



# **OIL INDUSTRY SAFETY DIRECTORATE**

अन्वेषण एवं उत्पादन क्षेत्र में पर्यावरण प्रबंधन  
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**ENVIRONMENT MANAGEMENT IN  
EXPLORATION & PRODUCTION SECTOR**

**OISD- RP-201**

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**FOR RESTRICTED CIRCULATION ONLY**

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## 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 by 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 three decades 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

The Oil Industry in India is over 100 years old. As such, various practices have been in vogue because of collaboration/ association with different foreign companies and governments. Standardization in design philosophies, operating and maintenance practices remained a grey area. This coupled with feedback from some serious accidents that occurred in the past in India and abroad, emphasized the need for the industry to review the existing state-of-the-art in designing, operating and maintaining of Oil and Gas installations.

With this in view, the Ministry of Petroleum and 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, standardizing and upgrading the existing standards to ensure safe operations. Accordingly, OISD constituted a number of functional committees of experts nominated from the industry to draw up standards and guidelines on various subjects.

The recommended practices for “Environment Management in Exploration & Production Sector” have been prepared by the Functional Committee. The first edition of OISD-RP-201 (December, 2001) titled “Recommended Practices for Environment Protection in Upstream Petroleum Sector (Onland facilities)” covered onland facilities only. In the present revised edition, offshore facilities have also been included and it has been renamed as “Environment Management in Exploration & Production Sector”. The document is based on the accumulated knowledge and experience of industry members and the national / international codes and practices.

The figures and photographs used in the document, if any, are representative in nature.

We, at OISD, are confident that the provisions of this standard, when implemented in totality, would go a long way in ensuring safe operation of the target group of locations.

Needless to mention, this standard, as always would be reviewed based on field level experience, incident analysis and environment scanning. Suggestions from all stake holders may be forwarded to OISD.

## NOTE

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These documents are intended only to supplement and not to replace the prevailing statutory requirements of PESO, DGMS, Factory Inspectorate or any other Government body which must be followed as applicable.

Wherever Acts/ Rules/ Regulation and National/ International Standards are mentioned in the standard, the same relates to in-vogue version of such documents.

Numaligarh Refinery Limited

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PRACTICES FOR ENVIRONMENT PROTECTION IN  
UPSTREAM PETROLEUM SECTOR (ONLAND OPERATIONS)  
2001**

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# Environment Management in Exploration & Production Sector

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# ENVIRONMENT MANAGEMENT IN EXPLORATION & PRODUCTION SECTOR

## 1.0 INTRODUCTION

Activities pertaining to exploration, drilling, production and processing etc., often interact with the environment and can have impact on ecology unless some environment protection measures are planned and implemented.

These recommended practices will assist organisations in planning and implementing environment management system and programmes effectively, so that impact of exploration and production (E&P) activities on the environment is minimised.

## 2.0 SCOPE

This document covers the recommended practices (RP) for environment management in onshore and offshore E&P sector.

## 3.0 DEFINITIONS

**Central Tank Farm:** A terminal where crude oil is collected from different group gathering stations for storage, quality control and onward transportation to the refinery for processing.

**Drill Cuttings:** The particles of rocks which are generated during drilling and lifted to the surface along with the drilling fluid.


**Drilling Fluid:** Drilling fluids are used primarily to keep a bore hole open & clean while drilling. The term fluids encompasses a broad range, including mud, water, and air.

**Gas Collecting Station:** A facility where gas producing wells are connected for treatment and onward transmission.

**Group Gathering Station:** An oil terminal where produced wells are connected through manifolds and well fluids are separated.

**Environmental Aspect:** An aspect is a feature of the activity that could or does lead to a change in the environment (e.g. emissions, waste, use of resources, noise).



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**Environment Management System:** A part of the overall management system including organizational structure, activities planning, responsibilities, practices, procedures, processes and resources for developing, implementing, achieving, reviewing and maintaining the environmental policy.

**E&P Sector:** Activities pertaining to hydrocarbon exploration, drilling, production, processing in onshore and offshore.

**Inactive Well:** A well where production, injection, disposal or workover operations have ceased, but permanent abandonment has not taken place. Inactive wells should be classified as either shut-in or temporarily abandoned. Shut-in status should begin 90 days after operations stop, and temporarily abandoned status should commence one day after temporary abandonment operations have been completed. Temporary abandonment means isolation of completion interval in the well.

**Shall:** The word ‘shall’ is used to indicate that the provision is mandatory.

**Should:** The word ‘should’ is used to indicate that the provision is recommendatory as per sound engineering practice.

## 4.0 APPLICABLE REGULATORY REQUIREMENTS


Regulatory regime governing environmental protection measures pertaining to E&P sector is briefly described below. Environment Management Plan shall be developed to address applicable regulatory requirements (including, but not limiting to the following):

### A. The Environment (Protection) Act, 1986 (EPA, 1986) and The Rules made there under

This Act is an umbrella legislation that provides comprehensive legislative framework for the protection of the environment. Several sets of Rules relating to various aspects of the management of ambient noise, hazardous chemicals, wastes, micro-organisms, bio-medical waste, etc have been made under this Act. Responsibilities of the operator and penalties for non-compliances are also stipulated in EPA, 1986. (Refer **Annexure I** for responsibilities and penalties). Also various notifications have been issued under the EPA, 1986 and the Environment (Protection) Rules, 1986. The important Rules and Notifications, applicable to E&P Petroleum Sector are covered below:

- a. **The Environmental (Protection) Rules, 1986** specifically prohibits industries, operations or processes from discharging or emitting any environmental pollutants in excess of the standards as prescribed in the schedule I to VI of the Rules. Standards of effluent disposal and gaseous emissions for ‘oil drilling and

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gas extraction industry’ are part of schedule I. Noise and emission standards for diesel generator sets and diesel engines are also part of schedule I.

- b. The Environment (Protection) Third Amendment Rules, 2005**, provide detailed guidelines for disposal of solid waste, drill cuttings and drilling fluids for both onshore and offshore drilling operations. Various functional requirements for use and disposal of drill fluids and drill cuttings have been specified in these guidelines.

- c. The Manufacture, Storage and Import of Hazardous Chemicals Rules, 1989**

The Rules apply to industries carrying on specified industrial operations or processes and or storing specified chemicals. The rules specify varying levels of requirements depending on the type and quantity of chemicals stored. Industry is required to prepare Disaster Management Plans (onsite and offsite) and also carry out drills at specified intervals.

- d. The Hazardous Wastes (Management and Handling) Rules, 1989**

As per these Rules occupier and the operator of a facility shall be responsible for proper reception, collection, treatment, storage and disposal of hazardous wastes listed in schedule 1, 2 and 3.


These Rules are under revision and draft rules are being discussed / deliberated.

- e. The Noise Pollution (Regulation and Control) Rules, 2000**

The Rules have been formulated for the control and regulation of noise pollution from various sources, like industrial activities, public address systems, diesel generator sets, construction activity, and pressure horns.

