturing of Ceramic Glaze Mixture:

Ceramic glaze mixture are tiny glass particles which are used as impervious layer or coating on ceramic tiles/wares. The basic raw materials for this product are Quartz, Feldspar Calcite, Dolomite, Borosil Glass, SRC Colomnaite and Borex. These raw materials, in powdered form and as per required composition, are mixed in a mixer along with ETP sludge and charged into a hopper attached to a furnace. The furnace is fired using natural gas and a temperature of 1300°C is maintained inside the furnace. The mixture is slowly fed into the furnace to maintain its temperature. After about 5 to 6 hours, the melted material in form of glass is poured continuously into a bucket in presence of cooling water for quenching. The wet finished product is drained of water after cooling and before packaging.

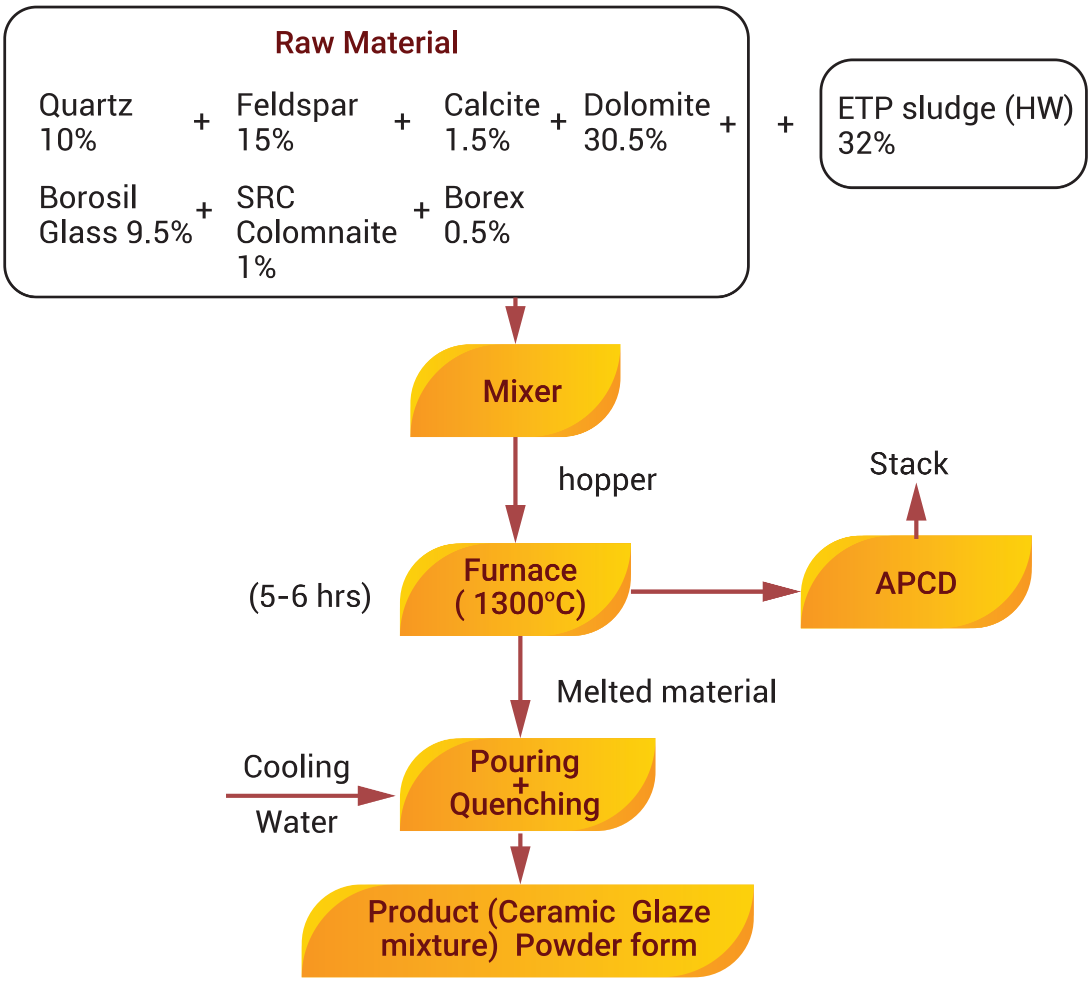


Fig 1: Process flow diagram for utilization of ETP sludge in manufacturing of Ceramic Glaze Mixture

1.2.2 In manufacturing of Industrial Ceramics

The product named 'Industrial ceramic' is a prism shaped about 2 inch block used as packing material in various industries. The basic raw materials for this product are China Clay, Quartz, Feldspar, Talc and Than-Clay. These raw materials are mixed as per required composition along with ETP sludge and grinded in ball mill for 11 to 12 hours with water. The grinded mixture is passed through filter press to separate cake and water. The separated cake from filter press is fed in pug mill to give required shape and cut into small pieces. These raw pieces of cake is dried and later fired at 1250°C in continuous tunnel furnace/kiln for about 24 hours.

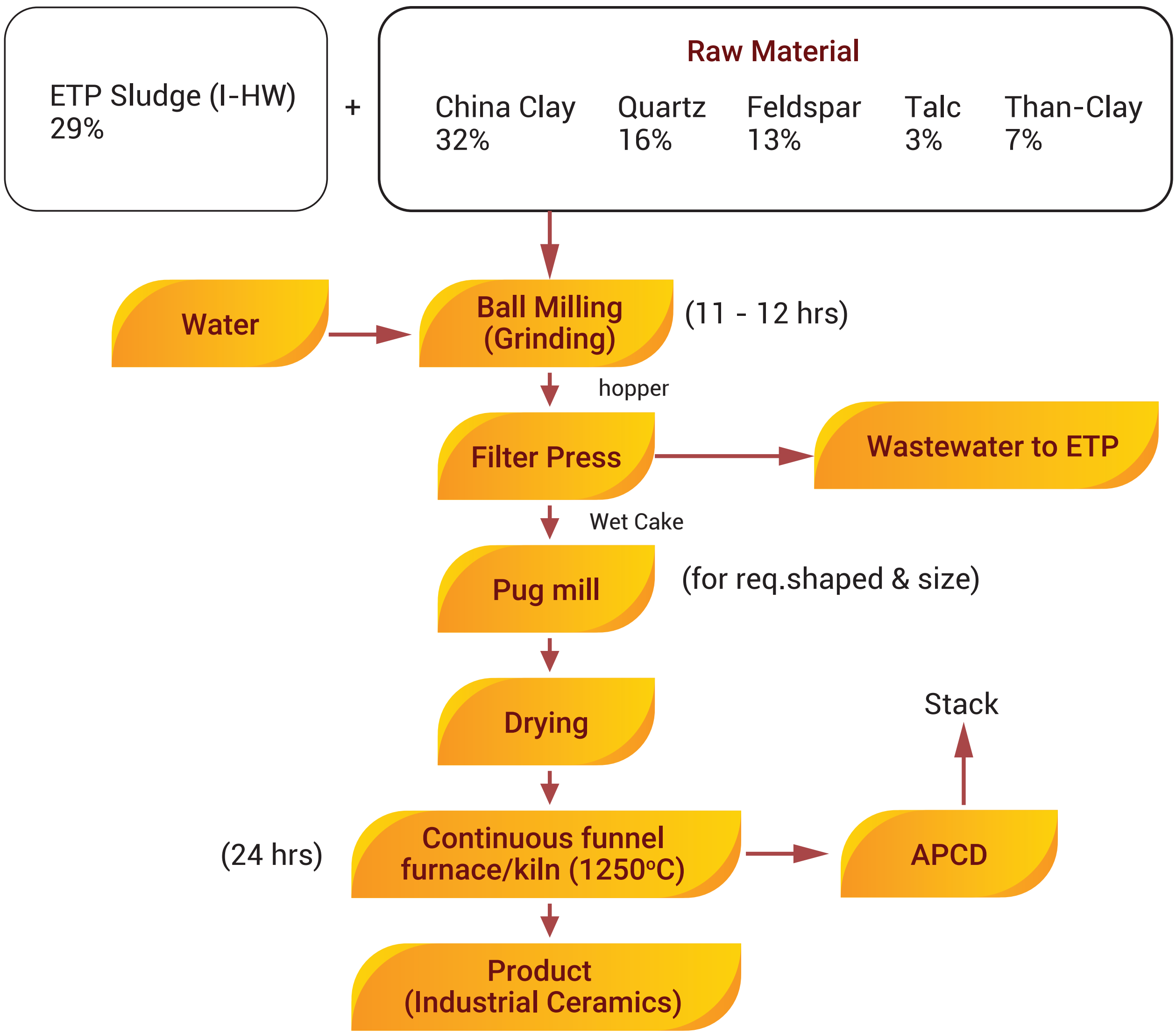


Fig 2: Process flow diagram for utilization of ETP sludge in manufacturing of Industrial Ceramics

1.3 Product Usage / Utilization

The ETP sludge will be utilized as partial raw material in the production of Ceramic Glaze Mixture and Industrial Ceramics.

The unit shall label its product (i.e. Ceramic Glaze Mixture and Industrial Ceramics) manufactured by utilizing aforesaid Hazardous waste as "This Ceramic Glaze Mixture /Industrial Ceramics has been manufactured by utilizing ETP sludge, generated during effluent treatment of ceramic industry."

1.4 Standard Operating Procedure for utilization

This SoP is applicable only for the utilization of ETP sludge generated from wastewater treatment of ceramic industries. Any other sludge generated from ceramic industries such as tarry sludge from coal gasifiers, etc, are prohibited for utilization.

1) The ETP sludge shall be transferred to mixer and ball mill through mechanized system ensuring minimal manual intervention. In case of manual transfer of sludge to mixer and grinding mill, proper personal protective equipment (PPEs) such as mask, gloves, safety shoes and helmet shall be provided to the workers.

2) There shall be a designated storage space for ETP sludge and provided with caution sign. Floor of storage area shall be acid proof brick lining or concrete with low raise bund wall.

3) Utilization of ETP sludge shall not exceed 32 % as partial substitute of total raw material.

4) During utilization of ETP sludge in the furnace of ceramic glaze mixture production process, APCD for proper treatment of SO_x shall be installed.

5) Air blower shall be provided to reduce the temperature of escaping flue gas through stack. Heat recovery system may be explored in consultation with SPCB/PCC, if any.

6) The unit shall provide oil-gas separator to avoid mixing of oil with natural gas before it enters in furnace. Furnaces using fuel other than natural gas shall not be permitted for utilization of ETP sludge in manufacturing of ceramic glaze mixture and industrial ceramic without taking approval of CPCB.

7) The unit shall ensure final product quality may not be degraded by utilization of ETP sludge.

8) The treated gases shall comply with emission norms prior to dispersion into atmosphere through stack. The stack height shall be a minimum of 30 m from ground level or as prescribed by the concerned SPCB/PCC, whichever is higher.

9) Treatment and disposal of wastewater:

Waste water generated from floor-washings, spillages, filter press, etc. shall be treated Physico-Chemically in an ETP so as to comply with inlet standards prescribed in case of CETP or be treated in captive ETP having adequate treatment facilities to comply with surface water discharge standards as stipulated in the Consent issued by the SPCBs/PCCs.

In case of zero discharge condition, the treated waste water from ETP may be managed as per conditions stipulated by the SPCB/PCC.

10) The hazardous wastes generated (if any) during utilization process shall be collected and temporarily stored in non-reactive drums under a dedicated hazardous waste storage area and be sent to authorized common TSDF or other authorized facility within 90 days from generation of the waste in accordance with the authorization issued by the concerned SPCB/PCC. Such storage shall be done under covered storage area with proper ventilation.

11) Prior to utilization of ETP sludge, the unit shall obtain authorization for generation, storage, and utilization from the concerned SPCB/PCC under HOWM Rules 2016.

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

13) 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.

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

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

1.5 Record/Returns Filing

1. The unit shall maintain a passbook issued by the concern SPCB/PCC and maintain details of each procurement of ETP sludge as mentioned below:
   - Address of the sender
   - Date of dispatch
   - Quantity procured
   - Seal and signature of the sender
   - Date of Receipt in the premises
2. A log book with information on source and date of generation/procurement of ETP sludge, quantity, date wise utilization of ETP sludge, quantity of ceramic glaze mixture and industrial ceramic manufactured, hazardous waste generation and its disposal, etc. shall be maintained including analysis report of emission monitoring & effluent discharged, as applicable.
3. The unit shall maintain record of hazardous waste generated, utilized and disposed as per Form 3 & also file annual returns in Form 4 as per Rule 20 (1) and (2) of HOWM Rules, 2016.
4. The unit shall submit quarterly and annual information on hazardous wastes consumed, its source, products generated or resources conserved (specifying the details like type and quantity of resources conserved) to the concerned SPCB/PCC.

1.6 Standards

1) Source emission monitoring from the stack attached to APCD of furnace and tunnel kiln shall comply with the following emission standards or as prescribed by the concerned SPCB/PCC, whichever is stringent;

PM	150 mg/Nm^3
SO_2	100 ppm
NO_x	50 ppm
(As^+, Pb^+, Cr^+, Co^+, Cu^+, Mn^+, Ni^+)	0.5 mg/Nm^3
TOC	20 mg/Nm^3

2) Fugitive emission in the work zone shall comply with the following standards:

PM_{10}	5.0 mg/m^3 TWA*
SO_2	13 mg/m^3
NO_x	9 mg/m^3
Silica	10 mg/m^3

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

3) Monitoring of the specified parameters for source emission shall be carried out quarterly for the 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 ISO 17025 accredited or EPA, 1986 approved laboratories and the results shall be submitted to the concerned SPCB/PCC on a quarterly basis.

1.7 Siting of Industry

Facilities for utilization of ETP sludge 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.

1.8 Size of Plant & Efficiency of utilization

2 MT of raw material including 0.64 MT of ETP sludge may yield 1.735 MT of ceramic glaze mixture i.e. 86.75 % yield with 13.25 % of loss in furnace.

0.965 MT of raw material including 0.28 MT of ETP sludge may yield 0.82 MT of industrial ceramic i.e. 84.98% yield with 15.02 % of loss in tunnel kiln.

1.9 On-line detectors / Alarms / Analysers

Online emission monitoring systems shall be installed in case of continuous process operations for PM, NO_x and SO_2 and connected to the server of concerned SPCB/PCC and CPCB.

1.10 Checklist of Minimal Requisite Facilities

S. No	Particulars
1.	Cool, dry, well-ventilated ETP sludge storage area with caution sign and low raise bond wall.
2.	Mechanized system for transfer of ETP sludge from storage area to mixer & ball mill.
3.	Mixer, hopper, furnace
4.	Ball mill, Filter press, pug mill and continuous tunnel furnace/kiln.
5.	Cooling water, Air blower
6.	Oil gas separator to avoid mixing of oil with natural gas before it enters furnace.
7.	De-dust system and cyclones for dust collection in work zone near raw material charging point i.e. mixer, furnace and ball mill.
8.	Suction arrangement to channelize emissions from furnace and tunnel kiln to APCD and finally to the stack of height 30m or as prescribed by the SPCBs/PCCs
9.	Effluent treatment plant.
10.	Stack to have 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.

Utilization of ETP Sludge (generated from Galvanizing unit) in the manufacturing of Iron Ore Pellet

SOP - 82

Sludge from Galvanizing unit

(Category: 35.3 of Schedule I of HOWM Rules, 2016)

1.0 Utilization of hazardous waste (H.W.):

Type of HW	Source of generation	Recovery/Product
ETP Sludge (Category 35.3 of Schedule-I of HOWM Rules, 2016)	ETP of Galvanizing unit	As a raw material in the manufacturing of iron ore pellet

1.1 Source of Waste:

Galvanizing is a Process of protecting steel components against corrosion by Zinc coating, which is applied by dipping them in a bath of molten Zinc. Before dipping the steel component into Zinc bath, surface of the steel components is treated to remove oil, rust, grease etc. by de¬greasing, rinsing, Pickling, etc. operations. The acidic wastewater generated from the galvanizing unit is neutralized with lime in effluent treatment plant (ETP). Sludge from ETP is collected by de-watering through thickener and filter press. This sludge slightly acidic and primarily contains iron.

