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

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

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Central Pollution Control Board

(Ministry of Environment, Forest & Climate Change, Government of India)

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

(i) While granting authorisation for utilization of hazardous wastes, SPCBs/PCCs shall ensure the following:

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

b. The utilization process is similar to the process of utilization described in SoPs.

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

d. Authorisation be granted only after verification of utilization process and minimum requisite facilities as given in SoPs.

e. Issuance of passbooks (similar to the passbooks issued for recycling of used oil, waste oil, non-ferrous scrap, 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 on quarterly basis for initial 2 years; followed by random checks in the subsequent period for atleast once a year.

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

(iii) SPCBs/PCCs shall provide half yearly updated list of units permitted under Rule 9 of Hazardous and Other Wastes (Management & Handling) Rules, 2016 (HOWM Rules, 2016) to CPCB and also upload the same on SPCB website, periodically. Such updated list shall be sent to CPCB half yearly by July and January respectively.

(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 (generated during utilisation) or its complete utilisation or arrangement of sharing with any other authorised disposal facility.

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

(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.

36.0 Utilization of Synthetic Oil based Mud / drill cuttings:

Type of HW	Source of generation	Recovery/Product
Synthetic Oil based Mud / drill cuttings waste (category no. 2.1 and 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

36.1 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 categorised 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.

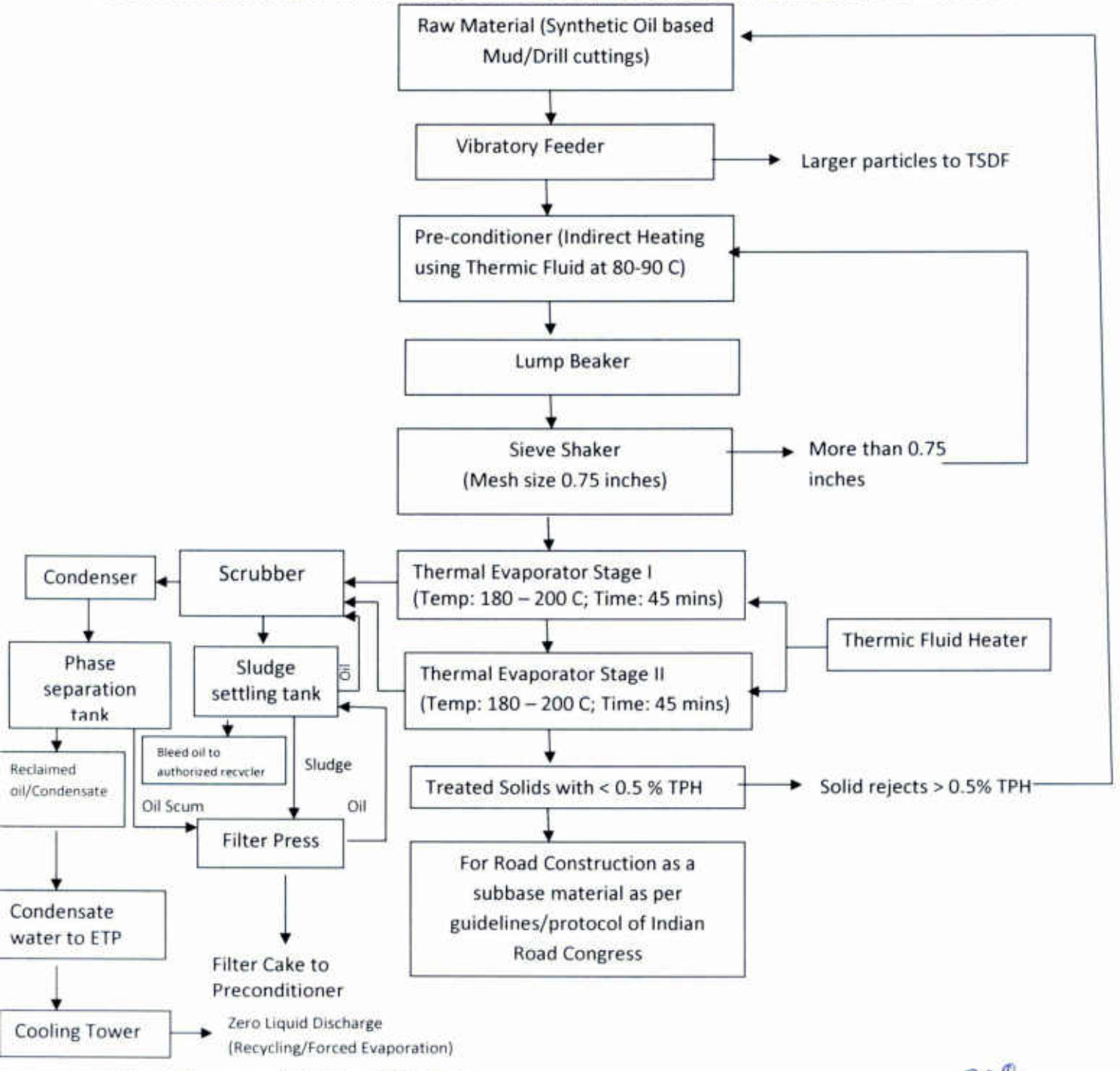
Synthetic Oil based mud is a base oil (lubricating oil) with proportionate composition of additives such as Barite (Barium Sulphate), Bentonite (Clay), Emulsifiers, Viscosifiers, Fluid loss additives, drilling detergents, wetting agents etc. Synthetic oil based mud is used to lubricate the drill bit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