- f. The Batteries (Management and Handling) Rules, 2001**

The Rules stipulate that consumers or bulk consumers have to ensure that used batteries are not disposed of in any manner other than by depositing with the dealer/manufacturer/ registered recycler or at the designated collection centers. Bulk consumers or their user units may auction used batteries to registered recyclers only. Bulk consumer also has to file half yearly return in prescribed form to SPCB.

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**g. The Chemical Accidents (Emergency Planning Preparedness & Response) Rules, 1996**

The Rules assign powers and responsibilities to central, state, district level and local level crisis groups for managing accidents involving hazardous, toxic and flammable chemicals.

**h. The Bio-Medical Waste (Management & Handling) Rules, 1998**

The Rules stipulate that bio-medical waste shall not be mixed with other wastes and has to be treated & disposed of in accordance with the Rules.

**i. The Ozone Depleting Substances (Regulation & Control) Rules 2000**

The Rules stipulate inter alia regulation of production, export, import, sale, purchase and use of ozone depleting substance.

**j. The notification S.O. 114(E) of MOEF of 19<sup>th</sup> Feb 1991** restricts the setting up and expansion of industries, operations or processes etc. in the Coastal Regulation Zone (CRZ).

**k. The notification S.O. 1533 of MOEF of 14<sup>th</sup> Sept 2006** stipulates requirement of prior environmental clearance for new projects or activities or the expansion or modernization of existing projects or activities. It also specifies procedures for the same.


**B. The Air (Prevention and Control of Pollution) Act, 1981; Rules 1982 & 1983**

The Act was enacted to prevent, control and reduce air pollution including noise pollution and to establish Boards at the States as well as Union Territories to achieve this. This Act prohibits the construction and operation or expansion of any industrial plant without the consent of SPCBs. For the prevention and control of air pollution, the State Government, in consultation with the SPCB has the powers to set standards for emissions from automobiles, impose restrictions on use of certain industrial plants and prohibit emissions of air pollutants in excess of the standards laid down by the SPCB. Regular returns need to be filed to SPCB as per the requirements of consent.

**C. The Water (Prevention and Control of Pollution) Act, 1974; Rules, 1975**

This Act provides for the prevention and control of water pollution and maintaining or restoring wholesomeness of the water bodies.

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The Act prohibits the construction and operation of any industrial facility, including undertaking any expansions without the consent of SPCBs. Regular returns need to be filed to SPCB as per the requirements of consent.

**D. The Water (Prevention and Control of Pollution) Cess Act 1977; Rules 1978**

This Act provides for levy and collection of Cess on water consumed by persons (organisations). The objective of the Act is to augment the resources of CPCB and SPCBs. Cess amount to be paid to SPCB at regular intervals based on the water consumption.

**E. The Public Liability Insurance Act, 1991; Rules, 1991**

This Act provides for public liability insurance for the purpose of providing immediate relief to the persons affected by accident occurring while handling any hazardous substance and for matters connected therewith or incidental thereto. Every owner handling any hazardous substance has to take out insurance policy or policies as per the provisions of the Rules.

**F. The National Environment Tribunal Act, 1995**

This Act provides for strict liability for damages arising out of any accident occurring while handling any hazardous substance and for the establishment of a National Environment Tribunal for effective and expeditious disposal of cases arising from such accident, with a view to giving relief and compensation for damages to persons, property and the environment and for matters connected therewith or incidental thereto.


**G. The Oil Mines Regulations, 1984**

It specifies safety distances and actions to be taken for protection against pollution of environment.

**H. The Oil Field (Regulation and Development) Act, 1948; The Petroleum and Natural Gas Rules, 1959.**

The Act provides for the regulation of oilfields and for the development of mineral oil resources.

The Rules include the stipulations with respect to removal of equipment, stores etc before the land is handed back to the Govt. on expiry / cancellation of license / lease.

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## **I. Petroleum and Natural Gas (Safety in Offshore Operations) rules 2008**

It requires risk assessment and emergency preparedness analyses with respect to environment.

## **J. The Merchant Shipping Act, 1958**

This Act is applicable to offshore installations and ships. Part XI A on ‘Prevention and Containment of Pollution of the Sea by Oil’ is applicable to incidents of marine casualty or acts relating to such casualty occurring with grave and imminent danger to Indian coast line or related interests from pollution or threat of pollution in the sea either by deliberate, negligent or accidental release of oil, ballast water, noxious liquid and other harmful substances into sea or including such incidents occurring on the high seas.

## **K. The Forest (Conservation) Act, 1980**

It stipulates the requirement of obtaining approval of Central Government for any E&P activity in a reserved forest land.

## **L. The Explosives Act, 1884; The Explosives Rules, 1983**

These provide for the regulation of manufacture, possession, use, sale, transport and import of explosives.

## **M. The Disaster Management Act, 2005**


The Act provides for the effective management of disasters and for matters connected therewith or incidental thereto.

National Disaster Management Authority (NDMA) constituted under The Disaster Management Act, 2005 has the responsibility of laying down the policies, plan and guidelines for effective disaster management.

Under this Act the government authorities may requisition resources, premises, and vehicles in time of disaster for the purpose of prompt response and rescue operations.

## **N. National Oil Spill – Disaster Contingency Plan (NOS-DCP)**

NOS-DCP stipulates the organizational and operational details to effectively combat a national oil spill contingency in marine environment. Director General,

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Indian Coast Guard is the central coordinating authority for this. Organisations should have facility to handle oil spill of Tier-1 level.

As amendments to the Acts, Rules etc is a continuous process, the organizations should ensure reference to as amended to date versions of the Acts, Rules etc.

## **5.0 PLANNING, IMPLEMENTING AND MONITORING ENVIRONMENT MANAGEMENT SYSTEM.**

Major operations in onshore and offshore E&P sector have been grouped under the following three categories:

### **5.1 Geophysical Surveys**

Geophysical survey refers to the systematic collection of geophysical data with the objective of exploring hydrocarbons.

Seismic survey is the most widely used method, out of all geophysical surveys. In onland seismic survey, holes are drilled to predetermined depth, for creating energy source with explosives or a vibrator is used to generate artificial vibrations within the earth. In offshore operation all the operations are conducted from a vessel.

### **5.2 Drilling activities**


It includes planning, selection and preparation of drill site, moving rig to the site, drilling and completion of well, testing of well, moving rig away from site and restoration of site.

### **5.3 Production and processing activities**

It includes design, construction, installation, operation, modification, decommissioning, dismantling and removal of a facility and pipeline

Operation of facility and pipeline (including trunk line) includes flow of well fluids from wells, collecting well fluids from wells at facilities, processing of well fluid at facility, storage and transportation of oil & gas, handling of wastes including produced water, injection of fluids (water, gas) into the wells etc.

Production activities also include well servicing (workover), stimulation and completion of wells.


