Chapter 6

Environmental Monitoring Programme

The Environmental Management Plan as presented in the previous sections for various components of the environment needs to be monitored for its effectiveness. Regular monitoring of environmental parameters is of immense importance to assess the status of environment during project operations. With the knowledge of baseline conditions, the monitoring programmed will serve as an indicator for any deterioration in environmental conditions due to operation of the project, to enable taking up suitable mitigation 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.

6.1 Environmental Monitoring and Reporting Procedure

Development of the programme 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.

CEIL will set up Environmental Monitoring Cell (EMC) to review the effectiveness of environment management system during construction and operational phase of crude oil terminals and other associated facilities along the pipeline route. EMC will work out a schedule for monitoring and will meet regularly to review the effectiveness of the EMP implementation. The data collected on various EMP measures would be reviewed by EMC and if needed corrective action will be formulated for implementation.

Monitoring shall confirm that commitments are being met. This may take the form of direct measurement and recording of quantitative information, such as amounts and concentrations of discharges, emissions and wastes, for measurement against corporate or statutory standards, consent limits or targets. It may also require measurement of ambient environmental quality in the vicinity of a site using ecological / biological, physical and chemical indicators. Monitoring may include socio-economic interaction, through local liaison activities or even assessment of complaints.

The preventative approach to management may also require monitoring of process inputs, for example, type and stocks of chemical use, resource consumption, equipment and plant performance etc.

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.

6.1.1 Objectives of Monitoring

The objectives of monitoring are:

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

6.1.2 Monitoring Schedule

The environmental quality monitoring program shall be carried out in the impact zones with suitable sampling stations and frequency for the parameters identified. For conventional pollutants the methods prescribed in “Standard Methods for water and Wastewater Analysis” published by APHA, AWWA & WPCF should be strictly adhered. The components of environmental monitoring program for CEIL is given in **Fig. 6.1**.

Environmental monitoring schedules are prepared covering various phases of project advancement, such as Constructional Phase, regular Operational Phase and Decommissioning Phase.

6.1.3 Monitoring Schedule during Constructional Phase

The project envisages laying of 600 km pipeline, setting up of storage terminals, power generating units and other associated facilities. The construction activities require clearing of vegetation, mobilization of construction material and equipment. The construction activities are expected to last for over one year.

The generic environmental measures that need to be undertaken during project construction stage are given in **Table 6.1**.

Table 6.1

Environmental Monitoring during Project Construction Stage

Sr. No.	Potential Impact	Action to be Followed	Parameters for Monitoring	Frequency of Monitoring
1	Environmental Management Cell/ Unit	The Environmental Management Cell/Unit is to be set up to ensure implementation and monitoring of environmental safeguards.	Responsibilities and roles will be decided before the commencement of work.	During construction phase
2	Air Emissions	All equipments are operated within specified design parameters.	Random checks of equipment logs/ manuals	Periodic
		Vehicle trips to be minimized to the extent possible.	Vehicle logs	Periodic during site clearance & construction activities
		Any dry, dusty materials stored in sealed containers or prevented from blowing.	Absence of stockpiles or open containers of dusty materials.	Periodic during construction activities
		Compaction of soil during various construction activities	Construction logs	Periodic during construction activities
		Maintenance of DG set emissions to meet stipulated standards	Gaseous emissions (SO_2, HC, CO, NOx)	Periodic emission monitoring
		Ambient air quality within the premises of the proposed unit to be monitored.	The ambient air quality will conform to the standards for RSPM, SPM, SO_x, NO_x, CO and HC	As per CPCB/ RSPCB requirement or on monthly basis whichever is earlier
3	Noise	List of all noise generating machinery onsite along with age to be prepared. Equipment to be maintained in good working order.	Equipment logs, noise reading	Regular during construction activities
		Night working is to be minimized.	Working hour records	Daily records
		Generation of vehicular noise	Maintenance of records of vehicles	Daily records
		Implement good working practices (equipment selection and setting) to minimize noise and also reduce its impacts on human health (ear muffs, safe distances, and enclosures).	Site working practices records, noise reading	Periodic during construction activities
		No machinery running when not required.		