The ETP sludge is categorized as hazardous waste as category 35.3 of Schedule I of HOWM Rules, 2016 which is required to be disposed in authorized disposal facility in accordance with authorization condition, when not utilized for resource recovery.

1.2 Utilization Process of hazardous waste (ETP Sludge):

Iron Ore fines charged into the ball mill through a belt conveyor and grinded with water. The slurry material from the thickener goes to the filtration and where iron ore cake is generated.

ETP sludge can be mixed with grinded iron ore fines, bentonite, dolomite & other raw materials to produce iron ore pellets, for use in recovery of iron in steel industry. This mixture is sent to the balling unit, where it is agglomerated on balling disc into green (or unfired) balls of 8 to 16 mm size.

The green balls of desired size are subjected to drying, preheating, induration and cooling, during which the balls attain adequate strength. Green balls are dried and preheated in the travel grate machine, then solidified to get adequate strength by undergoing induration in the rotary kiln and cooled in the annular cooler. The finished product (i.e., Iron ore pellets) from the Annular cooler is stored.

Table 1. Typical Characteristics of H.W. (ETP Sludge)

S.No	Parameters	Unit	Result
1.	pH	-	6.29
2.	LOI	%	41.21
3.	Moisture content	%	33.92
4.	Carbon content	%	0.62
5.	Sulphur	%	0.08
6.	Calorific value	Kcal/Kg	120
7.	Fluoride as F	mg/L	0.72
8.	Lead as Pb	mg/L	0.201
9.	Zinc as Zn	mg/L	0.28
10.	Cadmium as Cd	mg/L	ND
11.	Chromium as Cr	mg/L	ND
12.	Nickel as Ni	mg/L	ND
13.	Copper as Cu	mg/L	0.31
14.	Manganese	mg/L	0.08
15.	Arsenic as As	mg/L	ND
16.	Mercury as Hg	mg/L	ND
17.	Cobalt	mg/L	ND
18.	Vanadium	mg/L	ND
19.	Antimony	mg/L	ND
20.	TPH	mg/L	ND
21.	Iron as Fe	%	24.82

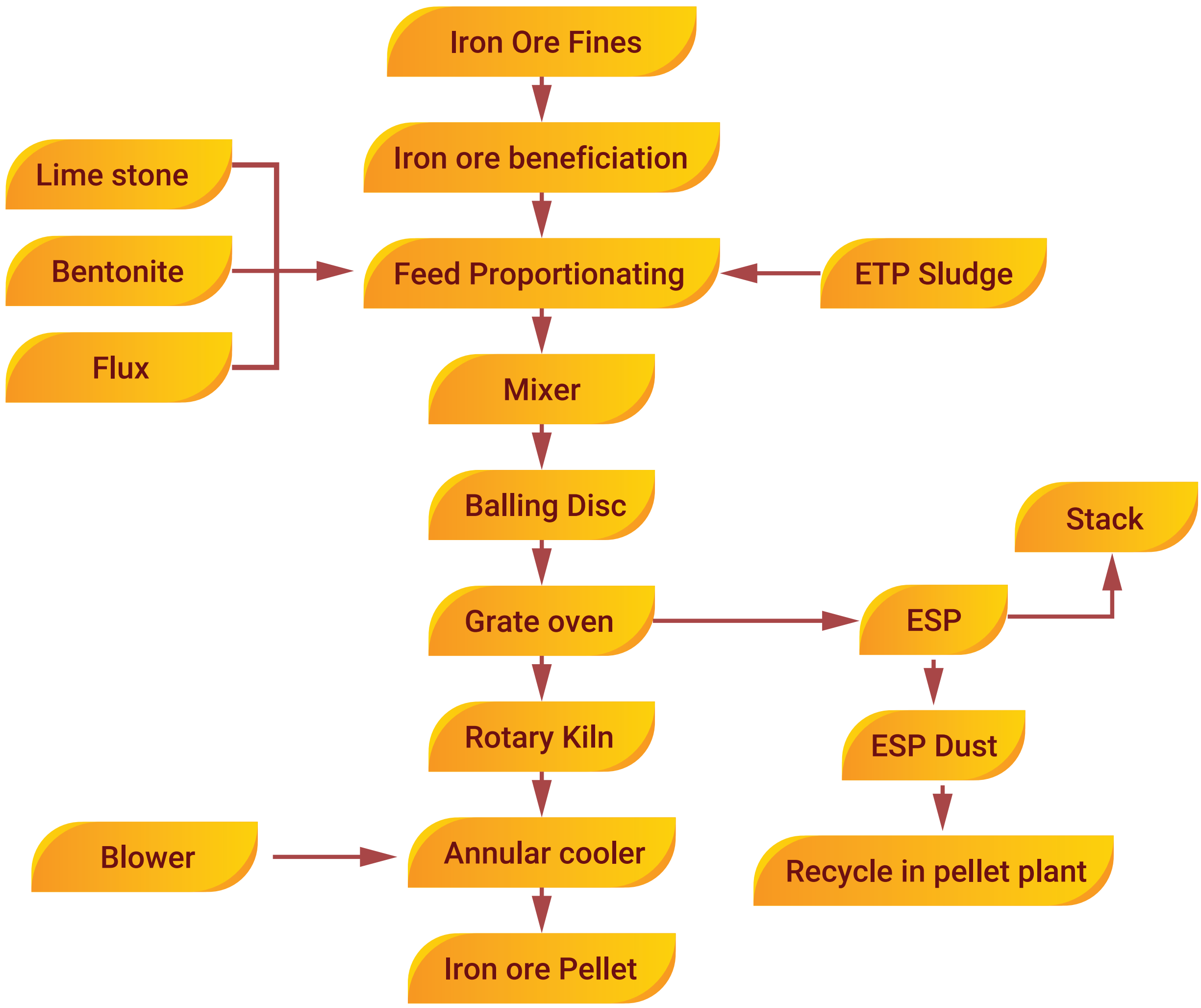


Fig 1: Process flow diagram for utilization of ETP Sludge.

1.3 Product Usage / Utilization

ETP Sludge utilized as additional raw material (along with iron ore) in the manufacturing of iron ore pellet, which will be further utilized in steel industry for production of iron.

1.4 Standard Operating Procedure for utilization of ETP Sludge:

This SoP is applicable only for Utilization of ETP Sludge (generated from Galvanizing unit) in the manufacturing of Iron Ore Pellet.

1) ETP Sludge shall be procured only in SPCB/PCC authorized barrels/closed tanks mounted over vehicles fitted with requisite safeguards ensuring no emissions / spillages.

2) ETP sludge storage area shall be designated with covered shed in the premises so as to prevent rain water intrusion. Floor of storage area shall be acid proof brick lining to avoid any leachates to the ground with low raise bund wall and proper slope to collect spillages, if any, into a collection pit. The collected seepage / floor washing shall be channelized to ETP for further treatment or can be used in the said utilization process. Other raw materials shall be stored in storage tank separately.

3) The moisture content in the ETP sludge shall not exceed 34% before procurement.

4) The unloading, storage, crushing, transfer and other handling ETP sludge shall be carried out using mechanical means with minimal manual intervention.

5) Material transfer / handling in entire utilization process shall be equipped with canopy /hood system or done in closed system. Manual handling shall be restricted.

6) The unit shall ensure control of fugitive emissions in process area by adopting closed system; through dust extraction system with APCD such as bag filter and also, to carry out intermittent water sprinkling in the working area.

7) The gases from Grate, rotary kiln shall pass through APCD like Electro static precipitator to meet the prescribe standards given at section 1.6 below. If required, the unit shall augment air pollution control systems with bag filter / scrubber units to meet the emission standards.

8) The treated gases shall comply with emission norms prior to dispersion into atmosphere through stack. The stack height shall be minimum of 30m from ground level or as prescribed by the concerned SPCB/PCC, whichever is higher.

9) Treatment and disposal of wastewater: Wastewater generated from floor-washings, spillages, units washing etc. shall be reused in the process while mixing raw materials or treated Physico-Chemically in an ETP or may be sent to Common Effluent Treatment Plant (CETP) for final disposal or be treated further in a captive facility to

comply with surface water discharge standards. In case of zero discharge, the treated waste water from ETP may be managed as per conditions stipulated by the SPCB/ PCC. The treated effluent shall be discharged in accordance with the conditions stipulated in the Consent to Operate issued by concerned SPCB/PCC under the Water (Prevention and Control of Pollution) Act, 1974.

10) 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.

11) The wastes generated during utilization of ETP sludge (namely APCD dust etc.) during manufacturing process of unit shall be captively utilized with in the process or collected and temporarily stored in non-reactive drums/ bags under a dedicated hazardous waste storage area and be sent to authorized common TSDF or other authorized facility within 90 days from generation of the waste in accordance with the authorization issued by the concerned SPCB / PCC. Such storage area shall be covered with proper ventilation.

12) The unit shall ensure that the ETP sludge is procured from authorized industries as required under HOWM Rules, 2016.

13) Transportation of ETP sludge shall be carried out by sender (generator) or receiver (utilizer) only after obtaining authorization from the concerned SPCB under HOWM Rules, 2016. Requisite manifest document shall be followed as laid down under the said Rules.

14) Prior to utilization of ETP sludge, the unit shall obtain authorization for handling, storage and utilization from the concerned SPCB/PCC under HOWM 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. The unit shall provide suitable fire safety arrangements and flame proof electrical fittings.

1.5 Record/Returns Filing

1) The unit shall maintain a passbook issued by concern SPCB/PCC and maintain details of each procurement of ETP Sludge as mentioned below:
   - Address of the sender
   - Date of dispatch
   - Quantity procured
   - Seal and signature of the sender
   - Date of Receipt in the premises
2) A log book with information on source and date of procurement of ETP sludge, date wise utilization of the same, hazardous waste generation and its disposal, etc. shall be maintained including analysis report of fugitive emission monitoring & effluent discharged, as applicable.
3) The unit shall maintain record of hazardous waste generated, utilized and disposed as per Form-3 & also file an annual return in Form-4 as per Rule 20 (1) and (2) of HOWM Rules, 2016, to concerned SPCB/PCC.
4) The unit shall submit quarterly and annual information on hazardous wastes consumed, its source, products generated or resources conserved (specifying the details like, type and quantity of resources conserved) to the concerned SPCB/PCC.

1.6 Standards

1) Source emissions from the stack connected to reactors/process unit shall comply with the following Emission standards or as prescribed by the concerned SPCB/PCC including other parameters, whichever is stringent;

Particulate Matter	50 mg/Nm^3

2) Work zone emission in the work zone area shall comply with the following standards:

PM_{10}	3 mg/m^3
NO_x	13 mg/m^3 TWA* (PEL)
SO_2	5 mg/m^3 #

**PEL - Permissible Exposure Limit.*
**Time-weighted average (TWA)- measured over a period of 8 hours of operation of process.*

#-A ceiling limit is one that may not be exceeded for any period of time, and is applied to irritants and other materials that have immediate effects.

3) Monitoring of the above specified parameters for Work zone emission shall be carried out quarterly for first year followed by at least annually in the subsequent year of utilization. The monitoring shall be carried out by ISO 17025 accredited or EPA, 1986 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 concerned SPCB/PCC under the Water (Prevention and Control of Pollution) Act, 1974. In case of zero discharge or no discharge condition stipulated in the consent or non-availability of the common Effluent Treatment Plant (CETP), zero discharge shall be met.

1.7 Siting of Industry

Facilities for utilization of ETP Sludge shall be preferably located in a notified industrial area or industrial park/estate/cluster and in accordance with Consent to Establish issued by the concerned SPCB/PCC.

1.8 Size of Plant and Efficiency of Utilisation

ETP sludge with moisture content < 34 % is allowed, accordingly, the facilities such as storage shed and handling equipment of adequate size and capacity shall be installed.

1.9 Online detectors/ Alarms/ Analyzers

In case of continuous process operations, online emission Analyzers for PM, SO_2 & NO_x in the stack shall be installed and the online data be connected to the server of the concerned SPCB/ PCC.

1.10 Checklist of Minimal Requisite Facilities:

S. No	Particulars
1.	Dedicated storage area and shed for ETP Sludge with acid proof bricklining and proper slope & seepage collection pit.
2.	Mechanized and closed systems for handling & transfer of ETP Sludge.
3.	Grinding equipment, Filter press, Mixer, Disc Pelletizer, and indurationplant for production of iron pellets.
4.	Dust extraction system followed by APCD where there is potential spaces for fugitive emissions.
5.	Material transfer / handling in entire recovery process shall be done without manual interventions inclosed system.
6.	APCD like electro static precipitator followed by bag filter/scrubber, to meet the prescribed standards (as required).
7.	Stack to have 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.
8.	Online analyzers for PM, SO_2, NO_x in the stack in case of continuous process operations.

Utilization of LD Converter gas cleaning sludge as a supplementary resource (along with Iron ore) in the manufacturing of Iron Ore Pellets

SOP - 93

sludge from LD Converter gas cleaning

(Category: 35.1 of Schedule I of HOWM Rules, 2016)

1.0 Utilization of hazardous waste (H.W.):

Type of HW	Source of generation	Recovery/Product
LD Converter gas cleaning Sludge - 35.1 of Schedule III of HOWM Rules – 2016)	Generated during scrubbing of off-gases in Gas Cleaning Plant (GCP) connected to (Linz Donawitz) LD converter in steel manufacturing process.	As a raw material in the manufacturing of iron ore pellet

1.1 Source of Waste:

LD Converter gas cleaning sludge is generated as a result of cleaning the off gases from LD Converter during steel manufacturing process. Hot process gas exits from the LD converter during lancing of Oxygen, is laden with iron oxide dust particles and other particles from the slag, flux charge and the hot metal. The hot process gas is quenched and passed through venturi scrubber. The scrubbing water carries the removed dust to the water treatment facility comprising of flocculation and clarifier units. The settled sludge is passed through the filter press/vacuum drum-filter/etc. and LD Converter gas cleaning sludge cake is generated.

The above sludge is categorized as hazardous waste under category 35.1 of Schedule I of HOWM Rules 2016.

Table 1. Typical Characteristics of LD Converter gas cleaning sludge are given below:

S. No	Parameter	Results
1.	Arsenic, As	0.37 mg/Kg
2.	Antimony, Sb	--
3.	Cadmium, Cd	0.005 mg/Kg
4.	Chromium, Cr	0.255 mg/Kg
5.	Lead, Pb	0.095 mg/Kg
6.	Mercury, Hg	0.043 mg/Kg
7.	Iron, Fe	62.4 %
8.	Nickel, Ni	0.056 mg/Kg
9.	Zinc, Zn	0.6 mg/Kg
10.	Manganese, Mn	2.26 mg/Kg
11.	Cobalt, Co	0.006 mg/Kg
12.	Copper, Cu	0.373 mg/Kg
13.	Vanadium, V	0.077 mg/Kg
14.	Tin, Sn	0.008 mg/Kg

1.2 Utilization Process of hazardous waste (LD Converter gas cleaning Sludge):

The process involves utilization of iron rich LD Converter gas cleaning sludge as a supplementary resource with iron ore fines to make iron pellets, suitable for charging to furnaces. Iron Ore fines charged into the ball mill through a belt conveyor and grinded. The slurry material from the grinder is thickened and send to the filter press where iron ore cake is generated.

Further iron ore cake, LD Converter gas cleaning sludge, bentonite (binding agent), dolomite (fluxing agent) & coke are mixed in the mixer. The mixture is then sent to the balling area where the mixed material is agglomerated on balling disc Pelletizers into green (or unfired) pellets.

Green pellets of desired size are subjected to thermal treatment viz. drying, preheating, induration and cooling, during which the pellets attain adequate strength. Green pellets dried out in a drying section of traveling grate, and finally undergo induration at about 950°C to 1250 °C in the rotary kiln. The pellets are then cooled with the help of annular cooler. The finished products (i.e., Iron ore pellets) from the annular cooler is stored.

