GUIDELINES FOR CONDUCTING ENVIRONMENTAL AUDIT IN UPSTREAM PETROLEUM SECTOR (ONLAND)

Prepared by

FUNCTIONAL COMMITTEE ON FORMULATION OF GUIDELINES FOR CONDUCTING ENVIRONMENTAL AUDIT IN UPSTREAM PETROLEUM SECTOR (ONLAND)

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OIL INDUSTRY SAFETY DIRECTORATE
8th Floor, OIDB Bhavan,
Plot No. 2, Sector - 73
Noida – 201301 (U.P.)
Preamble

Indian petroleum industry is the energy lifeline of the nation and its continuous performance is essential for sovereignty and prosperity of the country. As the industry essentially deals with inherently inflammable substances throughout its value chain – upstream, midstream and downstream – Safety is of paramount importance to this industry as only safe performance at all times can ensure optimum ROI of these national assets and resources including sustainability.

While statutory organizations were in place all along to oversee safety aspects of Indian petroleum industry, Oil Industry Safety Directorate (OISD) was set up in 1986 Ministry of Petroleum and Natural Gas, Government of India as a knowledge centre for formulation of constantly updated world-scale standards for design, layout and operation of various equipment, facility and activities involved in this industry. Moreover, OISD was also given responsibility of monitoring implementation status of these standards through safety audits.

In more than 25 years of its existence, OISD has developed a rigorous, multi-layer, iterative and participative process of development of standards – starting with research by in-house experts and iterating through seeking & validating inputs from all stake-holders – operators, designers, national level knowledge authorities and public at large – with a feedback loop of constant updation based on ground level experience obtained through audits, incident analysis and environment scanning.

The participative process followed in standard formulation has resulted in excellent level of compliance by the industry culminating in a safer environment in the industry. OISD – except in the Upstream Petroleum Sector – is still a regulatory (and not a statutory) body but that has not affected implementation of the OISD standards. It also goes to prove the old adage that self-regulation is the best regulation. The quality and relevance of OISD standards had been further endorsed by their adoption in various statutory rules of the land.

Petroleum industry in India is significantly globalized at present in terms of technology content requiring its operation to keep pace with the relevant world scale standards & practices. This matches the OISD philosophy of continuous improvement keeping pace with the global developments in its target environment. To this end, OISD keeps track of changes through participation as member in large number of International and national level Knowledge Organizations – both in the field of standard development and implementation & monitoring in addition to updation of internal knowledge base through continuous research and application surveillance, thereby ensuring that this OISD Standard, along with all other extant ones, remains relevant, updated and effective on a real time basis in the applicable areas.

Together we strive to achieve NIL incidents in the entire Hydrocarbon Value Chain. This, besides other issues, calls for total engagement from all levels of the stake holder organizations, which we, at OISD, fervently look forward to.

Jai Hind!!!

Executive Director

Oil Industry Safety Directorate
FOREWORD

Oil industry in India is more than 100 years old handling variety of hydrocarbon material, natural gas, crude oil and petroleum products. With the technological advances and need for transportation of bulk energy carrier and natural gas over the years a variety of practices have been in vogue because of collaboration/association with different foreign companies and governments. Standardisation in design, operating and maintenance practices was hardly in existence at a national level. This lack of uniformity, coupled with feedback from some serious accidents that occurred in the recent past in India and abroad, emphasised the need for the industry to review the existing state of art in designing, operating and maintaining oil and gas installations.

With this in view, the Ministry of Petroleum & Natural Gas in 1986 constituted a Safety Council assisted by the Oil Industry Safety Directorate (OISD) staffed from within the industry in formulating and implementing a series of self regulatory measures aimed at removing obsolescence, standardising and upgrading the existing standards to ensure safer operations. Accordingly, the principal panelists of OISD were requested to nominate the experienced persons in line for the above functional committee. OISD had constituted the functional committee of expert persons and finalized this draft of guidelines in several periodic meetings and discussions, based on the background note.