Sr. No.	Potential Impact	Action to be Followed	Parameters for Monitoring	Frequency of Monitoring
		Acoustic mufflers / enclosures to be provided in large engines	Mufflers / enclosures in place.	Prior to use of equipment.
		Noise to be monitored in ambient air within the plant premises.	Spot Noise recording	As per CPCB/RSPCB requirement or on quarterly basis whichever is earlier.
		The Noise level will not exceed the permissible limit both during day and night times.		
		All equipments operated within specified design parameters.	Random checks of equipment logs/ manuals	Periodic during construction activities
		Vehicle trips to be minimized to the extent possible	Vehicle logs	Periodic during construction activities
4	Wastewater Discharge	No untreated discharge to be made to surface water, groundwater or soil. Hydro test water shall be treated and disposed appropriately (either solar evaporated or disposed in nearby CETPs)	No discharge hoses in vicinity of watercourses.	Periodic during construction activities
		The discharge point should be selected properly and sampling and analysis should be undertaken prior to discharge	Discharge norms for effluents as given in Permits	Periodic during construction activities
		Take care in disposal of wastewater generated such that soil and groundwater resources are protected.	Discharge norms for effluents as given in permits	
5	Disruption of drainage and irrigation canals	Ensure drainage system and specific design measure working effectively. The design to incorporate existing drainage pattern and avoid disturbing the same.	Visual inspection of drainage and records thereof.	Through out construction period
6	Soil Erosion	Minimize area extent of site clearance, by staying within the defined boundaries	Routine monitoring to ensure that site boundaries not extended / breached as per plan document.	Periodic during construction activities
		Protect topsoil stockpile where possible at edge of site.	Effective cover in place.	Periodic during construction activities

Sr. No.	Potential Impact	Action to be Followed	Parameters for Monitoring	Frequency of Monitoring
7	Change in topography	Ensure proper restoration to the existing landscape.	Review of contractor infrastructure and management plan Documentation and application of mitigative measures	Throughout construction period
8	Loss of flora and fauna	Re-vegetation as per Forest guidelines Development and implementation specific management plans Temporary fencing along the pipeline corridor to prevent the entry of animals and wildlife	No. of plants, species Site inspection and monitoring Review of contractor management plans	During site clearance phase and throughout construction period
9	Migration of birds, breeding grounds etc	Avoid migration and breeding seasons if any and minimize duration	Include the environmental considerations in the schedule	Throughout construction period
10	Health	Employees and migrant labour health check ups	All relevant parameters including HIV	Regular check ups
11	Construction camps	Away from settlements and ensure disciplinary procedures Avoid use of public infrastructural facilities such as power, gas and water and maintain hygienic conditions	Regular monitoring	Pre-construction
12	Disturbance to archeological or local importance religious places, if any	Ensure appropriate management of cultural heritage Include local customs, archeological awareness in induction programme	Routine monitoring and checks on contractor performance	Pre-construction and throughout construction period
13	Waste Management	Implement waste management plan that identifies and characterizes every waste arising associated with proposed activities and which identifies the procedures for collection, handling & disposal of each waste arising.	Comprehensive Waste Management Plan in place and available for inspection on-site. Compliance with Hazardous Wastes (Management and Handling Rules), 2003	Periodic check during construction activities
14	Fuel and oil leaks	Use designated fuel storage methods and ensure that oil spill response plan is in place	Visual inspection and monitoring of soil and ground water quality	Throughout construction period
15	Flood risk	Ensure that gaps are left in	Routine	Pre-construction

Sr. No.	Potential Impact	Action to be Followed	Parameters for Monitoring	Frequency of Monitoring
		top soil stacks to allow flood water through and proper engineering methods	monitoring and checks on contractor performance	and throughout construction period
16	Non-routine events and accidental releases	Plan to be drawn up, considering likely emergencies and steps required to prevent/limit consequences.	Mock drills and records of the same	Periodic during construction activities
17	Public and animal safety	Erection of warning barriers	Routine monitoring and checks	Throughout construction period

6.1.4 Monitoring Schedule during operational Phase

As explained in the previous Chapter, the environmental impacts in pipeline project are temporary and confined during construction period. However, the operation of pumps, power generating units will contribute to the regular emissions at storage and heating stations. The following attributes which merit regular monitoring based on the environmental setting and nature of project activities are listed below:

- Source emissions from Gas and Diesel engines and ambient air quality
- Groundwater Levels and groundwater quality around storage terminals
- Solid and hazardous waste characterisation (oily wastes, used and waste oil)
- Soil quality and oil spills including soil temperature at selected sensitive locations and heating stations
- Monitoring of sewage characteristics and waste water quality during tank cleaning and pigging operations
- Noise levels (equipment and machinery noise levels, occupational exposures and ambient noise levels)
- Ecological preservation and afforestaion
- Energy use and consumption of resources
- Integrity and performance of pollution control equipment
- Review of Emergency response plans related to oil spills, fires and explosions, security etc.
- Socio-economic and health status around the operating facilities.