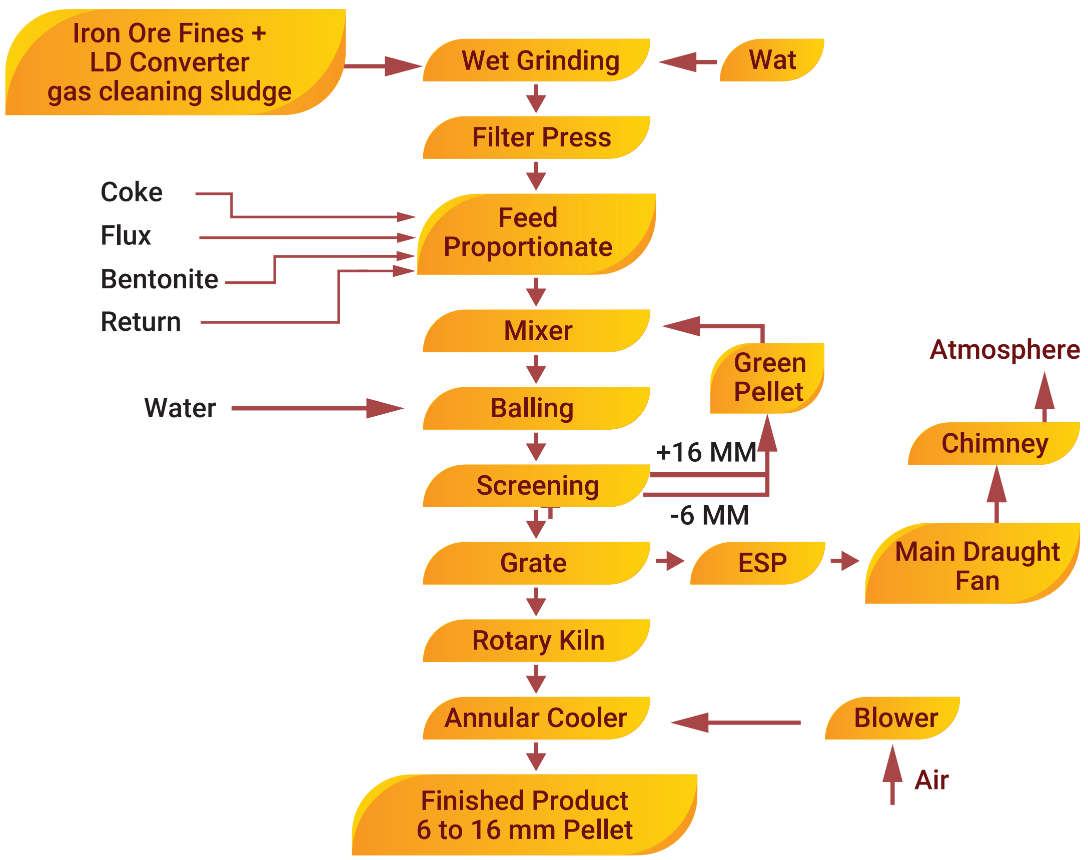


Fig 1: Process flow diagram for utilization of LD Converter gas cleaning Sludge.

1.3 Product Usage / Utilization

LD Converter gas cleaning sludge as supplementary resource (along with iron ore) in the manufacturing of Iron ore pellet, which will be further utilized in steel manufacturing industry.

1.4 Standard Operating Procedure for utilization of LD Converter gas cleaning Sludge:

This SoP is applicable only for the utilization of LD Converter gas cleaning sludge (generated during scrubbing off-gases in Gas Cleaning Plant connected to LD converter in steel manufacturing process) as supplementary resource (along with Iron ore) as a supplementary resource in the manufacturing of Iron Ore Pellet.

1) LD Converter gas cleaning sludge shall be procured only in SPCB/PCC authorized barrels/closed trucks mounted over vehicles fitted with requisite safeguards ensuring no emissions/spillages.
2) LD Converter gas cleaning sludge shall be stored in dedicated storage area with impervious floor under covered storage shed within premises. Further, storage sheds shall have proper slope and seepage collection pit to collect seepage/ floor washing. The collected seepage / floor washing shall be utilized in the process or channelized to ETP for further treatment. LD Converter gas cleaning sludge and other raw materials shall be stored separately.
3) Utilization of LD Converter gas cleaning Sludge shall not exceed 35 % of the total raw material consumption for manufacturing of iron ore pellet.
4) The unloading, storage, crushing, transfer and other handling LD Converter gas cleaning sludge shall be carried out using mechanical means with minimal manual intervention in closed system.
5) The unit shall ensure control of fugitive emissions at material transfer points, mixing units and grinding units by adopting closed system, and also through dust extraction system with APCD such as bag filter.
6) The unit shall install Electro static precipitator (ESP) and Bag filter for cleaning of exhausting gases from travelling grate and rotary kiln. However, if ESP complies with the prescribed standards, Bag filter may not be not required. Further, in case of using furnace oil or any other high sulphur fuels, alkali scrubber shall be installed in addition to above said APCD system.
7) The treated gases shall comply with emission norms prior to dispersion into atmosphere through stack. The stack height shall be minimum of 30m from ground level or as prescribed by the concerned SPCB/PCC, whichever is higher.

8) Wastewater generated from floor-washings, spillages, reactor washing, scrubber bleed shall be reused in the process while mixing raw materials or treated Physio-Chemically in an Effluent Treatment Plant (ETP). In case of zero discharge, the treated waste water from ETP may be managed as per conditions stipulated by the concerned SPCB/PCC.

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

10) 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.

11) The wastes generated during utilization of LD Converter gas cleaning sludge shall be collected and taken back to utilization process.

12) The unit shall ensure that the LD Converter gas cleaning sludge procured from the industries, which have valid authorization from the concerned SPCB/PCC as required under HOWM Rules, 2016.

13) Transportation of LD Converter gas cleaning sludge shall be carried out by sender (generator) or receiver (utilizer) only after obtaining authorization from the concerned SPCB under HOWM Rules, 2016. Requisite manifest document shall be followed as laid down under the said Rules.

14) Prior to utilization of LD Converter gas cleaning sludge, the unit shall obtain authorization for handling, storage and utilization from the concerned SPCB/PCC under HOWM 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) 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. The unit shall provide suitable fire safety arrangements and flame proof electrical fittings.

1.5 Record/Returns Filing

1) The unit shall maintain a passbook issued by concern SPCB/PCC and maintain details of each procurement of LD Converter gas cleaning sludge as mentioned below:
   - Address of the sender
   - Date of dispatch
   - Quantity procured
   - Seal and signature of the sender
   - Date of Receipt in the premises
2) A log book with information on source and date of procurement of LD Converter gas cleaning sludge, date wise utilization of the same, hazardous waste generation and its disposal, etc. shall be maintained including analysis report of fugitive emission monitoring & effluent discharged, as applicable.
3) The unit shall maintain record of hazardous waste generated, utilized and disposed as per Form-3 & also file an annual return in Form-4 as per Rule 20 (1) and (2) of HOWM Rules, 2016, to concerned SPCB/PCC.
4) The unit shall submit quarterly and annual information on hazardous wastes consumed, its source, products generated or resources conserved (specifying the details like, type and quantity of resources conserved) to the concerned SPCB/PCC.
5) The unit shall use NHWTS to manage the manifest, enter daily records of quantity generated, disposed, etc. once the portal is operational.

1.6 Standards

1) Source emissions from the stack connected to reactors/process unit shall comply with the following Emission standards or as prescribed by the concerned SPCB/PCC, whichever is stringent;

Particulate Matter	50 mg/Nm^3

2) In addition to the above, the concerned SPCB shall prescribe the standards for the necessary parameters in accordance with EP(A) Rules, 1986.

3) Work zone emission in the work zone area shall comply with the following standards:

PM_{10}	5 mg/m³ TWA* (PEL)
SO_2	13 mg/Nm³ TWA* (PEL)
NO_x	9 mg/Nm³ #

**PEL - Permissible Exposure Limit.*
**Time-weighted average (TWA) - measured over a period of 8 hours of operation of process.*
 # - A ceiling limit is one that may not be exceeded for any period of time, and is applied to irritants and other materials that have immediate effects.

4) Monitoring of the above specified parameters for Source emissions and Work zone emission shall be carried out quarterly for first year followed by at least annually in the subsequent year of utilization. The monitoring shall be carried out by ISO 17025 accredited or EPA, 1986 approved laboratories and the results shall be submitted to the concerned SPCB/PCC on a quarterly basis.

5) Standard for wastewater discharge: Treated effluent shall be discharged in accordance with the conditions stipulated in Consent to Operate issued by concerned SPCB/PCC under the Water (Prevention and Control of Pollution) Act, 1974.

1.7 Siting of Industry

Facilities for utilization of LD Converter gas cleaning sludge shall be preferably located in a notified industrial area or industrial park/estate/cluster and in accordance with Consent to Establish issued by the concerned SPCB/PCC.

1.8 Size of Plant and Efficiency of Utilisation

This SoP is applicable for the utilization of LD Converter gas cleaning sludge shall not exceeding 35 % of the complete raw material consumption. Therefore, requisite facilities of adequate size of storage shed and other plant & machineries shall be installed accordingly.

1.9 Online detectors/ Alarms/ Analyzers

In case of continuous process operations, online emission Analyzers for PM in the stack shall be installed and the online data be connected to the server of the concerned SPCB/ PCC.

1.10 Checklist of Minimal Requisite Facilities:

S. No	Particulars
1.	Cool, dry well-ventilated covered sheds for LD Converter gas cleaning Sludge and process activities within premises and dedicated hazardous storage area for temporary storage of hazardous waste generated during utilization process
2.	Mechanized and closed systems for handling & transfer of LD Converter gas cleaning Sludge
3.	Grinding equipment, Filter press, Mixer, Disc Pelletizer, Grate, Rotary Kiln and Annular Cooler.
4.	Dust extraction system with APCD like Electro static precipitators/ Bag filters/ Cyclone for fugitive emission.
5.	The unit shall install Electro static precipitator Electro static precipitator (ESP) and Bag filter for cleaning of exhausting gases from travelling grate and rotary kiln. However, if ESP complies with the prescribed standards, Bag filter may not be not required. Further, in case of using furnace oil or any other high sulphur fuels, alkali scrubber shall be installed in addition to above said APCD system.
6.	Stack to have 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.
7.	Online analyzers for PM emission monitoring in the stack, in case of continuous process operations.

Spent Catalyst

Utilization of Spent Catalyst and Chemical Sludge containing precious metals

SOP - 03

Spent Catalyst and Chemical Sludge

(Category: 1.6, 18.1, & 35.3 of Schedule I of HOWM Rules, 2016)

1.0 Utilization of Spent Catalyst and Chemical Sludge containing precious metals

Type of HW	Source of generation	Recovery/Product
Spent catalyst	Petrochemical process and pyrolytic operation, petroleum refining, production of acids, production of nitrogenous and complex fertilizers and production/formulation of drugs/pharmaceuticals	Recovery of Platinum, Iridium, Osmium, Palladium, Rhodium, Ruthium, Rhenium, Gold & Silver to produce electrical contacts and non-ferrous strips.
Chemical /ETP Sludge containing platinum	Effluent treatment plant	Platinum to produce electrical contacts and non-ferrous strips

The utilization process shall adopt hydrometallurgical processes involving, leaching, filtration and washing to obtain metal compound in solution form. Heat treatment in furnace, prior to hydrometallurgical processes, may be given to alumina/carbon/silica based catalysts as applicable. The metal from its compound form is recovered through replacement reaction.

The recovery of precious metals shall involve the following steps:

- In case of Carbon based spent catalyst, burning in the furnace at a temperature of 850°C, and leaching of the residue with HCl/ HNO_3 or aqua regia followed by filtration and residue washing to recover precious metals.
- In case of Spent alumina based catalyst, direct leaching as above followed by filtration and residue washing to recover precious metals. If carbon soot is present, burning in furnace followed by chemical leaching as above.

1.1. Standard Operating Procedure

1) Minimum temperature of 850°C shall be maintained with residence time of about 02 seconds in the furnace in cases where Spent Catalyst/Spent Carbon is subjected to heat in furnace. The flue gases from furnace shall be treated in air pollution control devices so as to meet standards prescribed for PM by the concerned SPCB.

2) The height of the stack attached to furnaces shall be 30 meters from ground or as prescribed by the concerned SPCB, whichever is higher.

3) All the reaction vessels (where acids are used or expected to be liberated) shall be connected with hood over them to suck acid fumes/vapours. The hood shall be maintained under suction followed by treatment in scrubber using alkaline medium. The treated gases from scrubber shall be dispersed into atmosphere through stack by complying with emission norms for HCl, Acid mist and NO_x.

4) There shall be no manual handling of the hazardous wastes, acids, water, residues, chemicals etc. The same shall be handled mechanically and it shall be ensured that there is no spillage or pilferages around the process area. The transit material shall be kept or handled in acid-proof containers.

5) The entire process area shall have leak-proof and acid proof tiles with adequate slope to collect spillages if any into collection pit.

6) The waste water generated from the process shall be treated in Effluent Treatment Plant to meet standards and treated water be discharged or utilized as prescribed by the concerned SPCB under the Consent to Operate issued under the Water (Prevention and Control of Pollution) Act, 1974.

7) The washed alumina after recovery of precious metals may be sent to refractory brick manufacturer. However, rest of the solid residues from process and ETP sludge shall be packaged and temporarily stored in a dedicated hazardous waste storage area within the unit premise and disposed in common hazardous waste treatment, storage and disposal facility within 90 days.

8) The unit shall ensure that all personnel involved in the plant operation shall wear proper personal protective equipment such as masks, safety gloves, goggles, safety shoes etc.

9) The unit shall comply with following standards:

- Stack emission standards for stacks attached to Furnace-

  Particulate Matter - as stipulated by the concerned SPCB

- Stack emission standards for stacks attached to Reaction Vessels-

  Work Zone standards –

Hydrochloric Acid Vapour & Mist	35 mg/Nm³
Sulphuric Acid Mist	50 mg/Nm³
Nitrogen Dioxide	400 mg/Nm³

** Time-weighted average (TWA), Short-term exposure limits (STEL).*

The Permissible Exposure Limit is 8-hour TWA.

Sulphuric acid	0.1 mg/m^3 TWA*, 3 mg/m^3 STEL*
Hydrochloric acid	7 mg/m^3 Ceiling limit
Nitrogen Dioxide	9 mg/m^3 Ceiling limit

A short-term exposure limit (STEL) is the acceptable average exposure over a short period of time, usually 15 minutes as long as the Time weighted average is not exceeded.

A ceiling limit is one that may not be exceeded for any period of time, and is applied to irritants and other materials that have immediate effects.

10) Monitoring of the specified parameters for source and work zone emissions as well as aforesaid effluent shall be carried out by NABL/EPA accredited laboratories quarterly and the results shall be submitted to the concerned SPCB quarterly.

11) Transportation of the Spent Catalyst/Chemical Sludge and residues generated from utilisation process shall be carried out by sender or receiver (utilizer/TSDF operator) after obtaining authorization from the concerned SPCB as per the provisions under the Hazardous and Other Wastes (Management & Transboundary Movement) Rules, 2016.

12) It shall be ensured that the aforesaid hazardous wastes is procured from the industries who have valid authorization for the same from the concerned SPCB as required under Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016.

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

14) The unit shall maintain a passbook issued by concerned SPCB wherein the following details of each procurement of Spent Catalyst and Chemical Sludge shall be entered:
    - Address of the sender
    - Date of dispatch
    - Quantity procured
    - Seal and signature of the sender
    - Date of receipt in the premises

15) The unit shall maintain record of hazardous waste utilised, residues 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 SPCB.

16) A log book with information on source and date of procurement of each type of the said hazardous wastes, quantity, date wise utilization of the same, quantity of other raw material used, quantity of products manufactured, hazardous waste generation and its disposal etc. shall be maintained including analysis report of emission monitoring & effluent discharged, as applicable.

17) In case of environmental damages arising due to improper handling of hazardous wastes including accidental spillage during generation, storage, processing, transportation and disposal, the unit 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.