Upstream petroleum industry deals with seismic survey, deep hole drilling both on land and offshore, production and transportation of crude oil and gas. These activities generate substantial amount of pollutants and waste(solid, liquid and gaseous) which are subject to specified standards and if not properly managed shall adversely affect the environment.

Further, to monitor and control the various aspects of environment of petroleum sector there are two options before the industry that either control through existing regulations of Government of India or by implementing novel environmental friendly technologies coupled with efficient Environment Management System. In this regard Government of India has notified a gazette notification related to the Environment audit i.e. ENVIRONMENT STATEMENT (as part of Environment audit) 1993.

In view of potential hazards and grey areas of the operational facilities which still have scope for further improvement, Oil Industry Safety Directorate (OISD), Ministry of Petroleum & Natural Gas, a nodal agency for petroleum industries has taken a task of formulation of Guidelines for Conducting Environmental Audit in Upstream Petroleum Sector (Onland).

Shri S. Bora, Deputy Chief Engineer, Oil India Limited, Duliajan as a leader and functional committee members have put in lot of efforts in drafting these guidelines. The guidelines are divided into four sections viz: Introduction, Definition, Pre-Audit, Audit and Post Audit including relevant annexures.

This document was prepared based on the accumulated knowledge and experience of industry members and the various national and international codes and practices. It is expected that these guidelines on environmental audit would be beneficial to user industry.

This document will be reviewed periodically for improvements based on the new experiences and better understanding.

Suggestions from industry members may be addressed to:

Member Coordinator
Committee on Formulation of Guidelines for Conducting Environmental Audit in Upstream Petroleum Sector (Onland)

OIL INDUSTRY SAFETY DIRECTORATE
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These documents are intended to supplement rather than replace the prevailing statutory requirements.
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GUIDELINES FOR CONDUCTING ENVIRONMENTAL AUDIT IN UPSTREAM PETROLEUM SECTOR (ONLAND)

1. Introduction

Environmental audit helps in finding many new possibilities of making operational facilities more productive, safe and sound. It enables the organisation to gain competitive advantage by lowering the cost of waste reduction, increasing productivity through more congenial working environment. It also facilitates development of environmental management plan. In this manner, it may save operational facilities from adverse action of statutory agencies.

Further the complex nature of various process facilities of oil and gas extraction industries coupled with diversified local environmental conditions has impressed environmental auditors to conduct site specific environment audit.

The necessary guidelines on the subject for maintaining uniformity among procedures for conducting the audit has been evolved considering key elements of the operations from environmental angle and existing environmental standards etc.

2. Scope

The scope of these guidelines is limited to only Oil drilling and Gas Extraction facilities of onland upstream petroleum sector incorporating facilities which involves manufacture, storage, transportation of hazardous toxic substances.

3. Definitions

3.1 Air Pollutants

Presence of obnoxious substances in air which affect on man, other animals or on plants are known as air pollutants. Pollutants may thus include almost any natural or artificial composition of matter capable of being airborne. They may occur as solid particles, liquid droplets, or gases, or in various admixtures of these forms.

3.2 Ambient Air

Surrounding environmental air.

3.3 Ambient Air Quality

A general term used to describe the state of the air outside. No qualitative measures are
associated with this term. Usually breathing level.

3.4 Aeration

The establishment of intimate contact between air and liquid by one of the following methods; spraying the liquid in the air, bubbling air through the liquid (diffused aeration), agitation of the liquid to promote surface absorption of air (mechanical aeration).

3.5 Aerobic

Living or active only in the presence of oxygen.

3.6 Biochemical Oxygen Demand (BOD)

The amount of oxygen required for the biological oxidation of the organic matter in a liquid. A test which measures the quantity of oxygen utilized in the biochemical oxidation of organic matter in a specified time and at a specified temperature (usually 5 days at 200 C).