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## 5.4 Recommended Practices

The following recommended practices will help the industry during various stages of environment management of E&P operations:

- I. All applicable documents related to environment protection, in the form of acts, regulations, notifications, standards, industry practices and organisational requirements should be identified, listed and applied during design, operation, maintenance and disposal stages of facilities.
- II. All the regulatory requirements, minimisation and mitigation of environmental impacts, closure and reclamation activities should be considered during planning and evaluation of the project.
- III. Functional requirements to be met as per applicable regulations and the related guidelines should be adopted by the organisation. In addition to the regulatory requirements, focus should be to reduce emissions / discharges by process design and through energy optimisation. Operational and accidental discharges to land / water and emissions to air should be eliminated or minimised through design, choice of chemicals and materials as well as operational and maintenance philosophies by adopting best practices.
- IV. The organisation should identify activities having environmental aspects, develop procedures to minimize environmental impact from these activities, and ensure that these are carried out as per procedures. The procedures should cover all normal and abnormal operating conditions with reference to generation of emissions and wastes, including emergencies. Each E&P facility should set targets for continual reduction in use of natural resources, energy and generation of waste.
- V. Responsibilities for implementation and day to day monitoring of environment management related activities should be assigned to designated persons.
- VI. Each installation should develop a site specific compliance manual. The organisation should be able to demonstrate that it has evaluated the compliance with the applicable legal and other requirements including conditions laid down in permits / licenses.
- VII. Employees and contractors' workers should be trained on procedures for controlling functions and operations that are associated with environmental aspects.
- VIII. Concerted efforts should be directed at preventing environmental damage rather than attempting to restore degraded environmental resources after the



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damage. The following order of priority is recommended for managing pollutants:

- Elimination / reduction at source
- Recycling
- Treatment
- Disposal

- IX. Emergency response plan should be prepared and personnel trained accordingly. For details refer OISD-GDN-227 on “Emergency Response Preparedness”.
- X. Each environmental incident should be investigated for assessment of impact on environment; root cause(s) identified and corrective action(s) for preventing recurrence should be taken.
- XI. Comprehensive periodic audit of environment management system should be carried out to ensure that the system is effective in operation, is meeting specified goals, and also meets relevant regulations and standards requirements.
- XII. Internal auditors should have competence in technical and environmental aspects of facilities’ operation, environmental laws and regulations, environmental management systems and auditing techniques.
- XIII. Structured management review should be carried out and it should include review of audit reports, summation of the measurements and monitoring results, time bound corrective actions, feedback for continual improvement of the system.

## 6.0 ELEMENTS OF ENVIRONMENT MANAGEMENT

Various elements of environment management in E&P sector are as hereunder:


### 6.1 Energy management:

Emphasis should be on energy optimization through energy audits and its benchmarking. Also, by replacing energy intensive equipment and processes.

### 6.2 Emission monitoring and control:

Relevant emission data for SO<sub>2</sub>, CO, NO<sub>x</sub>, VOC, SPM, RSPM and methane emissions (including H<sub>2</sub>S wherever applicable) should be monitored (preferably online) and the information should be utilized for optimizing the process to meet



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emission targets. For control of VOC emission, OISD-GDN-224 should be referred.

DG sets at drill sites as well as production installations shall conform to the norm for discharge of gaseous emission notified under The Environment (Protection) Rules, 1986, (Schedule-I, Sl. Nos. 95 & 96).

For discharge of gaseous emission refer MOEF guidelines (**Annexure II-B**) and OMR, 1984 stipulations. Guidelines for stack emission as issued by SPCB, if any shall also be adhered to.

### 6.3 Noise control

Ambient noise levels of engines, machinery and processes shall be maintained as per The Noise Pollution (Regulation and Control) Rules, 2000 and The Environment (Protection) Rules, 1986 (Schedule-I, Sl. No. 94).

Exposure of personnel to noise levels in the operational areas shall be controlled, in line with OMR, 1984 and OISD –STD-166.

### 6.4 Hazardous substance management:

Hazardous materials shall be stored, labeled, and disposed as per applicable regulatory requirements as per Section 4.0.

Hazardous waste materials should not be mixed with non-hazardous wastes. If so, the entire mixture should be considered hazardous and should meet hazardous waste disposal requirements.


Personnel handling or using hazardous substances should be aware of associated hazards, safe handling and use of required personnel protection measures. The material safety data sheets (MSDSs) should be available to the personnel at the workplace.

Used batteries should be sent for recycling or disposal in accordance with the laid down procedure as per The Batteries (Management and Handling) Rules, 2001.

### 6.5 Effluent management:

Formation water, oil, drilling fluid, waste, chemical substances or refuse from a well or facility should not be permitted:

- to create hazard to public health and safety

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- to run into or contaminate any fresh water structure or body of water or to remain in a place from which it might contaminate any fresh water or body of water; and
- to run over or damage any land, highway or public road

Oil and gas drilling and processing facilities, situated on land and away from saline water sink, may opt either for disposal of treated water by on-shore disposal or by injection in a well below a depth of 1000 meters from the ground level. For on-shore disposal, the permissible limits as per MOEF are given at **Annexure II**. In case of injection in a well the effluent has to comply with parameters with respect to suspended solids and oil/grease; limits being 100 mg/l and 10 mg/l respectively.

The effluent should be treated to meet the prescribed standards to protect the recipient environment by adopting appropriate treatment technology suitable for the nature of influent.

Effluent streams should be monitored as follows:

- Produced water streams should be metered and sampled downstream of the water treatment plant;
- Sampling points should be installed easily accessible at locations; upstream and downstream of the treatment units, and in the effluent lines, as well as between treatment stages;
- Access for sampling and visual control of holding tanks for drainage water should be provided.


Online monitoring should be considered for ensuring efficient effluent treatment and control.

## 6.6 Drilling fluid

Drilling fluid selection should be made following an environmental risk evaluation combined with operational and technical requirements. Refer MOEF guidelines given at **Annexure III**.

## 6.7 Storage Tanks / Vessels

Atmospheric storage or surge tanks should preferably be equipped with high-liquid-level sensors and alarms to prevent spills. Pressure vessels should have high level sensors and safety release system. A preventive maintenance system

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shall be established and followed in line with OISD-STD-129 and OISD-STD-130.

Breather valve / open vent for atmospheric storage fixed roof, and rim vent and bleeder vents for floating roof tanks should be ensured for proper functioning.

Dykes should be constructed and maintained around tanks used for storing hazardous materials like hydrocarbons etc. Dyke construction shall be in line with OISD-STD-118.

## **6.8 Spill containment**

Spill containment system should be implemented at all the installations. To control oil spill in marine environment, tier-1 level (as per NOS-DCP; refer Section 4.0) oil spill response facilities should be provided.

## **6.9 Well control systems and equipment**

Producing Wells - Type of surface and subsurface shut-in valves and devices used in the wells should be documented as to the method of operation & control, and known to all concerned.

Drilling and Workover Operations - For drilling or workover operations, a blowout preventer assembly and well control system shall be installed which is capable of controlling maximum wellhead pressure anticipated. Blowout preventer installations should be in accordance with OISD-RP-174.

The degree of redundancy introduced in well control systems design should be based on level of hazardous exposure anticipated and probable consequences of failure.


## **6.10 Safety equipment**

All safety equipment should be periodically inspected, tested, calibrated and maintained as per norms & guidelines, and records maintained thereof.