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

1.2. Checklist of Minimal Requisite Facilities

S. No	Requisite Facilities
1.	Storage shed for storage of Spent Catalyst and Chemical Sludge. The shed shall be covered so as to eliminate rain water intrusion. Cemented flooring or any other impervious flooring shall also be made under the storage shed.
2.	Size of the said storage shed to be adequate to store at least one week requirement of the said hazardous wastes to be used as raw material
3.	Furnaces of adequate capacity along with air pollution control devices like cyclone and alkali scrubber or other adequate system followed by stack of height 30 meters from ground level. Stack with easy access to port hole, for conducting stack monitoring
4.	Acid/aqua regia storage vessels

5.	Mechanical means for transferring of acids/liquid chemicals to the reaction vessels
6.	Jacketed Reactor Vessels (Lined with stainless steel or glass or suitable material)
7.	Centrifuge/filter press or other suitable equipment for filtration (to separate leached solution and solid residue), washing and dewatering
8.	The entire process area shall have leak-proof and acid proof tiles with adequate slope to collect spillages if any into collection pit.
9.	Boiler to supply heat to jacketed reactor vessel
10.	Reaction vessel to recover metal from its compound form
11.	Hood over all reaction vessels with proper acid proof ducting material maintaining suction and attached to scrubber and stack
12.	Effluent treatment plant to meet the prescribed treated water standards
13.	Properly covered hazardous waste storage area to store packaged process residues and ETP sludge. Size of the same shall be sufficient to store the said wastes for 90 days.

Utilization of Spent catalyst containing Mercury & Mercury Waste

SOP - 17

Spent catalyst containing Mercury & Mercury Waste

(Category: 29.1 of Schedule I of HOWM Rules, 2016)

1.0 Utilization of Spent catalyst containing Mercury & Mercury Waste

This SoP is applicable only for utilization of Spent catalyst - Containing Mercury and mercury waste as described below:

Type of HW	Source of generation	Recovery/Product
Spent catalyst - Containing Mercury and mercury waste	Various industry	Mercury

The utilization process shall involve heating of Spent catalyst containing Mercury (impregnated in activated carbon) in vacuum furnace and heated upto 400^{o}C for 48-72 hours using coal as fuel. Mercuric compound in the Spent Catalyst is disintegrated and mercury vapours are released. The mercury vapours generated are condensed in water cooled condenser and converted to liquid mercury which is packed in MS bottles.

1.1 Standard Operating Procedure

1) Spent catalyst - Containing Mercury and mercury waste shall be recived in HDPE bags/drums
2) Spent catalyst - Containing Mercury and mercury waste shall be received and stored under covered shed with ventilation
3) There shall be no manual handling of the Spent catalyst - Containing Mercury and mercury waste, residues, chemicals etc. The same shall be handled mechanically ensuring that there is no spillage or pilferages around the process area.
4) The entire process area shall have impervious floor.
5) Spent catalyst - Containing Mercury and mercury waste is heated in a closed vessel using conventional fuels. The flue gases from furnace shall be passed through water cooled condenser to recover liquid mercury. The condensate water shall be re¬circulated through a cooling circuit (Cooling Tower/Refrigeration unit/other cooling arrangement). The waste shall be heated at a temperature of 300°C - 450°C.
6) The flue gas after condenser shall be treated in scrubber using Sodium Sulphide solution so as to meet standards prescribed by the SPCB or CPCB, whichever is lower. The height of the stack (attached to the said scrubber) shall be 30 meter from ground or as prescribed by the concerned SPCB, whichever is higher.
7) The combustion emission from the heating shall be connected to scrubber.

8) The scrubbed liquor viz. Sodium Sulphide solution shall be re-circulated through a collection-cum-settling tank. The settled sludge from the recirculation tank shall be sent to sludge drying bed and finally be sent for disposal into common hazardous waste treatment, storage & disposal facility.

9) The bleed water from scrubber shall be sent to solar evaporation pan and dried residue shall be sent for disposal into common hazardous waste treatment, storage & disposal facility.

10) There shall no waste water discharge.

11) The hazardous waste (viz. furnace residue, sludge and solar evaporation residue etc.) generated from utilization process shall be packaged and temporarily stored in a dedicated hazardous waste storage area within the unit premise and be sent for disposal in common hazardous waste treatment, storage and disposal facility within 90 days.

12) The unit shall ensure that all personnel involved in the plant operation shall wear proper personal protective equipment such as masks, safety gloves, goggles, safety shoes etc.

13) The unit shall comply with following standards:

- Stack emission standards -
  Particulate Matter – 50 mg/Nm^3 or as stipulated by SPCB, whichever is lower; Mercury & its compounds – 0.05 mg/Nm^3 or as stipulated by SPCB, whichever is lower.

- Work Zone standards

PM_{10}	5 mg/m^3 TWA*
Mercury	0.1 mg/m^3 Ceiling limit

** Time-weighted average (TWA), The Permissible Exposure Limit is 8-hour TWA. A ceiling limit is one that may not be exceeded for any period of time, and is applied to irritants and other materials that have immediate effects.*

14) Monitoring of the specified parameters for source and work zone emissions as well as aforesaid effluent shall be carried out by NABL/EPA accredited laboratories quarterly and the results shall be submitted to the concerned SPCB quarterly.

15) Transportation of the aforesaid hazardous wastes (i.e. Spent catalyst containing Mercury & Mercury Waste) and residues generated during utilisation process shall be carried out by sender or receiver (utilizer/TSDF operator) as per authorization issued by the concerned SPCB under the Hazardous and Other Wastes (Management & Transboundary Movement) Rules, 2016.

16) It shall be ensured that the Spent catalyst containing Mercury & Mercury Waste is procured from the industries who have valid authorization for the same from the concerned SPCB as required under Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016.

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

18) The unit shall maintain a passbook issued by concerned SPCB wherein the following details of each procurement of Spent catalyst containing Mercury & Mercury waste shall be entered:

    - Address of the sender
    - Date of dispatch
    - Quantity procured
    - Seal and signature of the sender
    - Date of receipt in the premises

19) The unit shall maintain record of hazardous waste utilised, residues 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 SPCB.

20) A log book with information on source, quantity and date of procurement, date wise utilization of the same, quantity of products manufactured, hazardous waste generation and its disposal etc. shall be maintained including analysis report of emission monitoring & effluent discharged, as applicable.

21) In case of environmental damages arising due to improper handling of hazardous wastes including accidental spillage during generation, storage, processing, transportation and disposal, the unit 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.

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

1.2 Checklist of Minimal Requisite Facilities

S. No	Requisite Facilities
1.	Storage shed for storage of Spent catalyst containing Mercury & Mercury Waste. The shed shall have impervious flooring and well ventilated.
2.	Size of the Spent catalyst containing Mercury & Mercury Waste shall have minimum capacity of at least one week requirement
3.	Heating vessel along with Mercury Condenser
4.	Cooling circuit for recirculation of condensate water through Cooling Tower/Refrigeration unit/other cooling arrangement.
5.	Facility for Mercury collection in MS Bottles
6.	Scrubber with arrangement of re-circulation of scrubbing medium (Sodium Sulphide Solution) through a collection-cum-settling tank
7.	Stack (attached to the said scrubber) of height 30 meter from ground or as prescribed by the concerned SPCB, whichever is higher.
8.	Impervious floor in the entire process area
9.	Solar Evaporation pan of adequate size
10.	Sludge Drying Bed for scrubber residue
11.	Hazardous waste (i.e. furnace residue, sludge and solar evaporation residue etc.) shall be collected in HDPE bags/drums and stored under covered storage area

Others

Utilization of Spent Alumina generated from Polymerization in Swing Unit of Petrochemical Plant

SOP - 28

Spent Alumina from Petrochemical Plant

(Category: 1.6 of Schedule I of HOWM Rules, 2016)

1.0 Utilization of Spend Allumina

Type of HW	Source of generation	Recovery/Product
Spent Alumina Category 1.6 of schedule-I of HOWM Rules, 2016	Spent activated alumina used as molecular sieve/ absorbent for metal chelates in Polymerization in swing unit of Petrochemical Plant	For manufacturing of Refractory material like Insulation bricks, High Alumina bricks and High Alumina Refractory Binder

1.1 Source of Waste

Activated alumina is used in swing unit of Naptha Cracker plant in petrochemical industry, as an adsorbent, to improve the colour of the product. In swing unit, polymerization reaction takes place in presence of catalyst. The remaining catalyst is deactivated by the deactivators into metal chelates in reactor downstream. These deactivators and metal chelates are adsorbed on activated alumina in solution adsorber to improve the appearance of the finished product. The spent alumina after use is discarded after 3-4 days of operation as hazardous waste categories under S.No. 1.6 of Schedule-I of HOWM Rules, 2016. Spent alumina constitutes of 93-95% aluminium oxide and is non-combustible. This hazardous waste required to be disposed in authorized disposal facility in accordance with authorization condition, when not utilized as energy/resource recovery.

1.2 Utilization Process

Spent alumina is utilised by replacing use of fresh alumina in producing variety of insulation materials. Depending on type of insulation materials; raw material composition, moulds, temperature in kiln and time of heating are changed. Trial study was carried out to demonstrate safe utilization of spent alumina in producing following types of insulation material;

1) For Insulation Bricks -The utilization process involves mixing of spent alumina (25%) with china clay (45%) and saw dust (30%) then extruded through pug mill and kept for air drying after cutting these bricks through wire. After air drying these insulation bricks are passed through tunnel kilns @ 1250-1500 ℃ for 7-8 hours. After cooling these bricks are sent for cutting through machined brick cutting machine to get desired shape.

2) For High Alumina Refractory Binder- For manufacturing of high alumina refractory binder, spent alumina (85%) is mixed with hydrated lime then passed through noduliser using molasses as binder. These nodules are sent to rotary kiln at 1500 ℃ to get clinker (retention time inside rotary kiln is 03 hours). This clinker is crushed in closed circuit ball mill to get high alumina binder as a product.

3) High Alumina Bricks- Utilization process involves mixing of spent alumina (25%) with calcined bauxite (50%), calcined diaspore (5%) calcined pyrophillite (5%) and fire clay (15%) in counter current mixer with water. After mixing it is pressed in friction screw press & hydraulic press machine to mould high alumina brick. These pressed bricks are then treated in tunnel kilns @ 1250-1500°C for 7-8 hours.

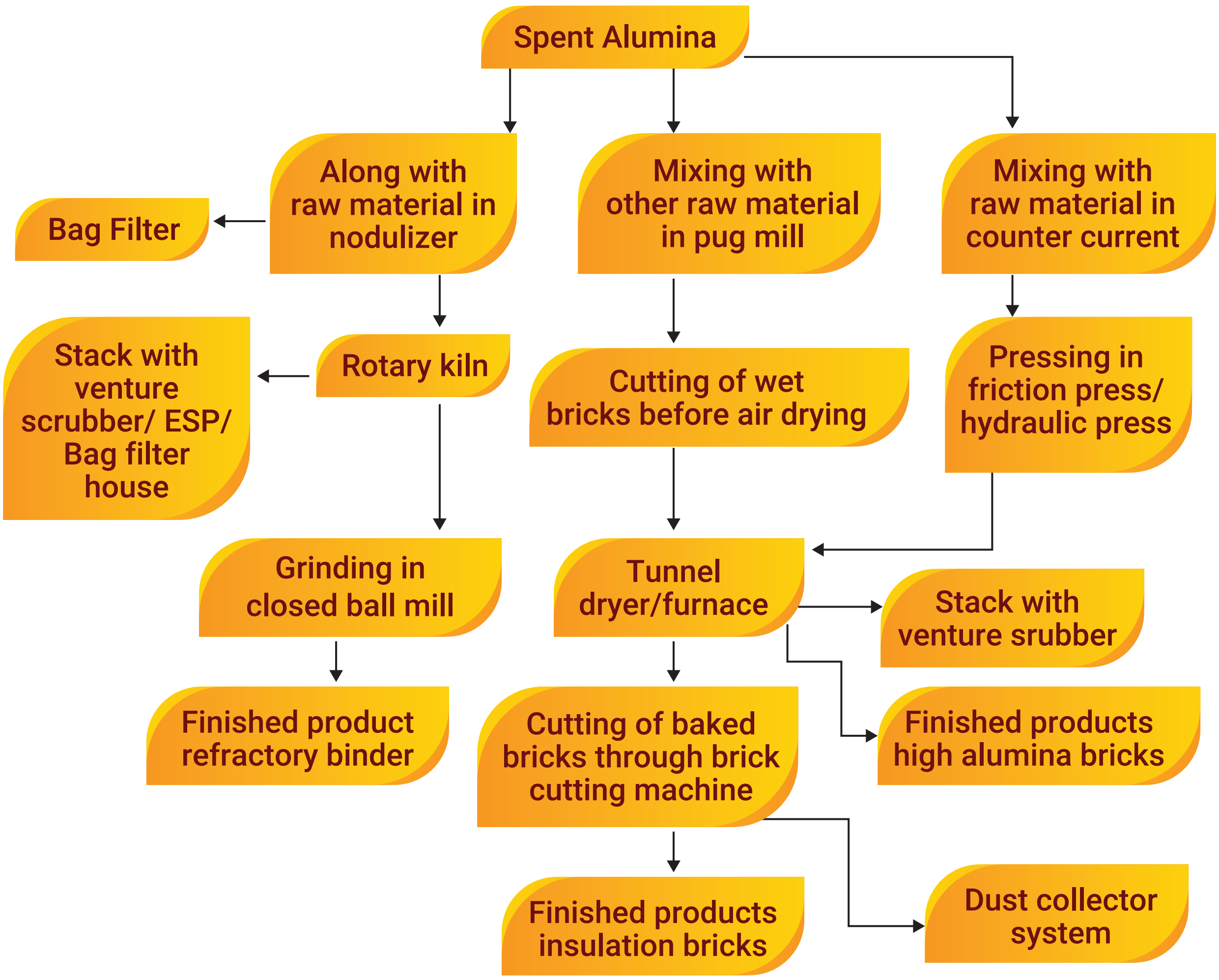


Fig 1: Process Flow Diagram for utilization of spent alumina genarated from Perochemical Plant

1. 3 Product Usage / Utilization

Spent alumina and along with other raw material would be utilised as supplementary resource material for production of insulation bricks, high alumina bricks and high alumina refractory binder, which are used as refractory material in various industrial furnaces, ovens and other processes.

1.4 Standard Operating Procedure (SoP) for utilization

This SoP is applicable only for the utilization of spent alumina generated from swing unit of Naptha Cracker plant in petrochemical industry to produce Insulation Bricks, High Alumina Bricks and High Alumina Refractory Binder.

1) The spent alumina should be transported in non-reactive bags/drums mounted on vehicles fitted with requisite safeguards ensuring no spillage of waste.
2) Transportation of spent alumina shall be carried out by the sender (generator) or receiver (utilizer) as per the authorization issued by concerned SPCB under the Hazardous and Other Wastes (Management &Transboundary Movement) Rules, 2016.
3) There should be a designated space for unloading of spent alumina bags/drums. The receiving storage area shall be placed above the ground and contained with low raise bund wall & concrete floor.
4) The unit shall store spent alumina under dry and well-ventilated covered storage shed(s) within premises, as authorized by the concerned State Pollution Control Board/Pollution Committee under Hazardous and Other Wastes (Management &Transboundary Movement) Rules, 2016 so as to eliminate rain water intrusion. Unit shall provide sprinkler system in the storage area to avoid dust emission during handling and transfer.
5) The entire process area shall have impermeable tiled/concrete floor.
6) There shall be no manual handling and transfer of spent alumina.
7) Mechanized equipment having cover shall be used for mixing of spent alumina with other raw material under covered shed with adequate safety gadgets provided to workers ensuring proper ventilation in the process area.
8) Water sprinkling system should be used in handling area and mixing process to minimise the dust emission.

9) The unit shall also provide proper storage and handling of saw dust to keep it moistened from time to time to arrest dust emission. There should be adequate systems for fire protection.

10) There shall be minimal manual handling of bricks and other refractory materials.