The following routine monitoring programme as detailed in **Table 6.2** would be implemented at site. Besides to this monitoring, the compliances to all environmental clearance conditions and regular permits from RSPCB / GPCB / MoEF shall be monitored and reported periodically.

Table 6.2

Environmental Monitoring During Operational Phase

Sr. No.	Potential Impact	Action to be Followed	Parameters for Monitoring	Frequency of Monitoring
1	Air Emissions	Stack emissions from power plants, DG sets, to be optimized and monitored	Gaseous emissions (SO_2, HC, CO, NOx)	Periodic during operation phase
		Cold venting any from storage tanks	Quantity and cold venting if any	Continuous
		Ambient air quality within the premises of the proposed unit and nearby habitations to be monitored. Exhaust from vehicles to be minimized by use of fuel efficient vehicles and well maintained vehicles having PUC certificate.	SPM, RSPM, SO_2, NO_x, CO, HC Vehicle logs to be maintained	As per CPCB/ SPCB requirement or on monthly basis whichever is earlier
		Measuring onsite data of Meteorology	Wind speed, direction, temp., relative humidity and rainfall.	Periodic during operation phase
		Vehicle trips to be minimized to the extent possible	Vehicle logs	Daily records
2	Indoor air contamination	Pollutants such as CO, CO_2 and VOCs to be reduced by providing adequate ventilation.	Monitoring of indoor air pollutants such as CO, CO_2 and VOCs.	As per CPCB / RSPCB / GPGB requirement

Sr. No.	Potential Impact	Action to be Followed	Parameters for Monitoring	Frequency of Monitoring
3	Noise	Noise generated from operation of DG set to be optimized and monitored DG sets to generate less than 75 dB(A) Leq at 1-m from the source DG sets are to be provided at basement with acoustic enclosures	Spot Noise Level recording; Leq(night), Leq(day), Leq(dn)	Periodic during operation phase
		Generation of vehicular noise	Maintain records of vehicles	Periodic during operation phase
4	Water Quality and Water Levels	Monitoring groundwater quality and levels around storage terminals	Comprehensive monitoring as per IS 10500 Groundwater level bgl	Once in a season
5	Wastewater Discharge	No untreated discharge to be made to surface water, groundwater or soil. The cleaning water shall be collected in tanks and disposed in nearby CETP	No discharge hoses in vicinity of watercourses.	Periodic during operation phase
		Take care in disposal of wastewater generated such that soil and groundwater resources are protected.	Discharge norms for effluents as per CETP norms	Periodic during operation phase

Sr. No.	Potential Impact	Action to be Followed	Parameters for Monitoring	Frequency of Monitoring
		Compliance of treated sewage to standards	Comprehensive as per GSR 422(E)	Once in a season
6	Drainage and effluent Management	Ensure drainage system and specific design measures are working effectively. Design to incorporate existing drainage pattern and avoid disturbing the same.	Visual inspection of drainage and records thereof	Periodic during operation phase
7	Maintenance of flora and fauna	Vegetation and greenbelt / green cover development	No. of plants species	Periodic during operation phase
8	Health	Employees and migrant labour health check ups	All relevant parameters including HIV	Regular check ups
9	Energy Usage	Energy usage power generation, air conditioning and other activities to be minimized Conduct annual energy audit for the terminals	Energy audit report	Annual audits and periodic checks during operational phase

Sr. No.	Potential Impact	Action to be Followed	Parameters for Monitoring	Frequency of Monitoring
10	Waste Management	Implement waste management plan that identifies and characterizes every waste arising associated with proposed activities and which identifies the procedures for collection, handling and disposal of each waste arising.	Records of solid waste generation, treatment and disposal	Periodic during operation phase
11	Emergency preparedness , such as fire fighting	Fire protection and safety measures to take care of fire and explosion hazards, to be assessed and steps taken for their prevention.	Mock drill records, on site emergency plan, evacuation plan	Periodic during operation phase
12	Non-routine events and accidental releases	Plan to be drawn up, considering likely emergencies and steps required to prevent / limit consequences.	Mock drills and records of the same	Periodic during operation phase
13	Soil Quality	Integrity of pipeline system including insulation Prevention of leakages and spills from pipeline, pumps and storage tanks	Physical, chemical and biological parameters Soil temperature at selected sensitive locations to check the heat insulation performance	Pre and post monsoon

6.1.5 Monitoring Methods and Data Analysis

All environmental monitoring and relevant operational data will be stored in a relational database and linked GIS system. This will enable efficient retrieval and storage and interpretation of the data. Regular data extracts and interpretive reports will be sent to the regulator.