3.7 Chemical Oxygen Demand (COD)

The amount of oxygen required for the chemical oxidation of organics in a liquid. A test based on the fact that all organic compounds, with few exceptions, can be oxidized to carbon dioxide and water by the action of strong oxidizing agents under acid conditions.

3.8 Clarification

Process of removing turbidity and suspended solids by settling. Chemicals can be added to improve and speed up the settling process through coagulation.

3.9 Clarifier

A sedimentation tank.

3.10 Coagulation

The agglomeration of colloidal or finely divided, suspended matter by the addition to the liquid of an appropriate chemical coagulant, by biological processes or by other means. The process of adding a coagulant and necessary other reacting chemicals.

3.11 Contamination

A general term signifying the introduction of micro-organisms, chemicals, wastes, or sewage which renders the water unfit for its intended use into water.

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3.12 Digestion

The biochemical decomposition of organic matter which results in the formation of mineral and simpler organic compounds.

3.13 Dissolved Oxygen (DO)

The oxygen dissolved in sewage, water, or other liquid, usually expressed in milligrams per liter or per cent of saturation.

3.14 Drill Cutting

Rock Chips produced by the action of the drill bit on rock as it works its way down to the subterranean oil or gas bearing formations. Drill cuttings are removed from the well-bore by drilling mud.

3.15 Drilling Mud

A specially formulated fluid used to lubricate the drill bit and remove drill cuttings. Different fluids bases exist for different types of mud. They may be water based, mineral oil based, or synthetic oil based. Mud have to be carefully formulated to match the varying geological, temperature, and pressure conditions that are met as an oil well is being drilled.

3.17 Effluent

General term denoting any fluid emitted from a source. The spent liquors that are allowed to flow away as waste from plant may be known as effluent.

3.18 Emission

The total amount of a solid, liquid, or gaseous pollutant emitted into the atmosphere from a given source in a given time, and usually indicated in grams per cubic meter of gas.

3.19 Emission Monitoring

Collection of data on the air quality of the atmosphere. This may be done at a specific emission source as well as for a general area.

3.20 Environment

An external condition or the sum of such conditions, in which people, living organism, equipment, or a system operates.
3.21 Environmental Audit

The environmental audit is an important tool for checking and verification of environment management plans and provides detailed information on the types, volumes, locations and handling procedures of all materials that have or likely to have potential impact on the environment which determines whether operations are in compliance with statutory requirements.

3.22 Floatation

A method of raising suspended matter to the surface of the liquid in a tank as scum-by aeration, vacuum, evolution of gas, chemicals, electrolysis, heat or bacterial decomposition and the subsequent removal of the scum by skimming.

3.23 Flaring

The controlled burning of combustible gases mainly for safety.

3.24 Flue

A passage for conducting combustion gases in an incinerator installation. Also, used synonymously with chimney (buildings)

3.25 Flue Gas

Waster gas from combustion processes.

3.26 Ground Level Concentration

The amount of solid, liquid, or gaseous material per unit volume of air, from 200 mm to 2000 mm above the ground.

3.27 Grease

In sewage, grease includes fats, waxes, free fatty acids, calcium and magnesium soaps, mineral oils, and other non fatty materials.

3.28 Hydrocarbons

Compounds which consist solely of carbon and hydrogen.

3.29 Heavy Metals

A general name given to the ions of metallic elements such as copper, zinc, iron, 

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chromium, and Aluminium.

3.30 Incineration

The combustion (by burning) of organic matter in waste water, sludge or solids after water evaporation from the respective matter.

3.33 Parts Per Million (PPM)

Parts by weight, ppm by weight - is equal to milligrams per liter divided by the specific gravity. It may be noted that in water analysis ppm is always understood to imply weight ratio even through in practice a volume may be measured instead of weight. By contrast, per cent; may be either a volume/ weight ratio or a weight / weight ratio.

3.34 Pollution Load

A measure of the strength of a waste water in terms of its solids or oxygen demanding characteristics and or other objectionable physical and chemical characteristics.

3.35 Produced Water

Water naturally present in the reservoir or injected into the reservoir to ensure sufficient pressure.