11) The unit shall maintain proper ventilation in the work zone and process areas (preferably ventilation ducts connected with ID fan and roof top exhaust may be provided). All personnel involved in the plant operation shall wear proper personal protective equipment such as Safety glasses with side shields, heat resistant gloves, helmet, mask, safety footwear with good traction to prevent slipping etc. in accordance with the OSHA guideline for personnel protective equipment.

12) The unit shall separately store the finished products under cool, dry and well-ventilated covered storage shed within the premises.

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

14) It shall be ensured that spent alumina is procured from the industries who have valid authorization for generation/storage of the same from the concerned SPCB/PCC as required under Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016.

15) Un-utilized spent alumina, if any, should be collected and temporarily stored in steel drums in a dedicated hazardous waste storage area and sent to TSDF within 90 days from generation of the waste. Such storage area shall be covered with proper ventilation.

16) Prior to utilization of spent alumina, the unit shall obtain authorization for generation, storage and utilisation of spent alumina from the concerned State Pollution Control Board under the Hazardous and Other Wastes (Management & Transboundary Movement) Rules, 2016.

17) In case of environmental damages arising due to improper handling of hazardous wastes including accidental spillage during generation, storage, processing, transportation and disposal, the unit 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.

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

1.5 Standards

1) Emissions from stack connected to rotary kiln and tunnel furnace shall comply with:
   i. PM emission —(As prescribed by the SPCB/PCC in the consent to operate)

   ii. NO_x emission—400 mg/Nm³

2) Fugitive emissions in the all four work zone area shall comply with:

   i. Respirable dust (PM_{10}) - 5000 µg/m³ TWA*

   **TWA - Time-weighted average*
   The Permissible Exposure Limit is 8-hour TWA.
   (Reference: OCCUPATIONAL SAFETY AND HEALTH STANDARDS 1910.1000)

3) STCL value of the refectory material shall meet the concentration value of vanadium less than 1.1 mg/L.

4) Monitoring of the specified parameters for source emission shall be carried out quarterly for the 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 accredited or EPA approved laboratories results shall be submitted to the concerned SPCB/PCC quarterly.

1.6 Record/ Returns Filing

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

2) A log book with information on source and date of procurement of spent alumina, quantity, date wise utilization of the same, hazardous waste generation and its disposal, etc. shall be maintained.

3) The unit shall maintain a passbook issued by concerned SPCB wherein the following details of each procurement of spent alumina shall be entered:
   - Address of the sender
   - Date of dispatch
   - Quantity procured
   - Seal and signature of the sender

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

1.7 Siting of Industry

Facilities for processing of spent alumina should preferably be located in a notified industrial area or industrial park/estate/cluster.

1.8 Size of Plant & Efficiency of utilisation

Spent alumina may be utilised as alternate raw material to supplement up to 85% by weight of the refractories produced. It is expected that spent alumina would be used completely without any residues. The requisite facilities of adequate size shall be installed accordingly as mentioned under section 1.10 below.

1.9 On-line detectors / Alarms f Analysers

Online emission analysers for PM and NO_X in the stack shall be installed and the online data be connected to the server of the concerned SPCB/PCC and CPCB.

1.10 Checklist of Minimal Requisite Facilities

S. No	Requisite Facilities
1.	Storage shed(s) for storage of spent alumina in non-reactive bags/drums only under cool, dry, well-ventilated covered storage shed(s) within premises.
2.	Separate storage shed(s) for storage of other raw materials only under dry, well- ventilated covered storage shed(s) within premises.
3.	Mechanized system for handling, transfer and mixing of spent alumina with other raw materials and product manufactured.
4.	Ventilation system in the work zone and process areas (preferably install ventilation ducts connected with ID fan and roof top exhaust).

5.	Dust suppression water sprinklers in material handling areas
6.	Nodulizers connected to dust extraction system comprising of bag house dust collectors (pulse jet type).
7.	Tunnel Furnace with APCD comprising of multicyclone and venturi scrubbers
8.	Rotary kiln with APCD comprising of multicyclone and venturi scrubbers or ESP/Bag filter house
9.	Stack of height as prescribed by SPCB with easy access to port hole and arrangement of platform, ladder for conducting stack monitoring
10.	Covered hazardous waste storage area to store hazardous generated during utilization process.
11.	Pulverizer / Ball Mill in closed system connected with bag dust collectors
12.	Pug Mill
13.	Mechanized brick cutting machine along with space de-dusting systems connected to dust collector bag house.
14.	Brick pressing/Friction screw press/Hydraulic press
15.	Blender
16.	Water sprinkling system
17.	Conveyer System
18	Storage hoppers for raw feeding
19.	Fire extinguisher systems and fire detectors
20.	Online analyzers for PM and NO_x emission monitoring in stack

Utilization of Spent Pot Lining (SPL) generated from Primary Aluminium Smelting Industries

SOP - 32

Spent Pot Lining from Primary Aluminium Smelting Industries

(Category: 11.2 of Schedule I of HOWM Rules, 2016)

1.0 Utilization of Spent Pot Lining (SPL)

Type of HW	Source of generation	Recovery/Product
Spent Pot Lining (SPL) – Category 11.2 of Schedule – I of HOWM Rules, 2016	During production of primary Aluminium from Alumina Smelting Industries	For manufacturing of carbon mineral fuel to be used as resource /energy recovery in high temperature (more than 1000°C) applications such as cement kiln, iron, steel and ferrous alloy industries

1.1 Source of Waste

Spent Pot Lining (SPL) is a waste generated in the primary aluminium smelting industries. Primary aluminium is produced by the electrolysis of alumina in Hall-Heroult electrolytic reduction pots at 960°C using carbon anode and a mixture of molten Cryolite (Na_3AlF_6) with 28% of dissolved alumina (Al_2O_3) and other additives. The reduction pot is provided with electrically conductive carbon linings for electrolyzing the molten electrolyte by passing an electric current between carbon anode dipped into the molten bath whereas the carbon lining acting as cathode. The outer pot lining consists of refractory material enclosed in a steel pot-shell. Cells of this type have a typical life span of 3 to 6 years. During pot operation, carbon lining gradually deteriorate with slow penetration of molten melt. The linings gets deteriorated and the continued operation of the cells demands replacement of pot – lining. This replaced pot lining is termed as Spent Pot Lining (SPL) which is categorized as hazardous waste as S.No. 11.2 of Schedule – I of HOWM Rules, 2016 which is required to be disposed in authorized disposal facility in accordance with authorization condition, when not utilized as energy resource recovery. Typical spent pot lining contains carbon (60-75%), SiO_2 (1-2%), Al_2O_3 (7-8%) Fe_2O_3 (1-2%), Na (7-11%), Fluoride (4-7%) and Cyanide (100-250 ppm).

1.2 Utilization Process

The utilization process involves crushing of SPL (of size 200-500 mm received from generator) in crusher followed by screening (30 mm). The screened (-30mm) SPL is subjected to heat treatment in a rotary kiln at 430-460℃ for cyanide destruction. The heat treated SPL is fed directly to the rotary hydro mist reactor along with lime and controlled water mist to convert the leachable fluoride into non-leachable CaF_2. Resultant mass form the reactor is collected and packed in bags as finished product termed as Carbon mineral fuel to be used in cement kiln.

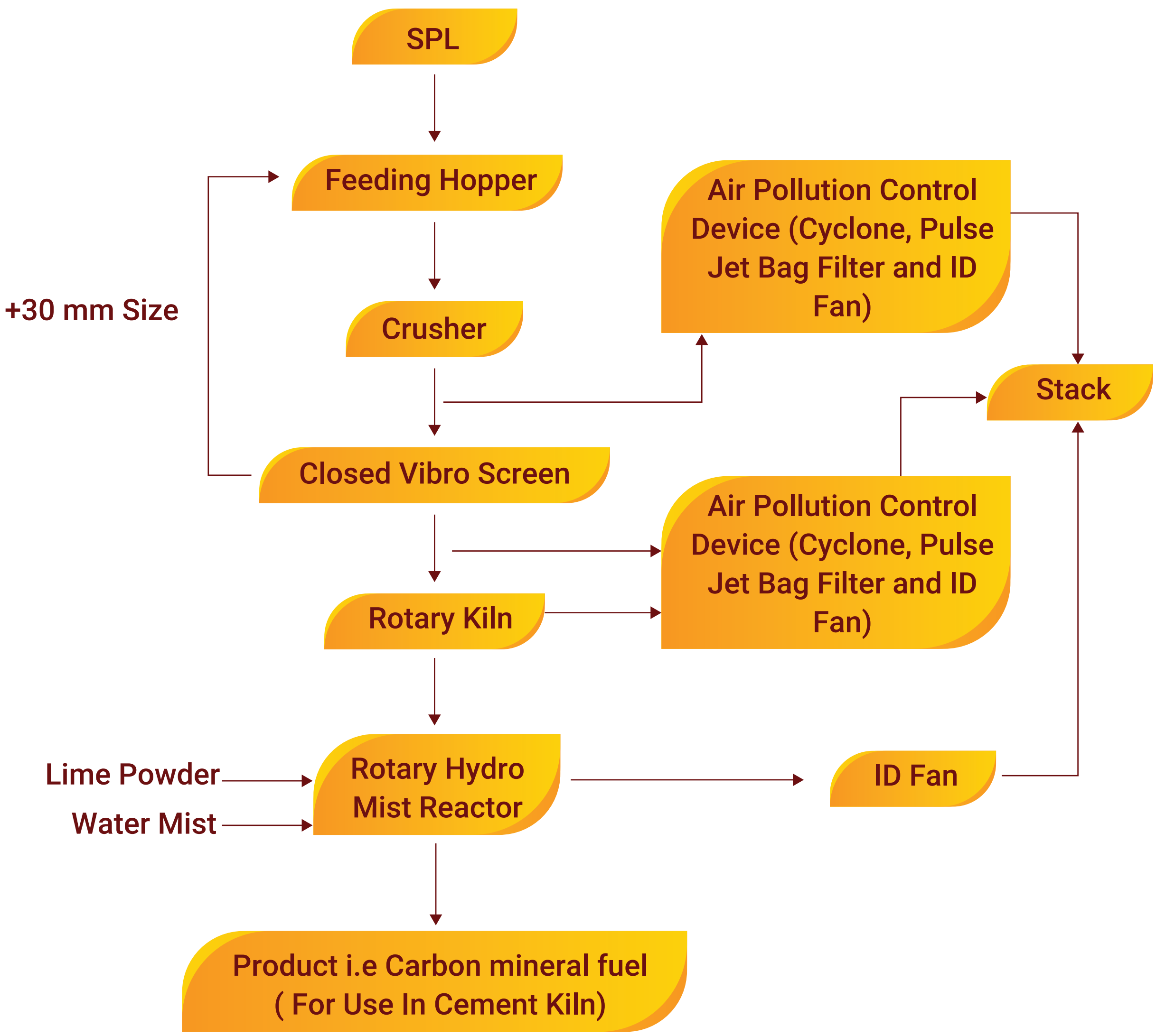


Fig 1 : Process flow diagram for utilization of SPL

1.3 Product Usage / Utilization

De-toxified SPL (Carbon) named as carbon mineral fuel shall be used as resource/energy recovery in high temperature (more than 1000°C) applications such as cement kiln, iron, steel and ferrous alloy industries but not for use in boilers. Such cement kiln, iron, steel & ferrous alloy industries shall comply with tire emission standards notified vide notification G.S.R. 497 (E) dated 10/05/2016 under Environment Protection Act, 1986.

1.4 Standard Operating Procedure (SoP) for utilization

This SoP is applicable only for the utilization of spent pot lining (SPL) generated from Primary Aluminium Smelting Industries.

1) The SPL of size 200-500 mm shall be transported in covered container mounted on vehicles fitted with requisite safeguards ensuring no spillage of waste in accordance with provisions stipulated under Hazardous and Other Wastes (Management & Transboundary Movement) Rules, 2016.

2) Transportation of SPL shall be carried out by the sender (generator) or receiver (utilizer) as per the authorization issued by concerned SPCB under Hazardous and Other Wastes (Management & Transboundary Movement) Rules, 2016.

3) The sender and receiver shall ensure that procured SPL should be carboneous fraction of SPL and free from refractory material.

4) The unit shall store SPL under cool, and well- ventilated covered storage shed (s) within premises having impervious RCC flooring as authorized by the concerned State Pollution Control Board/ Pollution Committee under Hazardous and Other Wastes (Management & Transboundary Movement) Rules, 2016 so as to eliminate rain water intrusion.

   There shall be a desígnated space for unloading of SPL within the said covered storage shed (s).

5) Breaking and loading of large chunks (200-500 mm) of SPL to hopper shall be done through mechanical breaker/ loader within the premises.

6) From feeding hopper the chunked SPL shall be conveyed to enclosed crushing chamber system to hopper through a closed conveyer.

7) The SPL from said hopper shall be crushed in crusher (suitably designed to crush SPL which has high crushing index) and be screened to less than 30 mm size through vibro double deck screen. The oversized SPL shall be again fed to the hopper of crushing chamber though closed conveying system.

8) The entire system of crushing and screening shall be in a closed system. Such closed system shall be maintained under negative suction and be connected to cyclone; pulse jet bag filter and ID fan followed by stack of height as prescribed by concerned SPCB/PCC.

9) The Screened SPL (of size less than 30 mm) shall be transferred to rotary kiln for direct heat treatment maintaining temperature not less than 430^{0}C ℃. The flue gas from rotary kiln shall be treated in separate system of cyclone, pulse jet bag filter and ID fan followed by individual / common stack of height as prescribed by concerned SPCB / PCC.

SPL shall be fed into the rotary kiln through automatic feeding system with electronic control panel to control the feed rate.

I0) Heat treated SPL shall be fed into a rotary hydro mist reactor through a closed chute in red hot condition along with lime and controlled water mist. Retention time in rotary hydro mist reactor shall be maintained as 15-20 minutes. Rotary hydro mist reactor shall be connected through ID fan connected to an individual / common stack of height as prescribed by concerned SPCB/PCC.

11) There shall be automated system (may operate under gravitational force from lime hopper) for lime powder addition into the reactor. High pressure nozzles with pump arrangement shall be used for water mist formation to be added in the reactor. Water tank with water flow meter and emergency re-circulating tank shall be connected with hydro mist reactor.

I2) The rotary hydro mist reactor shall have an arrangement of hood over it for collection of fumes. Such hoods shall be maintained under suction through ID fan and be connected individual / common stack of height as prescribed by concerned SPCB/PCC.

13) Product i.e. carbon mineral shall meet the following concentration limits based on Toxicity Characteristic Leaching Procedure (TCLP) /Soluble Threshold Limit Concentration (STLC) as specified in Schedule II of HOWM Rules, 2016

Cyanide- 20 mg/L [Based on TCLP] Fluoride- 180mg/L [Based on STLC]

14) Residue collected from cyclone and pulse jet bag filter shall be re-used in the utilization process.

15) 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 such as goggles, face mask, gloves, gum boot etc.,

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

17) It shall be ensured that spent pot lining is procured from the industries who have valid authorization for generation / storage of the same from the concerned SPCB / PCC as required under Hazardous and Other Wastes (Management & Transboundary Movement) Rules, 2016.

18) Prior to utilization of spent pot lining, the unit shall obtain authorization for generation, storage and utilization of spent pot lining from the concerned State Pollution Control Board under Hazardous and Other Wastes (Management & Transboundary Movement) Rules, 2016.

19) In case of environmental damages arising due to improper handling of hazardous waste including accidental spillage during generation, storage, processing, transportation and disposal, the unit shall be liable to implement immediate response measures, environmental site assessment and remediation of contaminated soil / ground water / sediment etc. as per the *"Guidelines on implementing Liabilities for Environmental Damages due to Handling & Disposal of Hazardous wastes and Penalty"* published by CPCB.

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

1.5 Record/Returns Filling

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

2) The unit shall maintain a passbook issued by concern SPCB wherein the following details of each procurement of SPL shall be entered:
   - Address of the sender
   - Date of dispatch
   - Quantity procured
   - Seal and signature of the sender
   - Date of Receipt in the premises

3) A log book shall be maintained with information or source and date of procurement of SPL, quantity date wise utilisation of the same, hazardous waste generation and its disposal, etc.

