

## **6.0 ENVIRONMENTAL MONITORING PROGRAMME**

### **6.1 Introduction**

Regular monitoring of environmental parameters is of immense importance to assess the status of environment during project operation. With the knowledge of baseline conditions, the monitoring programme will serve as an indicator for any deterioration in environmental conditions due to operation of the project, to enable taking up suitable mitigatory steps in time to safeguard the environment. Monitoring is as important as that of control of pollution since the efficiency of control measures can only be determined by monitoring.

Usually, as in the case of the study, an Impact Assessment study is carried over short period of time and the data cannot bring out all variations induced by the natural or human activities. Therefore, regular monitoring programme of the environmental parameters is essential to take into account the changes in the environmental quality.

### **6.2 Environmental Monitoring and Reporting Procedure**

Development of the programmes during the planning process shall be conducted or supported by environmental specialists. However, the implementation responsibility rests with line managers, who should, therefore, ensure they fully understand and subscribe to the commitments being made. These commitments will include the legal and statutory controls imposed on the operation as well as other corporate commitment to responsible environment management.

The key aims of monitoring are: first to ensure that results/conditions are as forecast during the planning stage, and where they are not, to pinpoint the cause and implement action to remedy the situation. A second objective is to verify the evaluations made during the planning process, in particular in risk and impact assessments and standard and target setting and to measure operational and process efficiency. Monitoring will also be required to meet compliance with statutory and corporate requirements. Finally, monitoring results provide the basis for auditing. A more detailed approach to monitoring and performance measurement is provided in various publications.

#### **6.2.1 Objectives of Monitoring**

The objectives of monitoring are to:

- Verify effectiveness of planning decisions;
- Measure effectiveness of operational procedures;
- Confirm statutory and corporate compliance; and
- Identify unexpected changes.

#### **6.2.2 Monitoring Schedule**

Periodic environmental monitoring schedules are prepared covering various phases of project advancement. This comprises the duration of proposed exploratory drilling as well as post-project phase, when the hydrocarbon is established in the

wells and production program is undertaken as well as the Decommissioning / Closure Phase for minimum 10 years.

In order to assess the extent and nature of impacts on environment due to drilling operations, the monitoring on various attributes of environment will be carried out during various phases of drilling as under:

**Pre-Drilling Phase:** Prior to the start of drilling activities, the environmental status around the proposed drilling locations shall be monitored. These results will represent the baseline environment status, against which the monitoring results from the other phases are compared.

**Drilling Phase:** Monitoring during drilling phase serves as a measure of the impact on the environment due to drilling operations. Besides, the analysis of drill cuttings and drilling mud at various depths shall be carried out as per MoEF&CC guidelines on disposal of drilling wastes.

**Testing Phase:** Well testing is a short term activity spread over a period of 2 to 3 days. Testing operations are carried out to determine the presence of hydrocarbons and to understand the reservoir characteristics. Monitoring during this phase will serve as a measure of the impact on the environment due to testing operations.

**Post-Drilling Phase:** Monitoring shall be carried out after completion of drilling and testing operations to determine if there has been any residual impact on the environment due to drilling and testing operations.

The detailed monitoring program covering development drilling phase is given in **Table-6.1**.

**TABLE-6.1**  
**SCHEDULE OF ENVIRONMENTAL MONITORING**

Sr. No.	Aspect	Parameter	Frequency	No. of Locations
<b>I. Pre-drilling Phase</b>				
1	Ambient air quality	PM <sub>10</sub> , PM <sub>2.5</sub> , SO <sub>2</sub> , NO <sub>x</sub> , CO and Hydrocarbons as CH <sub>4</sub>	Two days in week	4 locations
2	Noise monitoring	Leq(n), Leq(d), Leq(dn)	Once	4 locations
3	Water quality	As per IS: 10500 including heavy metals	Once	Min 5 locations
4	Soil quality	Texture, conductivity, organic carbon, P <sub>2</sub> O <sub>5</sub> , K <sub>2</sub> O, pH, Cl, O & G, Heavy metals viz. Cr, Ni, Cu, Zn, Cd, Hg and Pb	Once	8 locations
<b>II. Drilling Phase</b>				
1	Ambient air quality	PM <sub>10</sub> , PM <sub>2.5</sub> , SO <sub>2</sub> , NO <sub>x</sub> , CO and Hydrocarbons as CH <sub>4</sub>	Two days in week for two weeks	4 locations
2	Noise monitoring	Leq (n), Leq(d), Leq(dn)	Once	4 locations
3	Source emissions monitoring	Flue gas temp., velocity, flow, dust conc., SO <sub>2</sub> , NO <sub>x</sub>	Once	4 samples