The amount of producer water increases as the well ages. Residual amounts of oil are present in produced water which in most cases is treated and eventually discharged.

3.36 Sanitary Landfills (s)

Engineered burial of refuse.

3.37 Stack

A vertical passage or chimney constituent, whether of refractory, brick, tile concrete, metal, or other material, for conducting cooled products of combustion to the atmosphere from a process.

3.38 Stack Effluent

Gaseous and particulate waste products discharged to the atmosphere through stacks.

3.39 Stack Gas

Gaseous waste products discharged to the atmosphere through a stack.
3.40 Stack Sampling

Collection of representative gaseous and particulate samples of matter flowing through a duct or stack.

3.41 Standard(s)

An exact value, or a concept, that has been established by authority or in agreement, to serve as model or rule in the measurement of a quantity or in the establishment of a practice or procedure.

3.42 Sulfur Dioxide

The result of combustion of sulfur and oxygen. It may also be generated by the combustion of some compound which contains sulfur.

3.43 Suspended Matter

A non-uniform distribution of a solid in a liquid without the solid’s being dissolved in the dispersion medium.

3.44 Sludge

The material resulting from air drying or dewatering sludge (usually forkable or spadable.)

3.45 Toxicity

The quality of being poisonous, especially the degree of virulence of a toxic microbe or of a poison. It is expressed by a fraction indicating the ratio between the smallest amount that will cause an animal’s death and the weight of that animal.

3.46 Venting

The release of unburned gases to the atmosphere.

3.47 Wind Rose

One of a class of diagrams designed to show the distribution of wind direction experienced at a given location over a considerable period; it thus show the prevailing wind direction.
4. PRE-AUDIT

This phase of environmental audit basically involves total planning for conducting the audit by the Team designated for the respective facility. The main objective of this activity is to reduce the time for the audit activity at the site and maximise team productivity.

4.1 The audit team

4.1.1 The audit team shall be comprising of five members including leader of the team.

4.1.2 Leader of the audit team shall have OISD approval.

4.1.2.1 The respective organisation shall authorise audit team members to conduct Environment Audit and members shall be well conversant to the relevant statutory requirements, good familiarity with plant/operations or with the facility to be audited.

4.1.3 One coordinator of the team shall be from OISD Environment Department or relevant group with environmental back ground. The coordinator shall also take care for empanelment of other auditors and other liaison job.

4.1.4 One member of the team shall be taken from the respective organisation wherever audit is being carried out.

4.2 Duration

The audit time for processing terminal shall be 4 to 5 days whereas for drilling facilities shall be 2 to 3 days. The leader of the audit team can also plan their audit programme in conjugation of both the facilities.

5. Checklist shall be prepared. The typical sample of the checklist is enclosed and placed at ANNEXURE-1 for relevant data/information collection.

6. The team leader/coordinator shall ensure its prior dispatch to the respective audit locations for the desired information/data collection including sensitivity of adjacent location if any.

7. Team shall plan about kick off meeting based on information received from the checklist or from any other source.

8. During the meeting audit methodology shall be very clearly explained to the managers of the respective audit locations. Plant/site managers are need to be informed about inspection and evaluation of following points/documents;
8.1 EMP

8.2 EIA (if not available then status of air, water and land environment).

8.3 Risk Assessment study/DMP etc.

8.4 Operational manuals etc.

8.5 Copy of last audited report if any.

8.6 Description of site facilities.

8.7 Pollution control facilities available.

9 Site visit

9.1 Interrogation with relevant operators/managers.

9.2 Verification of different mass and evaluation of losses.

9.3 Observations on house keeping / green belt.

9.4 Observation on effectiveness of various pollution control facilities.

9.5 Statutory aspects/compliance.

10. Critical review to conclude.

11. Close off meeting with preliminary remark.

5 AUDIT

This phase of environmental audit pertains to visit of the site by the team and to collect & review the first hand information from the Plant authorities. This activity mainly includes meeting with the plant personnel and evaluation / verification of the technical data.