4) The unit shall maintain record of hazardous waste utilized, hazardous waste 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.

1.6 Standards

1) Fugitive emission in the work zone shall comply with the following standard

PM_{10}	$5mg/m^3$ TWA*
Ammonia	25ppm ($18mg/m^3$) TWA*
Fluoride as F	2.5 mg/m^3 TWA*
Cyanide as CN	5 mg/m^3 TWA*

Reference: Occupational Safety and Health Standard 1910:1000
**TWA: time-weighted average*
The permissible Exposure Limit is 8 hours TWA
STEL – Short term exposure limit (measured for 15 minutes duration of exposure)

2) Emission from common stack connected to rotary kiln and crushing & screening followed by APCD shall comply with de following:

PM	50 mg/Nm^3
Total Fluoride	25 mg/Nm^3
Hydrogen Fluoride	$4mg/Nm^3$
Ammonia	$75mg/Nm^3$
Hydrogen Cyanide	$10mg/Nm^3$

3) Monitoring of the specified parameters for source emission shall be carried out quarterly for the first year followed by at least annually in the subsequent year of utilization. Fugitive emission for specified parameters shall be carried our quarterly.

The monitoring shall be carried out by NABL accredited or EPA approved laboratories and the results shall be submitted to the concerned SPCB/PCC quarterly.

1.7 Siting of Industry

Facilities for processing of SPL shall preferably 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.

1.8 Size of Plant & Efficiency of utilisation

100 kg of SPL would produce 109.5 kg treated SPL as carbon mineral fuel, which will be used as energy/ resource recovery in cement kiln. Therefore, requisite facilities of adequate size of storage shed and other plants & machineries as given in para 1.10 below shall be installed accordingly.

1.9 On-line detectors / Alarms / Analysers

Online emission monitoring systems for PM emission should be installed in stacks attached to screening & crushing section and rotary kiln and the online data be connected to the server of the concerned SPCB / PCC and CPCB.

1.10 Checklist of Minimal Requisite Facilities

S. No	Particulars
1	Designated space for storage of SPL only under cool, dry, well – ventilated covered storage shed with concrete RCC flooring within premises, so as to eliminate water intrusion.
2	Mechanized handling system for loading and unloading of spent pot lining.
3	Closed crushing and screening chamber with crusher, double deck closed vibro screen (screen size 30 mm) with cyclone, pulse, jet, bag filter and ID fan followed by common stack of height as prescribed by SPCB / PCC. The crusher shall be suitably designed to crush SPL which has high crushing index.
4	Stack 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.
5	Rotary kiln with automated feeding system of SPL
6	Thermocouple in the rotary kiln along with temperature display system.

7	APCD (cyclone, pulse jet bag filter and ID fan) with the rotary kiln. The outlet of APCD shall be attached to common stack of height as prescribed by SPCB / PCC with easy access to port hole, for conducting stack monitoring
8	Closed conveying system for feeding of SPL into crushing & screening unit, rotary kiln and hydro mist reactor.
9	Rotary Hydro mist reactor with arrangement of hood over it for collection of fumes. Such hoods shall be maintained under suction through ID fan and be connected to an individual / common stack height as prescribed by concerned SPCB/PCC with easy access to port hole, for conducting stack monitoring
10	Lime feeding tank, water tank and emergency re-circulating tank
11	Separate hopper for lime powder with automatic control system
12	High pressure nozzles with pump arrangement for water mist formation in reactor. Water tank with valve for automatic control system for mist formation
13	Separate storage shed / space for storage of product
14	Online analysers for PM emission monitoring in stack and the online data be connected to the server of the concerned SPCB / PCC and CPCB

Note: To protect the patent rights, the utilizers of this SoP should take the permission from patent holder as per the provisions of Patent Act, 1970.

Utilization of Spent Ammonium Carbonate (generated during manufacturing of Copper Pthalocyanin blue (CPC Blue)) in Manufacturing of Zinc Carbonate, Copper Carbonate, Manganese Carbonate, Magnesium Carbonate and Ferrous Carbonate

SOP - 50

Spent Ammonium Carbonate from CPC Blue manufacturing

(Category: 26.1 of Schedule I of HOWM Rules, 2016)

1.0 Utilization of Spent Ammonium Carbonate

Type of HW	Source of generation	Recovery/Product
Spent Ammonium Carbonate - Category 26.1 of schedule-1 of HOWM Rules, 2016	During manufacturing of copper pthalocyanin blue (dye & dye-intermediate)	Metallic carbonates (i.e. Zinc, Copper, Manganese, Magnesium and Ferrous)

1.1 Source of Waste

Spent Ammonium carbonate (hazardous waste) is generated during manufacturing of dye & dye-intermediate i.e. Copper Pthalocyanin blue (CPC Blue). During the production of CPC blue, ammonia gas liberated from the reaction vessel is passed through water scrubber, which generates Ammonium carbonate.

The aforesaid Spent Ammonium Carbonate is categorized as hazardous waste at S.No. 26.1 of Schedule-I of HOWM Rules, 2016 which are required to be disposed in authorized disposal facility in accordance with authorization condition, when not utilized as resource recovery.

A typical characteristic of the hazardous waste is given below:

Parameters	Unit	Spent Ammonium carbonate (Hazardous Waste) used for production
Moisture	%	55.02
pH		9.39
Thylo cyanine	mg/kg	<1.0
Nitro benzene	mg/kg	8.2
Chloride as Cl	%	0.076
TOC	%	0.022
Copper	mg/kg	9.03
Zinc	mg/kg	371
Lead	mg/kg	13.88
Chromium	mg/kg	<0.05
Nickel	mg/kg	0.81
Cadmium	mg/kg	1.43

1.2 Utilization Process

The production of metallic carbonates (i.e. zinc carbonate, copper carbonate, Manganese Carbonate, Magnesium Carbonate and Ferrous Carbonate) includes precipitation of ammonium carbonate with metallic sulphates (i.e Zinc / Copper / Manganese / Magnesium / Ferrous Sulphate) to form metallic carbonates followed by filtration and drying.

Manufacturing of metallic carbonates involve addition of spent ammonium carbonate to metallic sulphate (Zinc/Copper/Manganese/Magnesium/Ferrous) solution in the reaction vessel and allowing to precipitate by maintaining pH 7 (by adding lime/H_2SO_4 accordingly).

After precipitation, metallic carbonate slurry is transferred through filter press to separate metallic carbonate and ammonium sulphate. The filter cake containing metallic carbonate (Zinc/Copper/Manganese/Magnesium/Ferrous) is sent to drier and dried product is collected and packed.

The ammonium sulphate solution collected from the filter press is sent to evaporator followed by crystallizer and centrifuge. The ammonium sulphate crystal collected may be used for alum manufacturing. The mother liquor generated from centrifuge may be recycled in the evaporator. The reject or wastewater generated from the process is to be managed as per the conditions stipulated in the Consent to Operate granted by concerned SPCB/PCC. The flow diagram of the utilization process is provided as below:

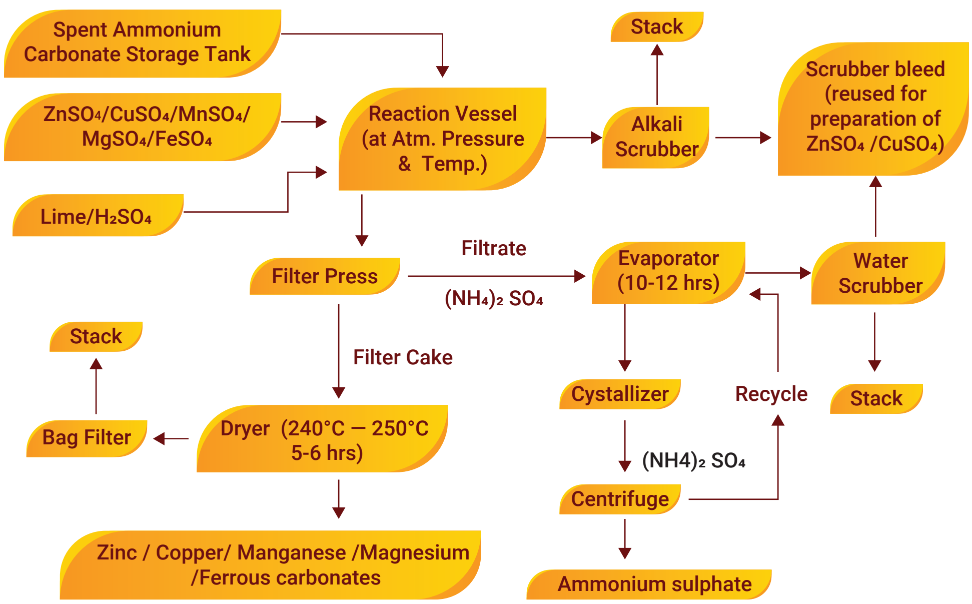


Fig 1:Process Flow Diagram of manufacturing of Metallic Carbonates (Zinc/Copper/Manganese/Magnesium and Ferrous)

1.3 Product Usage / Utilization

Metallic Carbonates (Zinc carbonate / copper carbonate /Manganese Carbonate/ Magnesium Carbonate/ Ferrous Carbonate) will be utilized in industrial use i.e. textile, rubber industry. The unit shall label its product (i.e. Zinc Carbonate / Copper Carbonate / Manganese Carbonate/ Magnesium Carbonate/ Ferrous Carbonate) manufactured by utilizing aforesaid Hazardous waste as "This zinc carbonate / copper carbonate / manganese Carbonate/ magnesium Carbonate/ ferrous Carbonate has been manufactured by utilizing spent ammonium carbonate, generated from Copper PhthaloCyanin Blue manufacturing process."

The ammonium sulphate so produced during the said utilization process be used for manufacturing alum. The application of alum, shall only be allowed in Dye & Dye intermediate manufacturing, Leather tanning process or other industrial process application etc. and shall not be permitted for use in manufacture of fertilizer or in water treatment. In case, the said end use of ammonium sulphate is not possible, the same may be disposed in TSDF.

1.4 Standard Operating Procedure (SoP) for utilization

This SoP is applicable only for the utilization of Spent Ammonium carbonate generated from CPC Blue manufacturing process.

1) Spent Ammonium carbonate shall be transported in SPCB/PCC authorised dedicated tankers mounted on vehicles fitted with requisite safeguards ensuring no spillage of the same.

2) There should be a designated space for unloading of Spent Ammonium carbonate into a rubber lined storage tank. The receiving storage tank shall be placed above the ground and contained with low raise parapet/bund wall & dedicated leak proof floor with slope to collect spillages, if any, into collection pit. Alternatively, storage tanks for spent ammonium carbonate may be below the ground provided it has HDPE, liner system beneath the tank and leachate collection system below HDPE liner. In the event of leachate detection in the leachate collection system, corrective measures shall be taken immediately.

3) The unit shall install storage tank under cool, dry, well-ventilated covered storage shed(s) within premises, as authorized by the concerned State Pollution Control Board/Pollution Control Committee under Hazardous and Other Wastes (Management & Transboundary Movement) Rules, 2016 so as to eliminate rain water intrusion.

4) There shall be no manual handling of the hazardous wastes (Spent ammonium carbonate). Chemical process pump shall be used for transfer of Spent ammonium carbonate through pipelines to the reaction vessel.

5) The entire process area shall have dedicated leak-proof floor tiles with adequate slope to collect spillages, if any, into a collection pit. The spillages from collection pit shall be transferred to ETP or reaction tanks, as the cases may be, through chemical process pump.

6) The unit shall provide separate storage tanks for the storage of chemicals and the storage tanks should be at designated place with proper cover and with acid proof brick lining floors.

7) The unit shall ensure that the said utilization process and its associated activities shall be demarcated separately within the unit.

8) Spent ammonium carbonate shall be mixed with metallic sulphates (Zinc/Copper/Manganese/Magnesium/Ferrous) only in closed vessel reactors (isolation vessel) having mechanised stirring system for proper mixing and maintaining the pH up to 7. The mixer shall be kept under covered shed with adequate safety gadgets provided to workers, as well as ensuring proper ventilation in the process area.

9) NH_3, heavy metals and TOC are expected to be liberated from the said reactors (isolation vessel) where the spent ammonium carbonate is added. Thus, the said reactors (isolation vessel) shall be connected with hood over it to suck acid fume/vapor. The hood shall be maintained under suction followed by treatment in scrubber using alkaline medium.

10) The dryer shall be attached with bag filter followed by Stack of height as prescribed by the concerned SPCB/PCC.

11) The evaporator shall be attached with scrubbing system to contain the fumes/vapors released from the evaporator followed by stack of height as prescribed by the concerned SPCB/PCC.

12) The evaporator followed by centrifuge and crystallizer shall be operated electrically or by fuel permitted by the concerned SPCB/PCC. Depending upon type of fuel, suitable air pollution control device(s) shall be installed at the evaporator followed by stack of height as prescribed by the concerned SPCB/PCC.

13) 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) such as Chemical goggles, full-face shield, or a full-face respirator, Impervious gloves of chemically resistant material (rubber or neoprene), Body suits, aprons, and/or coveralls of chemical resistant material and impervious boots of chemically resistant material.

14) The treated acid fume/vapour shall comply with emission norms and shall be dispersed into atmosphere through stack of minimum height of 6 m above the roof top or as prescribed by the concerned SPCB/PCC, whichever is higher.

15) Treatment and disposal of wastewater:

Following are the sources of wastewater from utilization process;

a) Wastewater (generated from Floor washing / reactor wash / vehicle wash / spillages, etc.)

b) Scrubber bleed

Wastewater and scrubber bleed may be reused in the said utilization process for the production of zinc carbonate / copper carbonate / manganese carbonate / magnesium carbonate / ferrous carbonate.

In case of wastewater generation, the same shall be treated Physico-Chemically in an ETP so as to comply with the prescribed inlet standards in case of CETP or be treated in captive ETP having adequate treatment facilities to comply with surface water discharge standards as stipulated in the Consent issued by the SPCBs/PCCs.

In case of zero discharge condition by SPCB/PCC, the treated waste water from ETP may be managed as per conditions stipulated by the SPCBs/PCCs.

16) It shall be ensured that Spent ammonium carbonate is procured from the industries that have valid authorization for the same from the concerned SPCB/PCC as required under Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016.

17) SPCBs/PCCs shall ensure synchronization of generation and utilization of Spent ammonium carbonate and the same shall be reflected in respective authorization specifying name and quantity.

18) Prior to utilization of Spent ammonium carbonate, the unit shall obtain authorization for generation, storage, and utilization of spent ammonium carbonate solution from the concerned State Pollution Control Board under the Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016.

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

20) a) The residue generated (from bag filter attached to dryer, scrubber, product spillages, etc.) in case of copper carbonate production, shall be collected and temporarily stored in non reactive drums / bags under a dedicated hazardous waste storage area and be sent to authorized common TSDF or other authorized facility within 90 days from generation of the waste in accordance with the authorization issued by the concerned SPCB/PCC. Such storage area shall be covered with proper ventilation.

b) The residue generated (from bag filter attached to dryer, scrubber, product spillages, etc) in case of zinc carbonate/ manganese Carbonate/ magnesium Carbonate/ ferrous Carbonate production may be reused in the said utilization process. If the residue is not reused, the same shall be collected and temporarily stored in non reactive drums / bags under a dedicated hazardous waste storage area and be sent to authorized common TSDF or other authorized facility within 90 days from generation of the waste in accordance with the authorization issued by the concerned SPCB/PCC. Such storage area shall be covered with proper ventilation.

21) Transportation of Spent Ammonium Carbonate and residues generated during utilisation shall be carried out by the sender or receiver (utilizer/TSDF operator) as per the authorization issued by concerned SPCB/PCC under the Hazardous and Other Wastes (Management & Transboundary Movement) Rules, 2016.

22) In case of environmental damages arising due to improper handling of hazardous wastes including accidental spillage during generation, storage, processing, transportation and disposal, the unit 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.