## **6.11 Interface with contractors**

Written instructions should be prepared by the owner / operator to be followed by the contractors and subcontractors during contract activities. Such instructions and procedures should be maintained at the facility. During operations, contractor activities may require supervision by an authorized representative of the owner or operator. The owner / operator should document the operations, wherein supervision by his representative would be required.

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## 6.12 Communication

Efficient means of communication should be provided, and maintained in good working order, between manned installations and base support / company management.

## 6.13 Flowlines / Pipelines

Route selection for flowlines / pipelines should address the related issues like topography, right of way maintenance, possible land erosion, emergency response and containment of releases, location of existing roads and likelihood of excavation & construction work near ROW in future.

All pipelines connected to the facility should be protected against corrosion. Methods of providing such protection should be documented.

Pipelines should be tested hydraulically before they are put into operation.

Pressure tests, profile surveys, and other health checks should be carried out to meet operating safety requirements.


All headers should be equipped with check valves on individual flowlines.

If the shut-in wellhead pressure can exceed the working pressure of the flowline from the well and/or header valves associated with that individual flowline, the flowline should be equipped with a pressure sensing device and shut-in valve actuation at the wellhead, unless a pressure relief system is provided.

## 6.14 Drainage system

The facilities should be provided with drainage systems (preferably closed) capable of collecting and draining off oil and chemicals so that the risk of pollution is minimized.

Drainage tanks / sumps should be designed with sufficient capacity for foreseeable operating conditions. Systems to prevent overfilling should be installed.

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## OFF-SHORE INSTALLATIONS:

Following are the additional recommendations for offshore activities:

### 6.15 Offshore Pipelines

Submarine pipelines associated with the facility should be adequately protected against sea stresses and other activities such as fishing operations, marine navigation etc.

### 6.16 Sump Systems

The sumps provided as overflow and spill collection equipment should be designed to allow protection against accidental spillages. Alternate means should be provided for removing the liquid in the sumps in case the primary sump pump becomes inoperative. The pump should be interlocked with high / low level of sump tanks for auto operations and be checked periodically.

### 6.17 Effluent disposal

Effluent treatment shall be maintained in a manner to ensure the oil content of the treated effluent without dilution shall not exceed 40mg/l for 95% of the observation and shall never exceed 100 mg/l. (refer **Annexure II**).


### 6.18 Sanitary waste and food waste handling

Sanitary waste should be treated in sewage treatment plant, before dumping into sea. Food waste should be segregated into biodegradable and non-biodegradable categories. The former can be dumped into sea and the latter is to be incinerated / sent to base.

## 7.0 Geophysical Surveys

Following recommended practices should be adhered to:

- I. Any natural system like grasslands, mangroves, and water body etc. around the area of activities of geophysical survey should be protected from contamination by any effluent and waste generated during operational activities.

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- II. Wildlife, habitats and biosphere reserves should be protected from the geophysical survey activities.
- III. Adequate precautions should be taken to prevent impact on public, properties and ecosystems while shots are being fired in the vicinity of public places, human settlement, riverine system and wildlife.
- IV. Adequate warning to be given to public by signals like putting up red flags in the danger zone. It should be ensured that humans are out of the danger zone. Sufficient noise should be created to drive away wild animals, from the danger zone. Soft starting procedure should be considered for shooting operation in water bodies for safe guarding aquatic animals.
- V. Electrical fittings and utilities should be secured in the manner so as not to pose any danger of electrocution to the wild animals.
- VI. Storage and handling of explosives including disposal of discarded and faulty explosives shall be done in accordance with The Explosive Rules, 1983.
- VII. Sanitation systems should be installed to prevent raw sewage from reaching surface or sub-surface water. Portable chemical toilets or other suitable means may be provided and maintained in clean sanitary condition for use by personnel.

## 8.0 DRILLING


Environment clearance as per guidelines of S.O. 1533 of 14<sup>th</sup> Sep 2006 shall be obtained from MOEF before commencing drilling operations.

### 8.1 Selection and preparation of drill site and approach road

- I. The drill site and rights of way (approach road) should be selected to minimise environmental impacts.

Following criteria should be considered during site assessment, selection and construction:

- a. The well site should be located to minimise impact on buildings, roads, reserve forest areas and public access areas, taking into consideration the gases and liquids which are expected to be encountered during drilling.

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- b. Site restoration requirements should be considered as part of the initial site assessment.
  - c. Plans to stockpile top soil for site reclamation should be made and implemented.
  - d. Protection of surface waters (ponds, creeks, wetlands etc.) should be considered.
  - e. Anticipated flow of rain water should be diverted from the location by contour, grading, or trenching. A control plan for water overflow from waste pit should be prepared.
- II. Sanitation systems should be installed to prevent raw sewage from reaching surface or sub-surface water. Portable chemical toilets or other suitable means should be provided and maintained in clean sanitary condition for use by personnel at the drilling site.
  - III. Areas for storage of fuel, lubricants, chemicals, solid waste, produced oil, and waste oil should be demarcated.
  - IV. Efforts should be made to provide system for recycle and reuse of effluent water, after treatment.
  - V. Reserve / waste pits should be lined with impervious lining.
  - VI. Disposal of cuttings is part of activities related to restoration of site. Refer MOEF guidelines given at **Annexure III**, for disposal of cuttings.

## 8.2 Rig movement and rig building

- I. Before moving equipment to the location, all the machinery should be inspected and plugged, drained or otherwise secured to ensure that fluids do not leak during transport.
- II. Emissions from all vehicles and internal combustion engines shall comply with the requirements of Motor Vehicle Act and CPCB respectively.
- III. Once equipment is placed and assembled, drilling site should be inspected to ensure that:
  - All drilling fluid lines and tanks have been checked for leaks and required corrective actions taken.
  - Any fuel or oil leaks have been corrected.
  - Drains, waste pit and bunds are as per plan.

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### 8.3 Drilling operations

- I. Surface casing depth shall be in accordance with stipulations of SPCB to protect quality of ground water.
- II. Drilling fluid and drill cuttings handling system should be designed to prevent spills.
- III. The solid control equipment should function efficiently so that maximum undesired solids and minimum liquids are removed from the drilling fluids.
- IV. Efficient use of water should be ensured.
- V. Leakage of drilling fluids should be avoided by resorting to the use of mud saving devices such as pipe wipers, kelly mud saver, drip pans etc.
- VI. Environmentally safe pipe lubricants should be considered for use. Lubricants containing lead should be avoided.
- VII. All well site equipment should be manufactured from materials which are suitable for the environment in which they are to be operated. Compatibility of the materials of different components should be ensured.
- VIII. Emission of toxic gases like H<sub>2</sub>S should be minimized by taking appropriate design measures for early detection (like H<sub>2</sub>S detectors), control and proper operational practices. Personnel should be trained to handle emergencies. For detail guidelines refer **annexure IV**.
- IX. For safe conduct of logging operations, OISD-STD-183 on 'well logging operations' shall be referred.
- X. During logging operations, in case of loss of radioactive source in the wellbore, frequent checks for radioactive contamination of the surroundings should be made during fishing operations. AERB guidelines shall be followed for mitigation. If the radioactive source is not possible to be retrieved, and has to be left in the well, proper abandonment procedure shall be followed as per guidelines of AERB.
- XI. During cementation operations, discharge of dry cement and cement slurry to open environment should be minimized and meet the stipulated requirements, if any.
- XII. When perforation is being done through the tubing (mostly underbalance) wireline blowout preventor installed, shall be fully operational and tested prior to perforation. In case of casing gun perforation (overbalance perforating) a double

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ram (i.e. a set of blind and pipe rams) blowout preventer shall be installed and tested to the maximum anticipated surface pressure.