12.1 The audit shall start with kick off meeting wherein objectives of the environmental audit, its background and modalities shall be very clearly explained to the managers of the site.

12.2 Statutory obligations/responsibilities/ rights shall be well explained to the
industry.

12.3. Site visit shall be performed from point of view of following:

I. Process facilities wise

II. Effluent inlet outlet point wise

III. Source wise

IV. Disposal point wise

V. Laboratory

VI. Other points as per the requirements of the checklist

12.4 Demonstration Of Oil Spill Control Equipment.

12.5 Checking the result of ongoing analysis.

12.6 Audit shall be carried out as per modality as decided (given) in pre audit.

12.7 Recording of relevant data i.e. flow rates, dosing, ambient air quality values, sludge etc.

12.8 Team shall clearly evaluate the effectiveness of the respective systems from cost benefit analysis point of view.

12.9 Team shall also appreciate is good work is done or any environmental initiative is taken by the respective company.

12.9 Team shall organise close off meeting wherein leader or his nominee should present the broad findings of the audit.

6. POST AUDIT

This phase of the environmental audit includes basically total review of the visits, data & inspections including report writing as per the Annexure - II. The post audit exercise also includes identifying the appropriate recommendations with action plan.

13. Team shall collate, evaluate and analyse the collective data on every aspect of environmental parameters.

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14. The necessary data shall be given in annexure of the report.

15. The team shall also analyse facility wise mass balance of various parameters.

16. Team shall also incorporate line sketches of pollution control facilities including plant flow sheet.

17. Report shall be written as per the enclosed format of the report placed at ANNEXURE – II.

18. Appraisal of audit report shall be submitted to the management of the plant along with action plan with time frame for further improvement.
CHECK LIST FOR ENVIRONMENT AUDIT OF EXPLORATION & PRODUCTION (E&P) INSTALLATIONS

1. GENERAL:

1.1 Environment Audit Report for the financial year :

1.2 Name of Installation :

1.3 Brief of the Installation with flow charts (Please enclose separate sheets, if required) :

1.4 Environment statement submitted to SPCB for the year (Please attach a copy of the latest statement filed) :

1.5 Brief Details :

a. Drilling rig

- Target depth :

- Mud system being used :

- Kind of drilling in progress :

Layout of different facilities at drilling site. Please attach a sketch of the site indicating the location of different facilities.

b. Processing facility

Average monthly capacity of production/processing of the installation

-- Design :

-- Actual :

Please attach a brief write-up on the facilities along with flow sheets.

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2. WATER ENVIRONMENT:

2.1 Source of fresh water: River / Lake / Tubewell / Formation / Sea

2.2 Water consumption in m³/day

   i) Fresh :
   ii) Recycled :
      (from drilling rig/ industrial ETP/domestic ETP)
   iii) Sea :
   iv) Formation :
   v) Any other :

2.3 Water consumption in different areas, m³/day

<table>
<thead>
<tr>
<th>Area</th>
<th>Design</th>
<th>Actual</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Fresh</td>
</tr>
<tr>
<td>Drilling</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cooling</td>
<td></td>
<td></td>
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<tr>
<td>Utilities (boilers etc)</td>
<td></td>
<td></td>
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<tr>
<td>Sanitary</td>
<td></td>
<td></td>
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<tr>
<td>Horticulture / Tree plantation</td>
<td></td>
<td></td>
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<tr>
<td>Fire</td>
<td></td>
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</tr>
<tr>
<td>Any other</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2.4 Total quantity of effluents generated, average m³/day :

2.5 Source-wise break-up of effluents generated, average m³/day and their destination (surface drain, ETP, Central effluent pit etc.)
Type of Water Source Average m³/day
--- Process water conditioner
--- Separators
--- Leakages
--- Waste from derrick / shale shakers / bilge / lube oils / K.O. etc.
--- Formation
--- Contaminated storm water
- Any other