Sr. No.	Aspect	Parameter	Frequency	No. of Locations
<b>I. Pre-drilling Phase</b>				
4	Water quality	pH, TDS, Alkalinity, F, Sulphates, Cl, Cr, Ni, Cu, Zn, Cd, Pb	Once	Min. 5 locations
<b>III. Testing Phase</b>				
1	Ambient air quality	PM <sub>10</sub> , PM <sub>2.5</sub> , SO <sub>2</sub> , NO <sub>x</sub> , CO and Hydrocarbons as CH <sub>4</sub>	Two day in week for two weeks	4 locations
2	Noise monitoring	Leq(n), Leq(d), Leq(dn)	Once	4 locations
<b>IV. Post Drilling Phase</b>				
1	Ambient air quality	PM <sub>10</sub> , PM <sub>2.5</sub> , SO <sub>2</sub> , NO <sub>x</sub> , CO and Hydrocarbons as CH <sub>4</sub>	Two days in week	4 locations
2	Water quality	As per IS: 10500 including heavy metals	Once	Min. 5 locations
3	Soil quality	Texture, conductivity, organic carbon, P <sub>2</sub> O <sub>5</sub> , K <sub>2</sub> O, pH, Cl, O & G, Heavy metals viz. Cr, Ni, Cu, Zn, Cd, Hg and Pb.	Once	8 locations

### 6.3 Reporting Schedules of the Monitoring Data

It is proposed that voluntary reporting of environmental performance with reference to the EMP should be undertaken.

The environmental monitoring cell shall co-ordinate all monitoring programmes at site and data thus generated shall be regularly furnished to the State regulatory agencies.

The compliance reporting shall be on six monthly basis to the local State PCB officials and to Regional Office of MoEF. The Environmental Audit reports shall be prepared for the entire year of operations and shall be regularly submitted to regulatory authorities.

### 6.4 Infrastructure for Monitoring of Environmental Protection Measures

A well-equipped laboratory with consumable items shall be provided for monitoring of environmental parameters in the site. Alternatively, monitoring can be outsourced to a recognized reputed laboratory.

The following equipment and consumable items shall be made available in the site for environmental monitoring.

#### Air Quality and Meteorology

High volume samplers, Stack monitoring kit, Personal Dust sampler, Central Weather Monitoring Station, Spectrophotometer (visible range), Single pan balance, Flame photometer, Relevant Chemicals as per IS:5182.

### Water and Wastewater Quality

The sampling shall be done as per the standard procedures laid down by IS: 2488. The equipments and consumables required are:

BOD incubator, COD reflex set-up, Refrigerator, Oven, Stop watch, Thermometer, pH meter, Distilled water plant, Pipette box, Titration set, Dissolved oxygen analyser, Relevant chemicals.

### Noise Levels

Noise monitoring shall be done utilising an integrating sound level meter to record noise levels in different scales like A-weighting with slow and fast response options.

## **6.5 Environmental Costs**

All costs involved in environmental mitigating measures and management are included in the project cost.

## **6.6 Audit and Review**

Review and audit is essentially a management tool. However, its application is crucial at the operational level for verification and feedback on the effectiveness of organization system and environmental performance. Basically, Auditing involves in the following items:

- Line management system;
- Awareness and training;
- Procedures, standards, targets;
- Plans: waste, contingency, pollution control compliance;
- Monitoring programmes;
- Verify Environmental Impact Assessment;
- Verify mitigation;
- Reporting and communication;
- Documentation; and
- Feedback.

Audit serves to substantiate and verify monitoring programmes and compliance, and to ensure that site environmental plans, procedures and standards are both effective and fit for purpose. Other benefits of auditing include increased internal and external awareness, communication and credibility of company environmental activities by demonstrating commitment to and achievement of responsible environmental management.

In addition to management and compliance audits, a number of technical or process audits, sometimes termed assessments or valuations, may be conducted. Thus, waste and emissions audits, energy audits, site (contamination) audits, emergency counter measure audits, worker health and safety audits, may be instigated independently or as part of a broader management audit.

Reports on environmental performance shall be made available for a wide public readership including shareholders and financing bodies. An important audience is also the company employees, who benefit from having the company's



environmental position and activities described in a way that allows him or her to be an ambassador in a general sense for the company. Reporting is becoming increasingly sophisticated, and more closely linked with the total environmental programme of companies.

The contents of these reports still vary greatly, with a gradual but noticeable tendency to quantify environmental performance, and include mention of a range of environmental and sustainability indicators such as pollution and safety incidents, greenhouse gas emissions, and even non-compliance statistics.