- XIII. Storage and handling of explosives including disposal of discarded and faulty explosives shall be done in accordance with The Explosive Rules, 1983.
- XIV. A plan to safely handle, treat and dispose off the spent acids, chemicals, additives, well fluids and solids should be finalised before carrying out stimulation jobs.
- XV. Well fluid during well testing should preferably be routed to production facilities. Alternately appropriate fluid storage should be provided for oil and produced water at site. Fluid should be removed from this storage at the earliest.
- XVI. No disposal pits shall be constructed within 45 metres of any railway, public road or of any public works or of other permanent structure not belonging to the owner.
- XVII. Flares should be installed downwind from the rig and associated equipment & facilities, and at a safe distance. Surrounding environment should be considered to protect vegetation, wildlife and live stock. MOEF guidelines for discharge of gaseous emission shall be referred, **Annexure II**.
- XVIII. Well should be tested at a rate not above the capacity of gas/oil separator.
- XIX. Cold Venting of gases shall never be resorted to and all the gaseous emissions shall be flared.
- XX. All the left over chemicals and other materials should be properly refilled / repacked and transported to the next location.
- XXI. For offshore drilling operations, drilling fluid and drill cuttings handling system should be designed to minimise risk of spills.

#### **8.4 Well site restoration**

- I. Plugging and abandonment of sub-surface zones shall be carried out as per OMR / OISD-STD-175 requirements.
- II. All chemical drums / sacks should be properly labeled as to the contents including any safety or transportation warning labels for transporting to the desired locations.
- III. Contaminated soil (if any) due to operations at the site should be remediated and records should be maintained.

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- IV. Empty drums shall be returned to the vendor or disposed off as per MOEF guidelines.
- V. Trash and debris should be removed from the drill site and properly disposed off.
- VI. The site shall be restored complying with the applicable requirements as per **Annexure III**.
- VII. On completion of site restoration, system for soil sampling, visual inspection and recordkeeping should be established. Long-term maintenance and tree plantation should be included and performed as necessary to complete the site restoration.

## 9.0 PRODUCTION

Environment clearance shall be taken as per guidelines of S.O. 1533 of 14<sup>th</sup> Sep 2006 from MOEF.

### 9.1 Design and construction of facilities

- I. The site should be away from:
  - a. water bodies.
  - b. monumental structures.
  - c. notified restricted areas.
  - d. human settlement / populated areas.
  - e. horticulture farm.
- II. The equipment and facilities should be located and designed to minimise the waste generation during operations and maintenance activities.
- III. Material of well equipment should be compatible with the well fluids / completion fluids. Compatibility of the materials of different components should be ensured.
- IV. Selection of valves, flanges and packings should aim to reduce gas leakages and fugitive emissions to atmosphere.
- V. Piping for all the relief valves should be adequately sized and routed to flare.
- VI. All wells should be equipped for pressure measurement of each annulus and integrity of each annulus to be ensured. Sustained casing pressure management policy to be formulated.

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- VII. Proper drainage system should be planned. Separate drainage system for effluent water & storm water should be constructed at the facility.
- VIII. Spill control & containment should be considered at the design & construction stage itself.
- IX. The effluent treatment systems should be designed and optimized to maintain the treatment efficiency regarding natural solutes, added chemicals and dispersed oil during load variations (e.g. high flow, low flow, during separator jetting).

The following measures should be considered to optimize the treatment process:

- minimize pressure drop and turbulence that create stable oil / water emulsions;
- use of treatment systems that reduce the content of oil, polycyclic aromatic hydrocarbons, and other components contributing to the environmental risk (For MOEF standards refer **Annexure-II**). Such systems may include different combinations of some of the techniques listed below:
  - ⇒ electrostatic oil / water separation;
  - ⇒ emulsion breaking and foam control;
  - ⇒ flocculation;
  - ⇒ hydrocyclones;
  - ⇒ stripping;
  - ⇒ extraction;
  - ⇒ filtration.
- X. The need for back-up systems for critical components in treatment / injection systems should be considered in order to maintain continuous operation during maintenance activities and keep discharges within limits.
- XI. Facilities should be fenced to prevent access by general public, livestock and wildlife.
- XII. Dust suppression system, if required, to be provided.
- XIII. Unused and excess construction materials should be removed from the site on completion of the construction work.

## 9.2 Operations

- I. Standard operating procedure manual covering safe operations, start-up, shutdown, & emergency procedures should be available and personnel trained accordingly.


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- II. MSDSs should be maintained at site for safe handling of hazardous materials and use of specified PPE.
- III. Waste management plan should address disposal of the specific wastes generated during normal operations and emergencies. Waste disposal shall be done in accordance with applicable regulatory requirements.
- IV. Equipment should be installed, operated and inspected according to OEM recommendations / industry standards.
- V. Necessary preventive measures should be taken at the wells, to avoid pilferage.
- VI. During crude transport by tanker and pipelines, adequate precautions should be taken to prevent spillage.
- VII. The facilities should be kept clean.
- VIII. An effective well monitoring programme for inactive wells should be implemented so that fluid migration into fresh water zones, surface soils, or surface waters is prevented. Fluid migration potentials for inactive wells can be evaluated based upon the presence of pressured formations, and upon the well construction and its mechanical integrity. A risk-based approach is recommended for determining if an inactive well poses a threat to fresh water zones, surface soils, or surface waters.
- IX. Well cellar pit should be kept empty, dry, clean and fenced to prevent accidental falling of human and animals.

### **9.2.1 Spill management**

- I. Spill Prevention Control & Counter Measure (SPCC) plan to be made.
- II. Spill potential to be determined.
- III. Contingency & shutdown plans to be made to cope up with disasters.
- IV. Spill control & containment equipment to be kept in readiness.
- V. Cleanup procedure should be developed & included in the emergency response and management plan.
- VI. Periodic mock drills shall be carried out in line with MSIHC rules. Prevention, control, containment and cleanup procedures should be revised & updated to make them more effective for future response.

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VII. Training for spill control should be imparted to operating personnel.