2.6 Performance of individual ETP/Recycling system (industrial as well as domestic)
(i) Provide flow scheme indicating capacities and operating parameters of individual sections.
(ii) Design capacity, m³/day, (wet as well as dry weather flow):
(iii) Actual influent flow, m³/day:
(iv) Characteristics of influent (include MINAS and any other significant parameters):
(v) Characteristics of treated effluent at the outlet of ETP (include MINAS as well SPCB stipulations indicating percent compliance w.r.t. each parameter:
(vi) Steps taken to correct any non-compliance of stipulated effluent quality:
(vii) Quantity of treated effluent recycled, m³/day:
(viii) Quantity of treated effluent discharged, m³/day and the point of discharge:
(ix) Brief details of chemical dosings adopted and their efficacy:

2.7 Frequency of testing of treated effluent discharged outside:

2.8 Quality of receiving water body – upstream and down stream of discharge

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point: (Provide analytical data)

2.9 Consent for effluent discharge valid till ............

2.10 Application for renewal of consent submitted on...........

2.11 Steps taken for correcting any non-compliance of statutory stipulations as pointed out by statutory authorities:

2.12 Mode of disposal for effluents

3. AIR ENVIRONMENT

3.1 EMISSIONS

3.1.1 Gas Flaring

- Quantity, average m3/day : 
- % on total gas production : 
- ‘S’ content of gas (raw as well as treated) : 
- Quantum of ‘S’ recovered in the year : 
- SO2 emission due to gas flaring, average kg/day :

3.1.2 Flaring facilities :

- No. of tall stacks, ground flare and box flares in operation :
- Capacity and height of such flares :
- If cold flaring is resorted to, duration and quantum of gas flared in the year :
3.1.3 Boilers / Generators/ any other prime mover

- Types of fuel used :
- Quantity of each type of fuel used , average m3/day :
- SO2 emission due to fuel firing, kg/day :

3.1.4 Fugitive emissions

- Is regular monitoring carried out (For HC, H2S etc) : Yes / No
- If yes, give details (frequency, duration of sampling and typical values)
- Annual consumption of CFC / Halon, if used:
- Total inventory of CFC / Halon in use and in stores:
- Plans for replacement of CFC /Halon.

3.1.5 Emission monitoring and compliance status. Details of emission monitoring and percent compliance of statutory stipulations.

3.2 AMBIENT AIR QUALITY

(i) No. of ambient air quality monitoring (AAQM) stations in operation :

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Station (Manual or Continuous)</th>
<th>Pollutants monitored including meteorological parameters</th>
<th>Frequency and duration of sampling</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
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<td></td>
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<td></td>
<td></td>
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<td></td>
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<td>24 hrs Max, Annual Average</td>
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</table>

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(ii) Location of AAQM based on: Dispersion modeling / SPCB  Recommendations / Other considerations

4. LAND ENVIRONMENT

4.1 Solid Wastes
(Data on raw sludge & drill cuttings)

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Type of Sludge</th>
<th>Source</th>
<th>Rate of generation, t/yr</th>
<th>Typical Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Oily Sludge</td>
<td>Crute Tank bottoms</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Product Tank bottoms</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>ETP facilities</td>
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<td></td>
<td></td>
<td>Any other</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Chemical Sludge</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Bio Sludge</td>
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<td></td>
</tr>
<tr>
<td>4</td>
<td>Drill cuttings</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Spent catalyst</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Any other</td>
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<td></td>
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</tr>
</tbody>
</table>

4.2 Data on treated (ultimate) sludge:

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Type of Sludge</th>
<th>Rate of disposal, t/yr</th>
<th>Treatment methods adopted</th>
<th>Typical analysis including metal content</th>
<th>Disposal methods adopted</th>
</tr>
</thead>
</table>

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*Please give details of treatment methods adopted separately.

4.3 Ground Water Monitoring

- Location of sampling points
- Frequency of sampling
- Monitored values

4.4 Has authorisation from SPCB been obtained for handling and storage of hazardous wastes? If yes, please annexe a copy of the latest authorisation letter.