36.2 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 material of different size particles are homogenized. During preconditioning, the material gets pre-heated using indirect heat by circulating hot thermic fluid through the jacket at 80-90°C. The homogenised 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 to 200 degrees centigrade under

negative pressure (i.e 200 to 300 mmHg) 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 provided below at Fig 1;

FIG. 1 TREATMENT 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 to 200 degrees centigrade 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 the both dryers are scrubbed in scrubber using oil as scrubbing medium so as to remove dust from vapours. The oil, 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 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.

36.3 Product Usage / Utilization

Treated mud (< 0.5 % TPH) may be used for road construction as a subbase 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 SPCB/PCC. It shall not be used in Water Bound Macadam (WBM) Road.

36.4 Standard Operating Procedure (SoP) for utilization

This SoP is applicable only for the utilization treated mud (< 0.5 % TPH) in road construction, where the treated mud is used as a subbase 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 SPCB/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 guideline for disposal of solid waste drill cutting and drilling fluids for offshore and onshore drilling operation notified under E (P) Rules, 1986 vide notification G.S.R 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 and 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 cuttings wastes shall be transferred mechanically through shovels 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 preconditioner to further loosen up the material so as to homogenise at temperature of about 85-90 °C. The said temperature shall be attained by indirect heat using thermic fluid. Thereafter, the homogenised material shall be passed through lump breaker for further homogenization.

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

(7) The homogenised 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 °C through indirect thermic fluid heating system. Negative (suction) pressure condition shall be maintained in the range of 200 to 300 mmHg using appropriate vacuum 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 settling 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/PCC.

(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 oily 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 homogenisation the synthetic oil based mud/drill cutting waste.

(15) Bleed oil from the scrubber shall be 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 subbase 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 annually.

(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 boots/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 (Management &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/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.

36.5 Records/Return Filing

(1) The unit shall maintain a passbook issued by concerned SPCB wherein the following details of each procurement of synthetic oil based mud/drill cuttings 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 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 & 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.

36.6 Standards

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

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

TWA - Time weighted Average measured over a period of 8 hours of operation of process*

(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	40^0 C
3.	Suspended Solids	100 mg/l
4.	Zinc	2 mg/l
5.	BOD	30 mg/l
6.	COD	100 mg/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/l
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 toxivity 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.

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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 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.

36.7 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.

36.8 Size of Plant & Efficiency of utilisation

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 construction. Further, about 220 litres of the 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 para 38.10 below shall be installed accordingly.

36.9 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/PCC/CPCB.

36.10 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 Emission 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.	Separate 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 arrangement 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

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