### **9.3 Well operations (completion, stimulation and workover operations)**

- I. Use of dual pack stuffing boxes / leak sensor and shut down devices should be considered for critical areas.
- II. Equipment should be installed, operated and inspected according to OEM recommendations / industry standards.
- III. Chemical storage containers must be of robust construction and material of construction should be compatible with the chemical stored.
- IV. Provision should be made to keep adequate and ready-to-use stock of such chemicals that may be required to nullify adverse effects caused by any accidental release / spill of hazardous chemicals.
- V. Properties of reaction products should be determined to ascertain the potential of their hazardous impact, prior to execution of the job involving such chemical reactions.
- VI. Waste management plan for handling waste materials generated during completion, stimulation and workover operations should be available.
- VII. Hazardous material should be segregated to prevent contamination of non hazardous materials.
- VIII. All blowout prevention equipment shall be selected, installed and properly maintained in line with recommended practices for well control, OISD-RP-174, to prevent uncontrolled releases of well fluid to the atmosphere.
- IX. Transportation, storage, handling and disposal of completion fluid should be done as per written down procedures.
- X. Well fluid during well testing should preferably be routed to production facilities. Alternately appropriate fluid storage should be provided for oil and produced water at site. Fluid should be removed from this storage at the earliest.

### **9.4 Flaring**

- I. The process system should be designed to minimize flaring. This should include, but not be limited to, consideration of the following measures:

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- Recycling of gas from high pressure relief systems during normal operations.
- Recycling of gas from low pressure relief systems during normal operations.
- Process design that minimizes risk of tripping of compressors etc.
- Control and condition monitoring systems to reduce the number of compressor trips.
- Proper planning of start-up activities to minimise flaring.

II. Cold Venting of gases shall never be resorted to and all the gaseous emissions shall be flared.

## 9.5 Laboratories

Recommended practices for laboratories as per OISD-GDN-211 should be followed.


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## 10.0 References:

1. API 49: Recommended Practice for Drilling and Well Servicing Operations involving Hydrogen Sulfide.
2. API 51: Onshore Oil and Gas Production Practices for Protection of the Environment.
3. API 52: Land Drilling Practices for Protection of the Environment.
4. IADC: Suggested Procedures for Development of Spill Prevention Control and Countermeasure Plans.
5. ISO 14001: 2004: Environmental Management Systems.
6. NORSOK Standard S-003: Environmental Care.

## Abbreviations

AERB-	Atomic Energy Regulatory Board, India
CPCB -	Central Pollution Control Board, Delhi
EIA-	Environment Impact Assessment
MOEF-	Ministry of Environment and Forests, Govt. of India.
MSDS-	Material Safety Data Sheet
OMR-	Oil Mines Regulations, 1984
RSPM-	Respirable Suspended Particulate Matter
SPCB-	State Pollution Control Board
SPM-	Suspended Particulate Matter
VOC-	Volatile Organic Compounds

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## ANNEXURE - I

### **Extract from The Environment (Protection) Act, 1986 on “Responsibilities and Penalties”.**

(Refer page- 258, PCLS/02/2006-Green Book; Published by CPCB, January, 2006, Notification No. G.S.R. 1198(E) dated 12-11-1986 published in the Gazette of India No. 525 dated 12-11-1986)

### **Chapter III - PREVENTION, CONTROL, AND ABATEMENT OF ENVIRONMENTAL POLLUTION**

#### **7. PERSONS CARRYING ON INDUSTRY OPERATION, ETC., NOT TO ALLOW EMISSION OR DISCHARGE OF ENVIRONMENTAL POLLUTANTS IN EXCESS OF THE STANDARDS**

No person carrying on any industry, operation or process shall discharge or emit or permit to be discharged or emitted any environmental pollutants in excess of such standards as may be prescribed.<sup>9</sup>

#### **8. PERSONS HANDLING HAZARDOUS SUBSTANCES TO COMPLY WITH PROCEDURAL SAFEGUARDS**

No person shall handle or cause to be handled any hazardous substance except in accordance with such procedure and after complying with such safeguards as may be prescribed.<sup>10</sup>

#### **9. FURNISHING OF INFORMATION TO AUTHORITIES AND AGENCIES IN CERTAIN CASES**

(1) Where the discharge of any environmental pollutant in excess of the prescribed standards occurs or is apprehended to occur due to any accident or other unforeseen act or event, the person responsible for such discharge and the person in charge of the place at which such discharge occurs or is apprehended to occur shall be bound to prevent or mitigate the environmental pollution caused as a result of such discharge and shall also forthwith--


(a) intimate the fact of such occurrence or apprehension of such occurrence; and

(b) be bound, if called upon, to render all assistance, to such authorities or agencies as may be prescribed.<sup>11</sup>

(2) On receipt of information with respect to the fact or apprehension on any occurrence of the nature referred to in sub-section (1), whether through intimation under that sub-section or otherwise, the authorities or agencies referred to in sub-section (1) shall, as

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early as practicable, cause such remedial measures to be taken as necessary to prevent or mitigate the environmental pollution.

(3) The expenses, if any, incurred by any authority or agency with respect to the remedial measures referred to in sub-section (2), together with interest (at such reasonable rate as the Government may, by order, fix) from the date when a demand for the expenses is made until it is paid, may be recovered by such authority or agency from the person concerned as arrears of land revenue or of public demand.

## **15. PENALTY FOR CONTRAVENTION OF THE PROVISIONS OF THE ACT AND THE RULES, ORDERS AND DIRECTIONS**

(1) Whoever fails to comply with or contravenes any of the provisions of this Act, or the rules made or orders or directions issued thereunder, shall, in respect of each such failure or contravention, be punishable with imprisonment for a term which may extend to five years with fine which may extend to one lakh rupees, or with both, and in case the failure or contravention continues, with additional fine which may extend to five thousand rupees for every day during which such failure or contravention continues after the conviction for the first such failure or contravention.

(2) If the failure or contravention referred to in sub-section (1) continues beyond a period of one year after the date of conviction, the offender shall be punishable with imprisonment for a term which may extend to seven years.


## **16. OFFENCES BY COMPANIES**

(1) Where any offence under this Act has been committed by a company, every person who, at the time the offence was committed, was directly in charge of, and was responsible to, the company for the conduct of the business of the company, as well as the company, shall be deemed to be guilty of the offence and shall be liable to be proceeded against and punished accordingly:

Provided that nothing contained in this sub-section shall render any such person liable to any punishment provided in this Act, if he proves that the offence was committed without his knowledge or that he exercised all due diligence to prevent the commission of such offence.

(2) Notwithstanding anything contained in sub-section (1), where an offence under this Act has been committed by a company and it is proved that the offence has been committed with the consent or connivance of, or is attributable to any neglect on the part of, any director, manager, secretary or other officer of the company, such director, manager, secretary or other officer shall also deemed to be guilty of that offence and shall be liable to be proceeded against and punished accordingly.

*Explanation--*For the purpose of this section,--

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(a) "company" means any body corporate and includes a firm or other association of individuals;


(b) "director", in relation to a firm, means a partner in the firm.

## **17. OFFENCES BY GOVERNMENT DEPARTMENTS**

(1) Where an offence under this Act has been committed by any Department of Government, the Head of the Department shall be deemed to be guilty of the offence and shall be liable to be proceeded against and punished accordingly.

Provided that nothing contained in this section shall render such Head of the Department liable to any punishment if he proves that the offence was committed without his knowledge or that he exercise all due diligence to prevent the commission of such offence.