5. HAZARDOUS MATERIALS HANDLING

- Please give a list of hazardous chemicals stored along with material safety data sheet (MSDS) and their quantity, type of storage, and fire and safety measures incorporated.

6. NOISE ENVIRONMENT

a) Frequency of noise survey :

b) List inplant noise survey results :

<table>
<thead>
<tr>
<th>S.NO.</th>
<th>LOCATION</th>
<th>NOISE LEVEL, dBA (RANGE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

c) Does any employee get exposed to noise level beyond OISD norms (Ref. OISD-GDN-166) : Yes / No

as given below

- 90 dBA - 8 Hrs.
- 92 dBA - 6 Hrs.
- 95 dBA - 4 Hrs.
- 97 dBA - 3 Hrs.

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100 dBA  -  2 Hrs.
102 dBA  -  11/2 Hrs.
105 dBA  -  1 Hr.
110 dBA  -  1/2 Hr.
115 dBA  -  ¼ or less

d) If yes, action taken for mitigation / protection of employees and public:

e) Compliance of air quality (noise) standard:

<table>
<thead>
<tr>
<th>Monitoring point along the plant boundary</th>
<th>Noise Level, dBA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Standard</td>
</tr>
<tr>
<td></td>
<td>Day</td>
</tr>
<tr>
<td></td>
<td>Day</td>
</tr>
</tbody>
</table>

7. TREE PLANTATION / GREEN BELT / ECOLOGICAL PARK DEVELOPMENT / LAND RECLAMATION

- No. of trees / other plants existing in and around the installation:
  
  - If green belt is existing, width of green belt:
  
  - Types of trees / plants existing:
  
  - No. of trees planted in the last two years and the future programme:
  
  - If ECO - Park is existing, brief details of the same:
  
  - Normal practice of land reclamation & measures taken for land reclamation.

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8. OCCUPATIONAL HEALTH AND SAFETY

a) Work environment monitoring (past one year data)

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Toxic Substance</th>
<th>Area</th>
<th>Monitored Values</th>
<th>Frequence of observations</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>TLV</td>
<td>STEL</td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>SO₂</td>
<td></td>
<td>Statutory Actual</td>
<td>Statutory Actual</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>CO</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>H₂S</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>CI₂</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>NH₃</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>HC</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Any other</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Exceedence of STEL (15 mts) and / or TLV (8 Hr) limit observed for any toxic substance at any time : Yes/No

If yes, please list the substance and reasons for exceedence :

Measures taken to avoid such exceedence in future :

b) Medical check up (Past one year data)

<table>
<thead>
<tr>
<th>Group</th>
<th>Target</th>
<th>Actual</th>
<th>%Of Total Employee</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Well Person</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>♦ Executives</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>♦ Non Executives</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>♦ Pre Employment</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Statutory</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>☐ Driver</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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Radiographer

Welder

Rig Operator

Haz. Substance handlers

c) No. of Persons found affected :

d) Mitigation / preventive measures taken to safeguard the health of affected as well as unaffected persons :

e) Other activities pertaining to occupational health like training, awareness campaigns etc. :

9. HUMAN RESOURCES DEVELOPMENT

Training of employees in environment protection, health and safety

- Types & frequency of training courses conducted :

- Percent employees covered so far :

- Future programmes :

10. MISCELLANEOUS :

1. Please name the R&D project sponsored during last two years.\n2. Please name the studies already carried out during last two years and their present implementation status.
3. Please state when last EIA was carried out.
4. Please state when risk analysis studies were carried out.
5. Have recommendations arising out of risk analysis studies been implemented / incorporated in DMP.
6. Does the risk analysis study over environment risks also ? If yes, please give details.
7. What are the laboratory facilities available for testing environment parameters.\n8. Incinerator for disposal of solid waste.
9. Any other item.