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

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

1.5 Records/Return filing

1) The unit shall maintain a passbook issued by concerned SPCB wherein the following details of each procurement of Spent Ammonium Carbonate shall be entered:
   - Address of the sender
   - Date of dispatch
   - Quantity procured
   - Seal and signature of the sender
   - Date of receipt in the premises

2) A log book with information on source and date of procurement of each type of the said hazardous wastes, quantity, date wise utilization of the same, quantity of zinc carbonate, copper carbonate, manganese Carbonate, magnesium Carbonate and ferrous Carbonate manufactured, hazardous waste generation and its disposal etc. shall be maintained including analysis report of emission monitoring & effluent discharged, as applicable.

3) The unit shall maintain record of hazardous waste utilised, hazardous waste 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.

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

1.6 Standards

1) Fugitive emissions in the work zone:

Ammonia	35.0 mg/m^3 TWA*
Zinc Oxides	5.0 mg/m^3 TWA*
Copper Fumes	0.1 mg/m^3 TWA*
Sulphur dioxide	13.0 mg/m^3 TWA*

(Reference: Occupational Safety and Health Standards 1910:1000)
**TWA - Time-weighted average*
The Permissible Exposure Limit is 8-hour TWA.

2) Monitoring of specified parameters for fugitive emission shall be carried out quarterly for the first year followed by at least annually in the subsequent year of utilization. Fugitive emission for specified parameters shall be carried out by NABL accredited or ISO 17025/EPA recognized laboratories and the results shall be submitted quarterly to the concerned SPCB/PCC.

3) Stack Emissions:

a) Stack attached to evaporator and reaction vessel

PM	50 mg/Nm³
Ammonia	30 mg/Nm³
Heavy Metals	0.5 mg/Nm³
TOC	20 mg/Nm³

b) Stack attached to dryer

PM	50 mg/Nm³
Ammonia	30 mg/Nm³

1.7 Siting of Industry

Facilities for processing of Spent Ammonium Carbonate shall preferably 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.

1.8 Size of Plant & Efficiency of utilisation

1) Maximum 3.08 Kgs of Spent ammonium carbonate yields 1 Kg of product i.e. Zinc carbonate.

2) Maximum 3.11 Kgs of Spent ammonium carbonate yields 1 Kg of product i.e. Copper carbonate.

Quantity of spent ammonium carbonate ranging from 2.85 to 5.0 kg may be required to yield 1 kg of Manganese carbonate/ Magnesium carbonate/ Ferrous carbonate. However, concerned SPCB/PCC shall permit the final quantity for utilization of spent

ammonium carbonate for production of the above products (Manganese carbonate/ Magnesium carbonate/ Ferrous carbonate) upon verifying the actual material balance.

Therefore, requisite facilities of adequate size of storage shed and other plant & machineries as given in para 1.10 below shall be installed accordingly.

1.9 On-line detectors / Alarms / Analysers

Online emission monitoring systems shall be installed in case of continuous process operations for parameters as prescribed by the SPCBs/PCCs.

1.10 Checklist of Minimal Requisite Facilities

S. No	Requisite Facilities
1.	Storage tank(s) of adequate capacity to store Spent Ammonium Carbonate of at least two weeks requirement.
2.	Such storage tank(s) shall be placed above the ground and contained with low raise parapet/bund wall & dedicated leak proof floor with slope to collect spillages, if any, into collection pit. Alternatively, the storage tank(s) may be below the ground provided it has HDPE liner system beneath the tank and leachate collection system below HDPE liner
3.	Cool, dry, well-ventilated covered storage shed(s) for Spent Ammonium Carbonate
4.	Storage tanks within premises.
5.	Mechanized system for transfer of Spent Ammonium Carbonate from tankers to storage tanks and storage tanks to reactor vessels
6.	The process units shall have proper ventilation (preferably with ventilation ducts above the process units connected to ID fan with exhaust above roof level)
7.	Covered hazardous waste storage space to store hazardous generated during utilization process
8.	Reactors (isolation vessel) with suction hood connected via duct to scrubber and stack
9.	Filter press
10.	Evaporator for filtrate (i.e. ammonium sulphate).
11.	Crystallizer with chilling unit (for ammonium sulphate)

12.	Centrifuge (for ammonium sulphate)
13.	Dryer (of adequate size operated electrically or by fuel as permitted by the concerned SPCB/PCC)
14.	Bag filter shall be installed in case of dryer followed by stack of height as prescribed by the concerned SPCB/PCC
15.	Suction arrangement to channelize emissions from reaction vessel, dryer and evaporator to the APCD. Appropriate Scrubber system shall be installed to reaction vessel and evaporator followed by stack of height as prescribed by the SPCBs/PCCs
16.	Adequate Effluent treatment plant so as to comply with standards/conditions prescribed by the concerned SPCB/PCC
17.	Forced Evaporator in case of zero discharge condition
18.	Boiler (attached with the dryer/forced evaporator) operated electrically or by fuel as permitted by the concerned SPCB/PCC. Depending upon type of fuel, suitable air pollution control device(s) shall be installed with the boiler followed by stack of height as prescribed by the concerned SPCB/PCC
19	Stack to have 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
20.	Dedicated hazardous waste storage area for temporary storage of hazardous waste generated during utilization process

Pre-processing of Waste Silicon Carbide Refractory bricks from Pot Lining Waste generated from primary Aluminium smelters

SOP - 72

Pre-processing of Waste Silicon Carbide Refractory bricks

(Category: 11.2 of Schedule I of HOWM Rules, 2016)

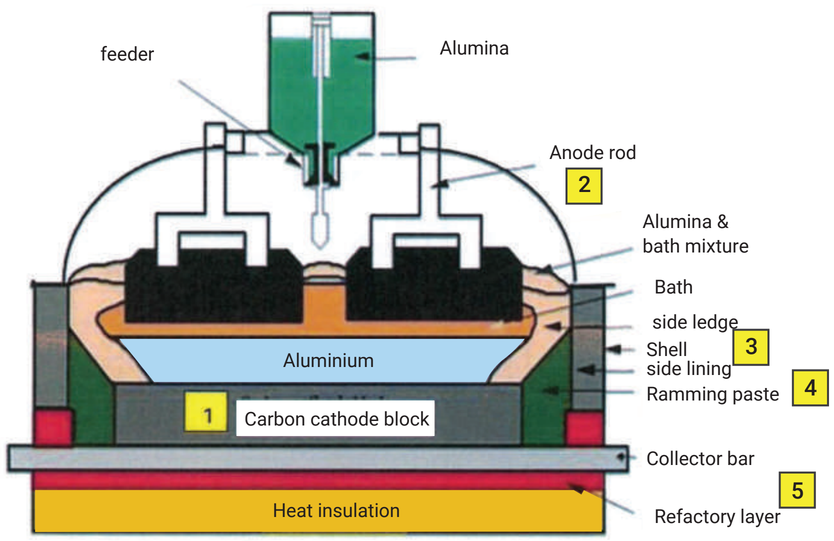
1.0 Pre-processing of waste Silicon Carbide Refractory bricks

Type of HW	Source of generation	Recovery/Product
Silicon Carbide Refractory bricks from Pot lining Waste Category 11.2 of Schedule I of HOWM Rules, 2016)	Primary Aluminium smelters	Silicon carbide refractory powder for use as raw material for silicon carbide and other refractory bricks manufacturing.

1.1 Source of Waste

In aluminium smelting process, there is a refractory liner between the carbon layer and steel casing of melting pot for insulation. After the end of pot life, the liners are discarded as pot liner waste, which is classified as hazardous waste due to high leaching potential for fluoride, cyanide and release of harmful gases in reaction with water. The refractory layers including silicon carbide bricks are categorized as hazardous waste - category 11.2 of Schedule I of HOWM Rules, 2016 which is required to be disposed in authorized disposal facility in accordance with authorization condition, when not utilized for resource/energy recovery.

There is a possibility of utilising waste refractory material for producing renewed refractory material, especially the silicon carbide bricks, DIM (Al_2O_3 castable refractory), calcium silicate bricks, insulating bricks (both refractory and clay bricks), etc.



Carbon Portion:
1) Cathode Block
2) Anode Rod

Refractory Portion:
1) Shell + Side Lining
2) Ramming Paste
3) Refractory Layer

Fig 1: Silicon Carbide refractory bricks are mainly installed in (3) Shell + Side lining of Refractory portion (Please refer diagram from PDF)

Figure 2: Fresh Silicon Carbide bricks installation in Side Wall of Pot.

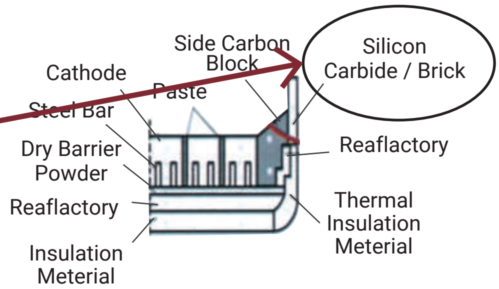


Figure 3: Silicon Carbide brick location in refractory layer of pot

References:
Fig.1: *https://www.lightmetalage.com/news/industry-news/smehing/the-spl-waste-management-challenge-in- primarv-aluminum/*
Fig. 2: *http://knowledgeplatforminAvp-content/uploads/2015/10/Small-Group-Activitv-on-Pat-bv-Sesa- Sterlite-Limited-Jharsuguda.pdf*
Fig. 3: *Feng-qin LIU, Ming-zliang XIE, Wei LIU, Hong-liang ZHAO, Footprint of harmful substances in spent pot lining of aluminum reduction cell. (Please redraw diagram from PDF)*

Table 1: - Typical Characteristics of waste Silicon carbide refractory bricks

S.no.	Parameters	Results	Unit
1	Carbon	5.50	%
2	Silica as SiO_2	74.25	%
3	Alumina as Al_2O_3	15.75	%
4	Iron as Fe	0.60	%
5	Magnesium as Mg	0.13	%
6	Phosphorus as P	0.22	%
7	Potassium as K	0.95	%
8	Sodium as Na	1.23	%
9	Titanium as Ti	0.38	%
10	Cadmium as Cd	<0.10	ppm
11	Antimony as Sb	<0.10	ppm
12	Chromium as Cr	14.32	ppm
13	Copper as Cu	21.21	ppm
14	Cobalt as Co	2.57	ppm
15	Arsenic as As	<0.10	ppm

S.no.	Parameters	Results	Unit
16	Boron as B	20.78	ppm
17	Lead as Pb	2.78	ppm
18	Manganese as Mn	40.88	ppm
19	Beryllium as Be	<0.10	ppm
20	Mercury as Hg	<0.10	ppm
21	Nickel as Ni	14.42	ppm
22	Zinc as Zn	639.3	ppm
23	Total Fluoride	49.68	mg/Kg
24	Leachable Fluoride	6.93	mg/L
25	Total cyanide	<0.10	mg/Kg
26	Leachable Cyanide	<0.10	mg/L
27	Fe_2O_3	8.58	%
28	Volatile Matter	0.88	%
29	Fixed Carbon	0.44	%
30	Gross calorific value	<200	Kcal/Kg

1) Waste silicon carbide refractory bricks shall only be procured from primary aluminium smelting industries excluding carbon portion and other refractory liners of cathode residue (pot liner waste). Separation of other refractory parts shall be done at generator premises before transportation to the pre-processor.

2) It is the responsibility of cathode residue generator (Primary Aluminium Smelters) and pre-processors to ensure proper segregation of waste Silicon carbide bricks from other refractory layers which should not exceed 5% of total quantity.

1.2 Pre-processing of waste silicon carbide refractory bricks

The waste silicon carbide refractory bricks procured from primary Aluminium smelting industries are charged into crusher preferably jaw crusher manually. The crushed material passed through separator to collect in different sizes (<5 mm). This powdered form of pre-processed Silicon Carbide is packed and sold to authorized users for manufacturing of refractory bricks.

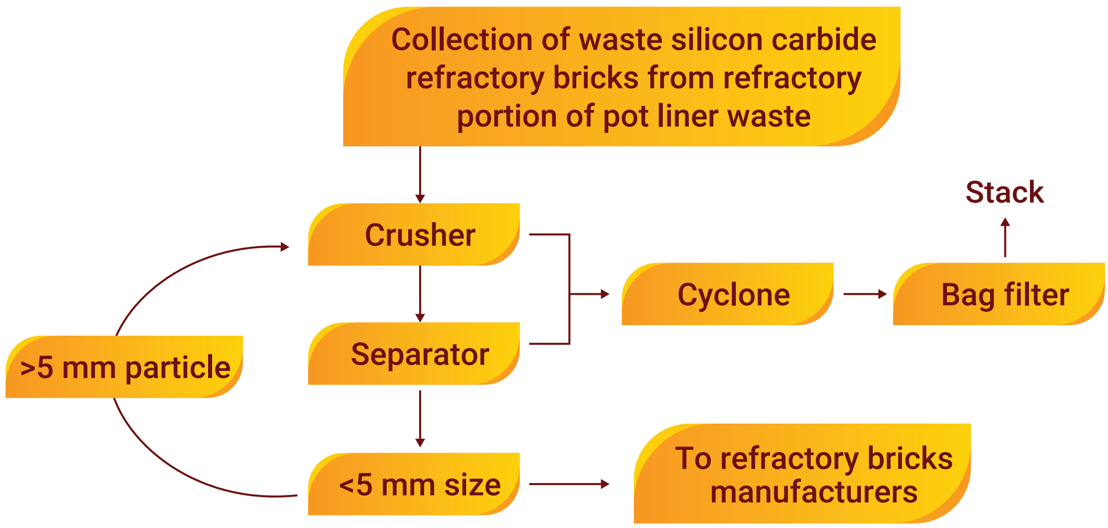


Fig 4: Process flow diagram for pre-processing of waste silicon carbide refractory bricks

1.3 Product Usage / Utilization

The product (Silicon Carbide powder) shall be utilized as raw material in manufacturing of silicon carbide and other refractory bricks only.

1.4 Standard Operating Procedure for utilization

This SoP is applicable only for Pre-processing of waste silicon carbide refractory bricks generated from primary Aluminium smelters.

1) The waste silicon carbide refractory bricks shall be transported in covered container mounted on vehicles fitted with requisite safeguards ensuring no spillage of waste in accordance with provisions stipulated under HOWM Rules, 2016.

2) The unit shall store waste silicon carbide refractory bricks in a designated storage area having concrete flooring with shed and proper ventilation ensuring no rain water intrusion.

3) The transfer of waste silicon carbide refractory bricks to crusher as well as separator shall be through mechanised system i.e. covered conveyer belt with minimal manual intervention. In case of manual transfer proper personal protective equipment (PPEs) such as mask, gloves, safety shoes and helmet shall be provided to the workers.

4) Dust is expected to be formed at crusher and mechanical separator. Therefore, near crusher and separator the unit shall provide dust cyclone with proper suction and bag filter followed by stack of height 30 m or as prescribed by concerned SPCB/PCC.

5) The entire system of operation i.e. crusher and separator shall be in a closed system.

6) The unit shall earmarked all machineries, storage areas and APCDs with sign board.

7) The unit shall ensure that hazardous waste i.e. waste silicon carbide refractory bricks procured as well as product i.e. silicon carbide after pre-processing shall comply with cyanide and fluoride concentration of <0.10 and 7 mg/L respectively based on Toxicity Characteristic Leaching Procedure (TCLP)/Soluble Threshold Limit Concentration (STLC). Silicon carbide shall not exceeds concentration limit as specified in Schedule II of HOWM Rules, 2016

   Cyanide — 20 mg/L [Based on TCLP]

   Fluoride — 180 mg/L [Based on STLC]

   In case the TCLP and STLC values of grinded silicon carbide refractory exceeds the prescribed standard for Cyanide and Fluoride, the material shall not be sent for further processing and the same shall be treated as hazardous waste and sent to TSDF for disposal.

   Processed samples shall be tested every month for leaching concentration of CN and F and the records of the same shall be maintained for verification.

8) The hazardous wastes generated (if any) during utilization process shall be collected and temporarily stored in non-reactive drums under a dedicated hazardous waste storage area and be sent to authorized common TSDF or other authorized facility within 90 days from generation of the waste in accordance with the authorization issued by the concerned SPCB/PCC. Such storage shall be done under covered storage area with proper ventilation.