(2) Notwithstanding anything contained in sub-section (1), where an offence under this Act has been committed by a Department of Government and it is proved that the offence has been committed with the consent or connivance of, or is attributable to any neglect on the part of, any officer, other than the Head of the Department, such officer shall also be deemed to be guilty of that offence and shall be liable to be proceeded against and punished accordingly.

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## ANNEXURE - II

### Oil Drilling and Gas Extraction Industry - Standards specified under Schedule –I, in The Environment (Protection Rules), 1986

(Refer Sl. No. 72, page-392, PCLS/02/2006-Green Book; Published by CPCB, January, 2006, Notification No. S.O. 32(E), dated 16.2.1987 and G.S.R. 546(E), dated 30.8.2005)

#### A. Standards for liquid effluent

##### 1.0 Onshore facilities (for Marine disposal)


Parameters	Limit
pH	5.5 – 9.0
Oil & Grease	10 mg/l
Suspended solids	100 mg/l
BOD (3days at 27 <sup>0</sup> C)	30 mg/l

#### Note:

- i. For on-shore discharge of effluents, in addition to the standards prescribed above, proper marine outfall has to be provided to achieve the individual pollutant concentration level in sea water below their toxicity limits as given below, within a distance of 50 metre from the discharge point, in order to protect the marine aquatic life:

Parameters	Toxicity limit, mg/l
Chromium as Cr	0.1
Copper, as Cu	0.05
Cyanide, as CN	0.005
Fluoride, as F	1.5
Lead, as Pb	0.05
Mercury, as Hg	0.01
Nickel, as Ni	0.1
Zinc, as Zn	0.1


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- ii. Oil and gas drilling and processing facilities, situated on land and away from saline water sink, may opt either for disposal of treated water by onshore disposal or by re-injection in abandoned Well, which is allowed only below a depth of 1000 metres from the ground level. In case of re-injection in abandoned well the effluent have to comply only with respect to suspended solids and oil and grease 100 mg/l and 10 mg/l, respectively. For onshore disposal, the permissible limits are given below.

S.No.	Parameters	On-shore discharge standards (Not to exceed)
1.	pH	5.5 – 9.0
2.	Temperature	40 <sup>0</sup> 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 & 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

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20.	Mercury	0.01 mg/l
21.	Nickel	3.0 mg/l

## 2.0 Off-shore facilities

For off-shore discharge of effluents, the oil content of the treated effluent without dilution shall not exceed 40 mg/l for 95% of the observation and shall never exceed 100 mg/l. Three 8 hourly grab samples are required to be collected daily and the average value of oil and grease content of the three samples shall comply with these standards.

### B. Guidelines for Discharge of Gaseous Emission

1.0 DG Sets: DG Sets at drill site as well as production station shall conform with the norm notified under the Environment (Protection) Act, 1986.

#### 2.0 Elevated / ground flares

(2.1) Cold Venting of gases shall never be resorted to and all the gaseous emissions are to be flared.

(2.2) All flaring shall be done by elevated flares except where there is any effect on crop production in adjoining areas due to the flaring. In such cases, one may adopt ground flaring.

(2.3) In case of ground flare, to minimize the effects of flaring, the flare pit at Group Gathering Station (GGS) /Oil Collecting Station (OCS) and Group Collection Station (GCS) shall be made of RCC surrounded by a permanent wall (made of refractory brick) of minimum 5 m height, to reduce the radiation and glaring effects in the adjoining areas.


(2.4) A green belt of 100 m width may be developed around the flare after the refractory wall in case of ground flaring.

(2.5) If the ground flaring with provision of green belt is not feasible, enclosed ground flare system shall be adopted, and be designed with proper enclosure height, to meet the ground level concentration (GLC) requirement.

(2.6) In case of elevated flaring, the minimum stack height shall be 30 m. Height of the stack shall be such that the max. GLC never exceeds the prescribed ambient air quality limit

3.0 Burning of effluent in the pits shall not be carried out at any stage.

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### ANNEXURE-III

## Guidelines for Disposal of Solid Waste, Drill Cutting and Drilling Fluids for Offshore and Onshore Drilling Operation

(Refer C. of Sl. No. 72, page-395, PCLS/02/2006-Green Book; Published by CPCB, January, 2006)

### 1. Disposal of Drill Cutting and Drilling Fluids for On-shore Installations:

(a) Drill Cuttings (DC) originating from on-shore or locations close to shore line and separated from Water Base Mud (WBM) should be properly washed and unusable drilling fluids (DF) such as WBM, Oil Base Mud (OBM), Synthetic Base Mud (SBM) should be disposed off in a well designed pit lined with impervious liner located off-site or on-site. The disposal pit should be provided additionally with leachate collection system.

Design aspects of the impervious waste disposal pit; capping of disposal pit should be informed by the oil industry to State Pollution Control Board (SPCB) at the time of obtaining consent.

(b) Use of diesel base mud is prohibited. Only WBM should be used for on-shore oil drilling operations.


(c) In case of any problem due to geological formation for drilling, low toxicity OBM having aromatic content < 1% should be used. If the operators intend to use such OBM to mitigate specific whole problem/ SBM it should be intimated to Ministry of Environment and Forests/State Pollution Control Board.

(d) The chemical additives used for the preparation of DF should have low toxicity i.e. 96 hr LC<sub>50</sub> > 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.

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

(f) The waste pit after it is filled up shall be covered with impervious liner, over which, a thick layer of native soil with proper top slope is provided.

(g) Low toxicity OBM should be made available at installation during drilling operation.

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(h) Drilling wastewater including DC wash water should be collected in the disposal pit evaporated or treated and should comply with the notified standards for on-shore disposal.

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

(j) Total material acquired for preparation of drill site must be restored after completion of drilling operation leaving no waste material at site. SPCB should be informed about the restoration work.

(k) In case, environmentally acceptable methods for disposal of drill waste such as (a) injection to a formation through casing annulars, if conditions allow (b) land farming at suitable location (c) bio-remediation (d) incineration or (e) solidification can be considered, in such cases oil industry is required to submit proposal to Ministry of Environment and Forests/State Pollution Control Board (MoEF/SPCB) for approval.

## **2. Disposal of Drill Cutting and Drilling Fluids for Off-shore Installations:**

(a) Use of diesel base mud is prohibited. Only WBM is permitted for offshore drilling. If the operator intend to use low toxicity OBM or SBM to mitigate specific hole problems in the formation, it should be intimated to MoEF/SPCB. The low toxicity OBM should have aromatic content < 1%.


(b) The toxicity of chemical additives used in the DF (WBM or OBM or SBM) should be biodegradable (mainly organic constituents) and should have toxicity of 96 hr LC50 Value > 30,000 mg /l as per mysid toxicity or toxicity test conducted on locally available sensitive sea species.

(c) Hexavalent chromium compound should not be used in DF. Alternative chemical in place of chrome lignosulfonate should be used in DF. In case, chrome compound is used, the DF/ DC should not be disposed offshore.

(d) Bulk discharge of DF in offshore is prohibited except in emergency situations.

(e) WBM/OBM /SBM should be recycled to a maximum extent. Unusable portion of OBM should not be discharged into sea and shall be brought to on-shore for treatment & disposal in an impervious waste disposal pit.