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ENVIRONMENTAL AUDIT REPORT
(Illustrative format for preparation of the Audit report)

Executive Summary

OBJECTIVE

BACKGROUND OF ENVIRONMENTAL AUDIT

AUDIT MODALITIES

BRIEF ON STATUTORY REQUIREMENTS

OUTCOME OF KICK OF MEETING WITH PLANT MANAGEMENT / INCHARGES OF DRILLING ETC.

REVIEW OF RELEVANT DOCUMENTS & VERIFICATION OF DATA COLLECTED THROUGH CHECK LIST.

SITE VISIT

DESCRIPTION OF SITE FACILITIES (Processes and Drilling)

DESCRIPTION OF POLLUTION CONTROL FACILITIES

DESCRIPTION OF PREVAILING POLLUTION CONTROL PRACTICES (Incorporating EMP etc.).

CRITICAL VIEW ON INTERACTION OF ASSOCIATED RELEVANT PERSONNELS OF THE FACILITY.

DESCRIPTION OF SOURCES OF POLLUTION / POLLUTANTS – QUALITATIVELY & QUANTITATIVELY INCLUDING MATERIAL BALANCE.

ISSUE WISE DISCUSSION ON OBSERVATIONS / FINDINGS OR CASE IN POINTS (TECHNICAL/ STATUTORY)ALONG WITH RECOMMENDATIONS / SUGGESTIONS FROM FURTHER IMPROVEMENT POINT OF VIEW.

RECOMMENDATIONS WITH ACTION PLAN AND TIME FRAME

CONCLUSION (POINT WISE SUMMARY)

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OUTCOME OF CLOSE OFF MEETING /EXIT MEETING WITH SENIOR MANAGEMENT.
ANNEXURES & REFERENCES
Annexure –III

CONVERSIONS

FROM PPM to (g/m³)

Gaseous pollutants present in the air are commonly expressed as parts per million (PPM).

Thus

\[
\text{1 parts per million} = \frac{1 \text{ volume of gaseous pollutant}}{106 \text{ volumes (Pollutants + Air)}} = 0.0001 \% \text{ by volume}
\]

The weight of a pollutant is expressed as micrograms of pollutant per cubic meter of air. Symbolically

\[
\frac{\text{micrograms}}{\text{cubic meter}} = (g/m^3)
\]

The relationship between ppm and ug/m³ at –

I. STP i.e. 760 mm Hg (1 atm.) pressure, 298 deg. K (273 + 25) temperature at which 1 g-mole of any ideal gas has a volume of 24.5 liters

\[
\text{ppm} \times \text{mol.wt. of gas} = \frac{\text{ppm} \times \text{mol.wt. of gas}}{24.5} \times 10^3
\]

II. NTP i.e. 760 mm Hg (1 atm.) pressure, 273 deg. K temperature at which 1 g-mole of any ideal gas has a volume of 22.41 liters

\[
\text{ppm} \times \text{mol.wt. of gas} = \frac{\text{ppm} \times \text{mol.wt. of gas}}{22.41} \times 103
\]

Example:

I. 50 ppm of SO₂ at STP is equal to

\[
(50 \times 64 \times 1000) / 24.5 = 1,30,612.24 \text{ (g/m³)}
\]
2. 800 (g/m$^3$) of NOx (NO + NO$_2$) at NTP is equal to

\[
\frac{(800 \times 22.41)}{(1000 \times 38)} = 0.4717 \text{ ppm.}
\]

**STANDARD EQUIVALENTS**

- 1 tonne of oil equivalent (toe) = $1 \times 10^{10}$ calories
- $10^3$ toe = 41.868 TJ
- 1 short ton = 0.9072 tonne
- 1 tonne = 1.1023 short tons
- 1 tonne = 1 megagram
- 1 kilotonne = 1 gigagram
- 1 megatonne = 1 teragram
- 1 kilogram = 2.2046 lbs
- 1 hectare = $10^4$ m$^2$
- 1 calorie = 4.1868 joules
- 1 atmosphere = 101.325 kPa

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