

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

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



**cpcb**

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**Central Pollution Control Board**  
(Ministry of Environment, Forest & Climate Change, Government of India)  
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**Standard Operating Procedure and Checklist of Minimal Requisite Facilities for Utilization of Tungsten Scrap  
(Tungsten carbide insert tips) generated from metal cutting operations**

**Procedure for grant of authorisation by SPCBs/PCCs for utilization of Hazardous Waste**

- (i) While granting authorisation for utilization of hazardous or other wastes, SPCBs/PCCs shall ensure that authorisation is given only to those wastes for which SoPs on utilisation have been circulated by CPCB ensuring the following:
  - a. The waste (intended for utilization) should have similar source of generation as specified in SoPs.
  - b. The utilization process should be similar to the process of utilization described in SoPs.
  - c. End-use / product produced form the waste shall be same as specified in SoPs.
  - d. Authorisation shall be granted only after verification of minimum requisite facilities installed and after verification of utilization process as given in SoPs.
  - e. Issuance of passbooks (similar to the passbooks issued for recycling of use oils, waste oil, non-ferrous scraps, etc.) for maintaining records of receipt of hazardous wastes for utilization.
- (ii) After issuance of authorization, SPCB/PCC shall verify the utilization process, checklist and SOPs, quarterly during the initial 02 years of operation followed by random checks in subsequent years atleast once in every year.  
 In-case of lack of requisite infrastructures with the SPCBs/PCCs, SPCBs/PCCs may engage 3<sup>rd</sup> party institutions and EPA/NABL/ISO17025 accredited laboratories for monitoring and analysis of prescribed parameters of the SoPs for verification purpose. Such labs shall have accreditation (EPA/NABL/ISO17025) for the parameters specified in SoP.
- (iii) SPCB/PCC shall provide half yearly up-dated list of units permitted for utilization of hazardous or other wastes to CPCB and also periodically update the same on SPCB website Such updated list shall sent for January-June and July- December of every year and reach to CPCB by July and January respectively of every year.
- (iv) Authorisation for utilisation shall not be given to the units located in the State/UT where there is no Common TSDF, unless the unit ensures authorised captive disposal of the hazardous waste or its complete utilisation or arrangement of sharing with any other authorised disposal facility.
- (v) In case of the utilization proposal is not similar with respect to source of generation, utilization process and end-use as outlined in this SoP, the same may be referred to CPCB for clarification / conducting trial utilization studies and developing SoPs.
- (vi) The source and work zone standards suggested in the SoPs are based on the E(P)A notified and OSHA standards respectively, however, SPCB/PCC may impose more stringent standards based on the location or process specific conditions

**31.0 Utilization of Tungsten Scrap**

<b>Type of Other Waste</b>	<b>Source of generation</b>	<b>Recovery/Product</b>
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

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**31.1 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.

**31.2 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 likes ferrous materials (steel screws, washers, steel bur, etc.) and low magnetic inserts.

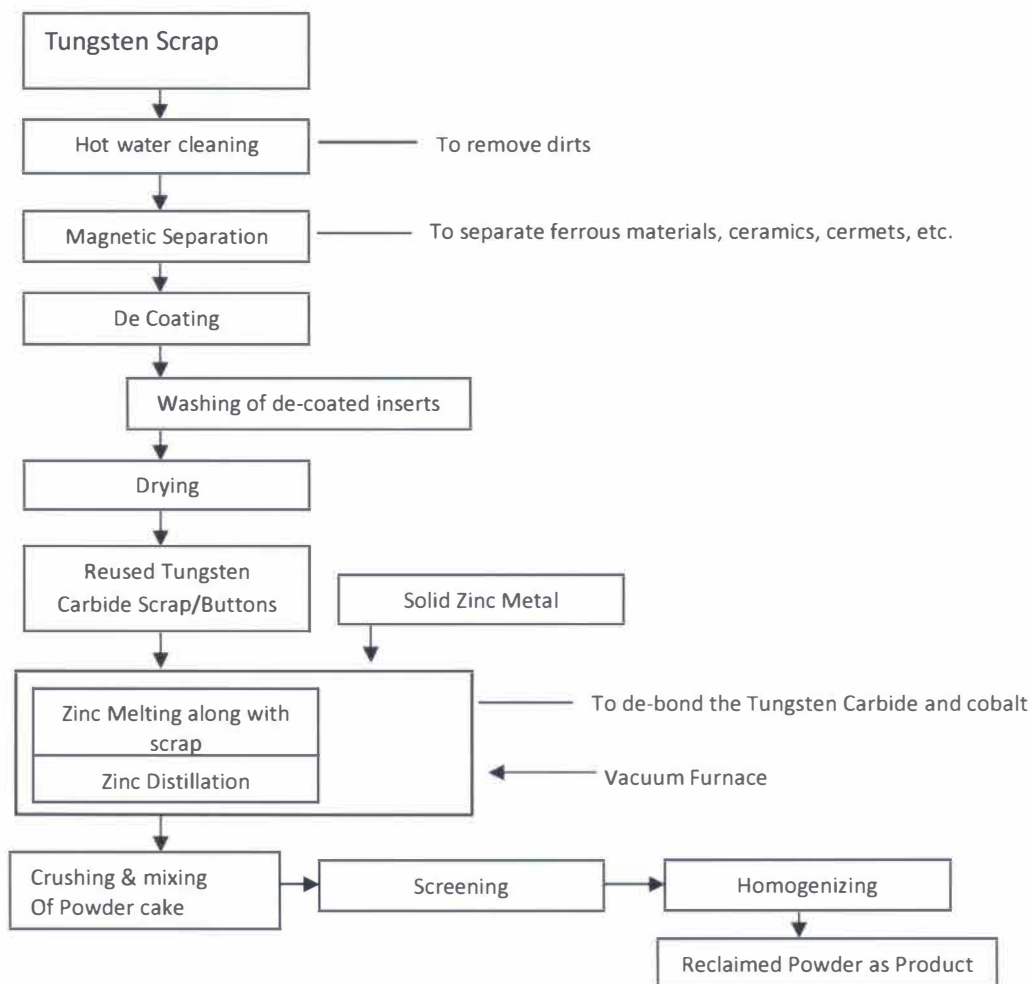
After sorting, the material is transferred to de-coating mill where the coating layers (with different types of coating layer) of inserts is removed by tumbling the inserts with water. During tumbling process, the tungsten carbide coating gets eroded due to self-abrasion and is collected separately in 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 alongwith 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.

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**Process Flow**



**31.3 Product Usage / Utilization**

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

**31.4 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.

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- (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-à-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

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- 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.

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- (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.

**31.5 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.

**31.6 Standards**

- (i) Fugitive emissions in the work zone shall comply with following standards
- Tungsten (as W) Insoluble compounds: 5.0 mg/m<sup>3</sup>TWA\*
  - Tungsten (as W) Soluble compounds: 1.0mg/m<sup>3</sup>TWA\*
  - Tungsten carbide containing cobalt as binder: 0.1 mg/m<sup>3</sup>TWA\*
  - Tungsten carbide containing nickel as binder: 1.0 mg/m<sup>3</sup>TWA\*

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*\* 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<sup>3</sup> 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.

**31.7 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.

**31.8 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 29.10 below shall be installed accordingly.

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

**31.9 On-line detectors / 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.

**31.10 Checklist of Minimal Requisite Facilities:**

S.No	Requisite Facilities
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)

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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.

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