(f) Thoroughly washed DC separated from WBM/SBM & unusable portion of WBM/SBM having toxicity of 96 hr LC50 > 30,000 mg/l shall be discharged off-shore into sea intermittently, at an average rate of 50 bbl/hr/well from a platform so as to have proper dilution & dispersion without any adverse impact on marine environment.

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(g) Drill cutting of any composition should not be discharged in sensitive areas notified by the Ministry of Environment and Forests.

(h) In case of specific hole problem, use of OBM will be restricted with zero discharge of DC. Zero discharge would include re-injection of the DC into a suitable formation or to bring to shore for proper disposal. In such a case, use of OBM for re-injection should be recorded and made available to the regulatory agency. Such low toxic OBM having aromatic content < 1% should be made available at the installation.

(i) In case, DC is associated with high oil content from hydrocarbon bearing formation, then disposal of DC should not have oil content > 10 gm/kg.

(j) The DC wash water should be treated to confirm limits notified under EPA, before disposal into Sea. The treated effluent should be monitored regularly.


(k) Discharge of DC from the installation located within 5 km away from shore should ensure that there is no adverse impact on marine Eco-system and on the shore. If, adverse impact is observed, then the industries have to bring the DC on-shore for disposal in an impervious waste disposal pit.

(l) If any, environmental friendly technology emerges for substitution of DF and disposal technology, it may be brought to the notice of MoEF and regulatory agencies. If the operator desires to adopt such environment friendly technology a prior approval from Ministry of Environment and Forests is required.

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

(n) Oil drilling operators are required to record daily discharge of DC & DF to offshore and also to monitor daily the effluent quality, and submit the compliance report once in every six-month to Ministry of Environment and Forests."



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## ANNEXURE-IV

### Guidelines for Hydrogen Sulfide (H<sub>2</sub>S) safety

For H<sub>2</sub>S environment, equipment and materials should be selected on the basis of resistance to sulfide stress cracking and corrosion. Refer to NACE MR0175 / ISO 15156 for recommendations for selection of equipment and materials.

**All personnel (including contractors' and visitors) should be alerted of the possibility of H<sub>2</sub>S atmospheric concentrations greater than 10 ppm, which may be encountered in the performance of their work.**


Prior to entering a potentially hazardous area, visitors and other non-essential personnel should be briefed on escape route(s), emergency assembly area(s), applicable warning signals, and how to respond in the event of an emergency, including use of personal protective equipment, if required.

Personnel protection should be provided if the work area concentration of H<sub>2</sub>S exceeds 10 ppm 8-hour time weighted average (TWA) or 15 ppm as a Short Term Exposure Level (STEL) averaged over 15 minutes.

In addition to providing personal protective equipment, personnel should be trained in the selection, use, cleaning, inspection, and maintenance of the PPE.

Breathing (respiratory protection) equipment:

- a. Respirators should be selected on the basis of the hazards to which workers are exposed.
- b. The user shall be instructed and trained in the proper use of respirators and their limitations.
- c. Respirators should be stored in a convenient, clean, and sanitary location.
- d. Respirators should be cleaned and disinfected after each use.
- e. Respirators should be inspected during cleaning. Worn or deteriorated parts should be replaced. Respirators for emergency use should be thoroughly inspected at least once a month and after each use.
- f. Persons should not be assigned to tasks requiring the use of self-contained breathing apparatus (SCBA) unless it has been determined that they are physically able to perform the work while using SCBA.
- g. Equipment needing repair shall be appropriately tagged and removed from equipment stock until it is suitably repaired or replaced

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All personnel working in an area where concentrations of hydrogen sulfide may exceed the threshold levels should be provided with training prior to beginning the work assignment.

The following elements are considered a minimum level of training for personnel assigned to the operations, in H<sub>2</sub>S environment:


- a. The hazards, characteristics, and properties of hydrogen sulfide and sulfur dioxide.
- b. Sources of H<sub>2</sub>S.
- c. Proper use of H<sub>2</sub>S detection methods used at the workplace.
- d. Recognition of, and proper response to, the warning signals initiated by H<sub>2</sub>S detection systems in use at the workplace.
- e. Symptoms of H<sub>2</sub>S exposure.
- f. Rescue techniques and first aid to victims of H<sub>2</sub>S exposure.
- g. Proper use and maintenance of breathing equipment for working in H<sub>2</sub>S atmosphere.
- h. Work place practices and relevant maintenance procedures that have been established to protect personnel from the hazards of H<sub>2</sub>S
- i. Wind direction awareness and escape routes.
- k. Emergency response procedures that have been developed for the facility or operations.
- l. Locations and use of safety equipment.
- m. Locations of safe briefing areas.

If the atmospheric concentration could exceed threshold levels for H<sub>2</sub>S, detection instruments shall be available on location. An adequate number of fixed or portable or both type detectors should be provided for the safety of working personnel. In workplace where H<sub>2</sub>S is present or likely to be present, the working personnel should carry portable personal H<sub>2</sub>S detector. Manufacturers' recommendations should be followed for the installation, maintenance, calibration and repair of detection equipment. Monitoring equipment should be serviced, calibrated, and tested as recommended by the equipment manufacturer. Inspections, calibrations, and tests should be documented.

Fixed H<sub>2</sub>S atmospheric monitoring systems should include visual and audible alarm(s), located where the alarm can be seen or heard throughout the work area. Visual low level alarms shall be set to activate at 10 ppm. High level alarms shall be set no higher than 300 ppm. The high level alarm shall activate an audible evacuation alarm. For single-set point monitors, the alarm shall be set at 10 ppm. The equipment alarms should be functionally tested at least once daily.

Site specific H<sub>2</sub>S emergency response plan should be prepared. The contingency plan (concise instructions to be followed by designated personnel any time they receive notice of a potentially hazardous H<sub>2</sub>S discharge) should contain an immediate action plan for the protection of personnel (including the general public) and abatement of the discharge.

*"OISD hereby expressly disclaims any liability or responsibility for loss or damage resulting from the use of OISD Standards/Guidelines."*

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This Immediate Action Plan should include the following provisions:

- a. Alert
  - b. Don proper personal breathing equipment.
  - c. Alert other affected personnel.
  - d. Proceed to the designated safe briefing area.
  - e. Account for onsite personnel.
- B) Take immediate measures to control present or potential H<sub>2</sub>S discharge. Emergency shutdown procedures should be initiated as deemed necessary to correct or control the specific situation. When the required action cannot be accomplished in time to prevent exposing operating personnel or the public to hazardous concentrations of H<sub>2</sub>S, proceed to the following steps, as appropriate for the site specific conditions:
- a. Alert the public (directly or through appropriate government agencies), who may be subjected to potentially harmful exposure levels.
  - b. Initiate evacuation operations.
  - c. Block unauthorized access to the unsafe area.
  - d. Monitor the ambient air in the area of exposure (after abatement measures are initiated) to determine when it is safe for re-entry.

Training and drills in emergency response procedures for oil and gas operations involving H<sub>2</sub>S should convey the importance of each role and the effect that each person's action(s) has on implementing an effective emergency response.