9) Prior to pre-processing of waste silicon carbide refractory bricks, the unit shall obtain authorization for transportation, storage and pre-processing of silicon carbide from the concerned SPCB/PCC under the HOWM Rules, 2016.

10) The unit shall maintain proper ventilation in the work zone and process areas. All personnel involved in the plant operation shall wear proper PPEs specific to the process operations involved and type of chemicals handled as per MSDS. The safety precautions of the worker shall be in accordance with the Factory Act, 1948, as amended from time to time.

11) 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.

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

13) During the handling and pre-processing of hazardous waste, the unit shall comply with requirements in accordance with the Public Liability Insurance Act, 1991 as amended, wherever applicable.

1.5 Record/Returns Filing

1) The unit shall maintain a passbook issued by the concern SPCB/PCC and maintain details of each procurement of silicon carbide as mentioned below:

   - Address of the sender
   - Date of dispatch
   - Quantity procured
   - Seal and signature of the sender
   - Date of Receipt in the premises

2) A log book with information on source and date of generation/procurement of silicon carbide, quantity, date wise utilization of the same, quantity of product manufactured, hazardous waste generation and its disposal, etc. shall be maintained including analysis report of emission monitoring & effluent discharged, as applicable.

3) The unit shall maintain record of hazardous waste generated, utilized and disposed as per Form 3 & also file annual returns in Form 4 as per Rule 20 (1) and (2) of the HOWM Rules, 2016, to concerned SPCB/PCC.

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

1.6 Standards

1) Source emissions from the stack connected to APCD shall comply with the following Emission standards or as prescribed by the concerned SPCB/PCC, whichever is stringent;

Particulate Matter	50 mg/Nm^3
Total Fluoride	25 mg/Nm^3

2) Fugitive emission in the work zone shall comply with the following standards:

PM_{10}	5.0 mg/m^3 TWA*
Total Fluoride	2.5 mg/m^3 TWA*
Cyanide	5 mg/m^3 TWA*

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

3) Monitoring of the specified parameters for source emission shall be carried out quarterly for the 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 ISO 17025 accredited or EPA, 1986 approved laboratories and the results shall be submitted to the concerned SPCB/PCC on a quarterly basis.

1.7 Siting of Industry

Facilities for pre-processing of waste silicon carbide refractory bricks 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.

1.8 Size of Plant & Efficiency of utilization

99 % recovery of material shall be achieved during pre-processing of waste silicon carbide refractory bricks. i.e. 1 MT of waste silicon carbide refractory may generate 990Kg of product (silicon carbide refractory powder)

Therefore, requisite facilities of adequate size of storage shed and other plants & machineries as given in section 1.9 below shall be installed accordingly.

1.9 Checklist of Minimal Requisite Facilities

S. No	Particulars
1.	Cool, dry, well-ventilated storage areas (separate for hazardous wastes and product) earmarked with signs and concrete flooring & shed.
2.	Mechanized and closed system for transfer of waste silicon carbide refractory bricks.
3.	Closed system of operation i.e. crusher & separator
4.	Crusher and Separator
5.	Cyclone with bag filter followed with stack of height 30m or as prescribed by SPCB/PCC.

Utilization of Spent Calcium Hypochlorite (generated during manufacturing of High Strength Bleach Powder) as neutralizing agent in ETP

SOP - 78

Spent Calcium Hypochlorite from manufacturing of High Strength Bleach Powder

(Category: Sr. No: 7. Class - B of Schedule II of HOWM Rules, 2016)

1.0 Utilization of Calcium Hypochlorite

Type of HW	Source of generation	Recovery/Product
Spent Calcium Hypochlorite (Sr. No: 7. Class – B of Schedule – II, HOWM Rules – 2016)	Generated during manufacturing of High Strength Bleach Powder (HSBP)	Used as neutralizing agent in Effluent Treatment Plant (ETP) of inorganic chemical manufacturing industries.

1.1 Source of Waste

Spent Calcium Hypochlorite generated during manufacturing of High Strength Bleach Powder is categorized as hazardous waste at S. no: 7. Class-B of Schedule-II, HOWM Rules - 2016. which is required to be disposed in authorized disposal facility in accordance with authorized condition, when not utilized as resource recovery.

Table 1. Typical Characteristics of Spent Calcium Hypochlorite are given below:

	Parameters	Unit	Value		Parameters	Unit	Value
1.	pH	..	10.7	12.	Lead	gm/kg	0.0326
2.	Calcium	%	1.53	13.	Iron	gm/kg	0.0424
3.	Sodium	gm/kg	1659.66	14.	Nickel	gm/kg	0.0046
4.	Potassium	gm/kg	11 .56	15.	Zinc	gm/kg	0.0525
5.	Sulphate	gmikg	2.09	16.	Manganese	gm/kg	0.0024
6.	Hexa Chromium	gm/kg	ND	17.	Mercury	gm/kg	<0.0004
7.	Chloride	gm/kg	729.9	18.	Total Chromium	gm/kg	0.0004
8.	TOC	gm/kg	0.58	19.	Arsenic	gm/kg	<0.0004
9.	COD	gm/kg	86.66	20.	Cyanide	gm/kg	ND
10.	Cadmium	gm/kg	0.0024	21.	Total Nitrogen	gm/kg	ND
11.	Copper	gm/kg	0.0056				

1.2 Utilization Process

Effluent generated from manufacturing process is collected into equalization cum neutralization tank. Spent Calcium Hypochlorite dosing is carried out using venturi so as to neutralize the effluent. Neutralized effluent is mixed for 2.5 hours and then passed through a filter press where the insoluble (Filter cake) are separated to get clear, neutral treated effluent. The filter cake is bagged and stored in the hazardous waste storage area and disposed by co-processing in cement industry / disposed at TSDF site. The treated effluent is transferred to final storage tank from where it is treated in ETP units or sent to CETP for further treatment and final disposal.

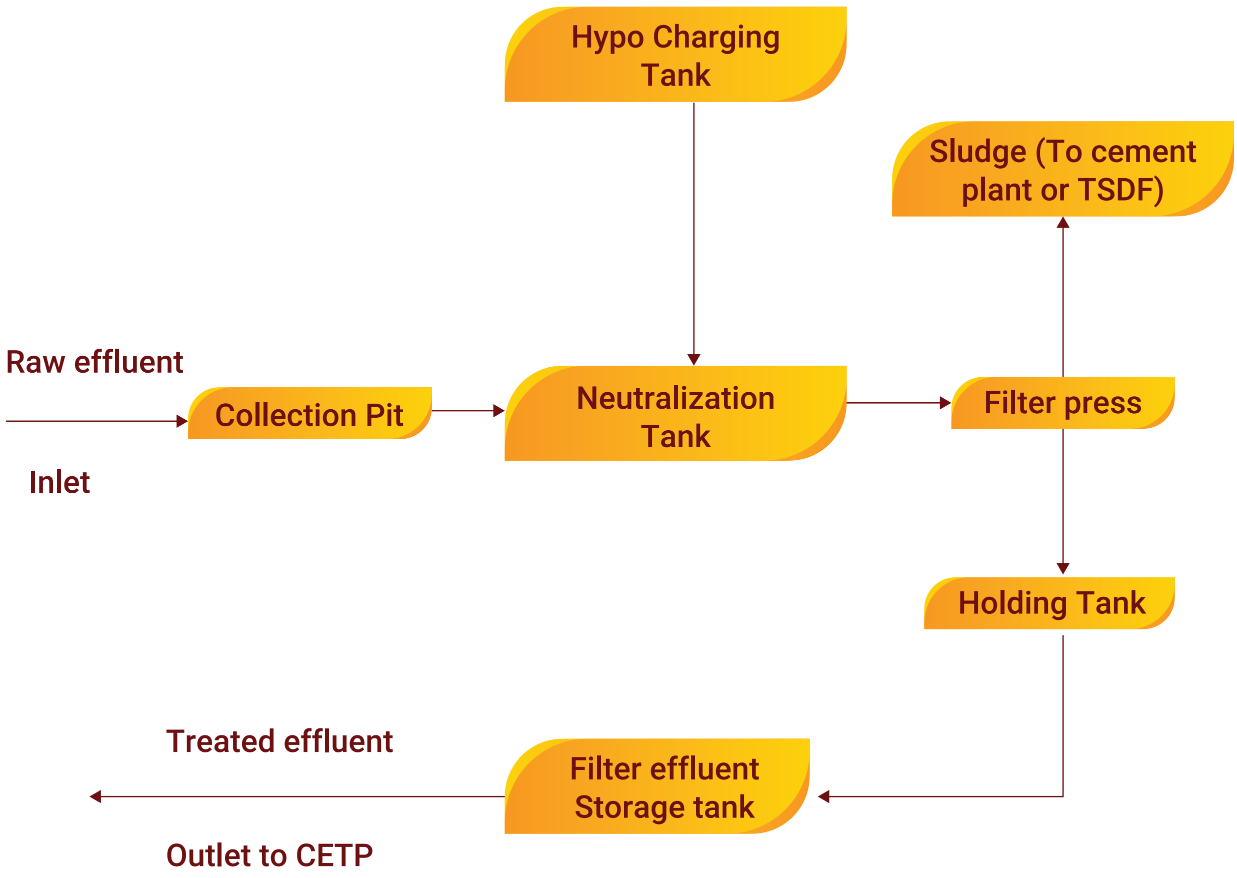


Fig 1:Process flow diagram for utilization of spent Calcium Hypochlorite generated from manufacturing of high strength bleaching powder.

1.3 Product Usage / Utilization

Spent Calcium Hypochlorite generated during manufacturing of High Strength Bleach Powder (HSBP) shall be used in Effluent Treatment Plant (ETP) as neutralizing agent.

1.4 Methodology for finalization of quantity and quality of Spent Calcium Hypochlorite (generated during manufacturing of High Strength Bleach Powder) for utilization in ETP as neutralizing agent

1) MoEF&CC vide Office Memorandum No: SO 3518(E) dated 23/11/2016 notified the procedure to issue permission for the "Change in product mix without increase in pollution load". As per this notification, all SPCBs shall have to frame Technical Committee to implement the notification.

2) It is envisaged that wherever scrutiny and assessment are required in this SoP, implementation of this SoP is done through the above committee and in case the said committee has not been constituted then implementation be done through committee constituted for implementation of HOWM Rules, 2016. by the SPCBs/PCCs. Further, the following shall be the responsibilities of Technical Committee while reviewing the application for utilization of spent calcium hypochlorite:

   a) Technical committee shall check characteristics of spent calcium hypochlorite i.e. COD/TOC, Acidity, Heavy Metals and Toxicity generated from the source industry.

   b) The quality of industrial wastewater shall be reviewed so as to evaluate the feasibility of utilization of spent calcium hypochlorite.

   c) The committee shall permit the quantity for utilization of spent calcium hypochlorite for neutralization into ETP based on mass balance, water balance, inlet/outlet standards, and results of Jar test, design criteria of ETP.

   d) The committee shall also consider the effect of dosage of spent calcium hypochlorite in secondary ETP system.

   e) Based on above, the quantity and quality of spent calcium hypochlorite shall be permitted.

1.5 Standard Operating Procedure for utilization

This SoP is applicable only for utilization of Spent Calcium Hypochlorite generated during manufacturing of HSBP as neutralizing agent in ETP.

1) Spent Calcium Hypochlorite shall be procured only in SPCB/PCC authorized closed tankers mounted over vehicles fitted with requisite safeguards ensuring no spillage of Spent Calcium Hypochlorite.
2) Spent Calcium Hypochlorite shall be stored in designated storage tank under covered storage shed. The storage area of Spent Calcium Hypochlorite shall 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 ETP, as the cases may be. through chemical process pump. Further, storage sheds shall have proper slope and seepage collection pit to collect seepage / floor washing. The collected seepage / floor washing shall be channelized to ETP for further treatment.
3) Spent Calcium Hypochlorite shall be unloaded from the closed tanker to the storage tank through pipelines using dedicated transfer pump.
4) Transfer of Spent Calcium Hypochlorite from storage tank to neutralization tank shall be carried out through mechanical transfer pump with fixed pipeline
5) The unit shall utilize fresh lime to adjust pH within permissible limit, if required.
6) Treatment and disposal of wastewater:

   Wastewater generated from floor-washings, spillages, including the wastewater from filtration shall be treated Physico-Chemically in an ETP or may be sent to CETP for final disposal or be treated further in a captive facility to comply with surface water discharge standards.

   In case of zero discharge condition by SPCB/PCC the treated waste water from ETP may he managed as per conditions stipulated by the SPCB/PCC.
7) The treated effluent shall he discharged in accordance with the conditions stipulated in the Consent to Operate issued by concerned SPCB/PCC under the Water (Prevention and Control of Pollution) Act, 1974.
8) The hazardous wastes generated (if any) shall be collected and temporarily stored in non-reactive drums/ bags under a dedicated hazardous waste storage area and be sent to authorized common TSDF or other authorized facility within 90 days from generation of the waste in accordance with the authorization issued by the concerned SPCB/PCC.
9) The unit shall ensure that the Spent Calcium Hypochlorite are procured from the industries, which have valid authorization from the concerned SPCB/PCC as required under HOWM Rules, 2016.

10) Transportation of Spent Calcium Hypochlorite shall be carried out by sender (generator) or receiver (utilizer) only after obtaining authorization from the concerned SPCB/PCC under HOWM Rules. 2016. Requisite manifest document shall be followed as laid down under the said Rules.

11) Prior to utilization of Calcium Hypochlorite, the unit shall obtain authorization for generation storage and utilization of Spent Calcium Hypochlorite from the concerned SPCB/PCC under HOWM Rules, 2016.

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) 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.

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

15) 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.

1.6 Record/Returns Filing

1) The unit shall maintain a passbook issued by concern SPCB and maintain details of each procurement of opent acid ac mentioned below:
   - Address of the sender
   - Date of dispatch
   - Quantity procured
   - Seal and signature of the sender
   - Date of Receipt in the premises

2) A log book with information on source and date of generation/procurement of spent calcium hypochlorite, date wise utilization of spent calcium hypochlorite, hazardous waste generation and its disposal, etc. shall be maintained including analysis report of fugitive emission monitoring & effluent discharged, as applicable.
3) The unit shall maintain record of hazardous waste generated, utilized, and disposed as per Form 3 & also file annual returns in Form 4 as per Rule 20 (1) and (2) of the HOWM Rules, 2016, to concerned SPCB/PCC.
4) The unit shall submit quarterly and annual information on hazardous wastes consumed. its source, products generated or resources conserved (specifying the details like, type and quantity of resources conserved) to the concerned SPCB.

1.7 Standards

1) Fugitive emission in the work zone area shall comply with the following standards:

Cl_2	3 mg/ m^3 TWA* (PEL)

**PEL - Permissible Exposure Limit*

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

2) Monitoring of the above specified parameters for fugitive emission shall be carried out quarterly for first year followed by at least annually in the subsequent year of utilization. The monitoring shall be carried out by ISO 17025 accredited or EPA, 1986 approved laboratories and the results shall be submitted to the concerned SPCB/PCC on a quarterly basis.
3) Standard for wastewater discharge: Treated effluent shall be discharged in accordance with the conditions stipulated in Consent to Operate issued by concerned 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.

1.8 Siting of Industry

Facilities for utilization of Spent Calcium Hypochlorite 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.

1.9 Checklist of Minimal Requisite Facilities

S. No	Particulars
1.	Dedicated storage tank for storage of spent Calcium Hypochlorite with proper slope & seepage collection pit.
2.	Mechanical transfer pump(s) with fixed pipeline for transportation of spent Calcium Hypochlorite.
3.	Neutralization tank with venturi provision for dosing spent Calcium Hypochlorite.
4.	Online pH Sensor at neutralization tank.
5.	Filter Press
6.	Treated wastewater holding tank.
7.	If required, treated wastewater shall be further treated in captive ETP units or sent to CETP for achieving discharge norms prescribed by concerned SPCB / PCC. Disposal of wastewater shall be as per consent of concerned SPCB / PCC

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