6.1.5.1 Air Quality Monitoring

Stack Monitoring

The emissions from all the stacks will be monitored regularly. The exit gas temperature, velocity and pollutant concentrations will be measured. Any unacceptable deviation from the design values will be thoroughly examined and appropriate action will be taken. Air blowers will be checked for any drop in exit gas velocity.

Work Zone Monitoring

The concentration of air borne pollutants in the workspace / work zone environment will be monitored periodically. If concentrations higher than threshold limit values are observed, the source of fugitive emissions will be identified and necessary measures may be taken. Methane and non-methane hydrocarbons shall be monitored in work zone. If the levels are high suitable measures as detailed in EMP shall be initiated.

Ambient Air Quality Monitoring

The ambient concentrations of SPM, SO_2, NO_X, CO and HC in the ambient air will be monitored at regular intervals. Any abnormal rise will be investigated to identify the causes, and appropriate action will be initiated. Greenbelt shall be developed for minimising dust propagation. The ambient air quality data should be transferred and processed in a centralised computer facility equipped with required software. Trend and statistical analysis should be done.

6.1.5.2 Noise Levels

Noise levels in the work zone environment such as storage terminals, power generating locations, etc. shall be monitored. The frequency shall be once in three months in the work zone. Similarly, ambient noise levels near habitations shall

also be monitored once in three months. Audiometric tests should be conducted periodically for the employees working close to the high noise sources.

6.1.5.3 Water and Wastewater Quality Monitoring

To ensure a strict control over the water consumption, flow meters shall be installed for all major inlets. All leakages and excess shall be identified and rectified. In addition, periodic water audits will be conducted to explore further possibilities for water conservation.

Methods prescribed in "Standard Methods for Examination of Water and Wastewater" prepared and published jointly by American Public Health Association (APHA), American Water Works Association (AWWA) and Water Pollution Control Federation (WPCF); Manual on Water and Wastewater Analysis published by NEERI, Nagpur are recommended.

Monitoring of Wastewater

All the wastewater streams in the project area shall be regularly monitored for flow rate and physical and chemical characteristics. Such analysis is carried out for wastewater at the source of generation, at the point of influent into the wastewater treatment plant and at the effluent point for final discharge / injection into deep ground. These data are properly documented and compared against the design values for any necessary corrective action.

Monitoring of Groundwater

In order to detect any contamination of the groundwater due to leakage from any storage tanks and other associated activities, groundwater samples shall be taken from representative locations periodically and analysed for necessary corrective actions, if any.

6.1.5.4 Land Environment

The following parameters should be monitored for land environment.

- The effectiveness and constant strengthening of green belt development should be made in and around the project site and associated facilities.

6.1.5.5 Biological Environment

- Development of green belt with carefully selected plant species is of prime importance due to their capacity to reduce air and noise pollution impacts by attenuation / assimilation and for providing food and habitat for local micro and macro fauna. This not only overcomes the problem but also enhances the beauty of area that will attract bird and insect species and by this way ecology of the area will maintain to great extent.

- The planting of evergreen species may have certain advantages that may reduce the environmental pollution.

- Survival rate of the planted trees should be closely monitored and the trees which not survive should be counted. Equal number of trees should be replaced and their survival should be closely monitored

- Treated sewage and effluent in the best combination should be used for green belt development. The rain water harvesting should be done. Water scarcity should not be the reason for not expanding and strengthening green belt

6.1.5.6 Socio-economic Environment

- In order to mitigate the impacts likely to arise out of the proposed project and also to maintain goodwill of local people for the proposed project, it is necessary to take steps for improving the social environment. Necessary social welfare measures by the industry shall be useful in gaining public confidence depending on local requirement.

- Some basic amenities, viz. education, safe drinking water supply, regular medical check up in the villages may be taken up

- Formal and informal training to be provided to the employees of the effected villages due to the project shall be taken up on priority basis. Job oriented skill training, courses may be organized

- Personal protective facilities like helmets, safety (gas) mask / safety dress, shoes etc. be ensured for all workers, engaged in operation of process units within terminal complex.

6.1.6 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 frequency of reporting shall be on six monthly basis to the local SPCB 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. The frequency of monitoring and the parameters to be analysis etc. is presented in **Table 6.3**.

6.2 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, Respirable 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 sets, 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.

6.3 Environmental Monitoring of Cost

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

6.4 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
- 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 investigated 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.

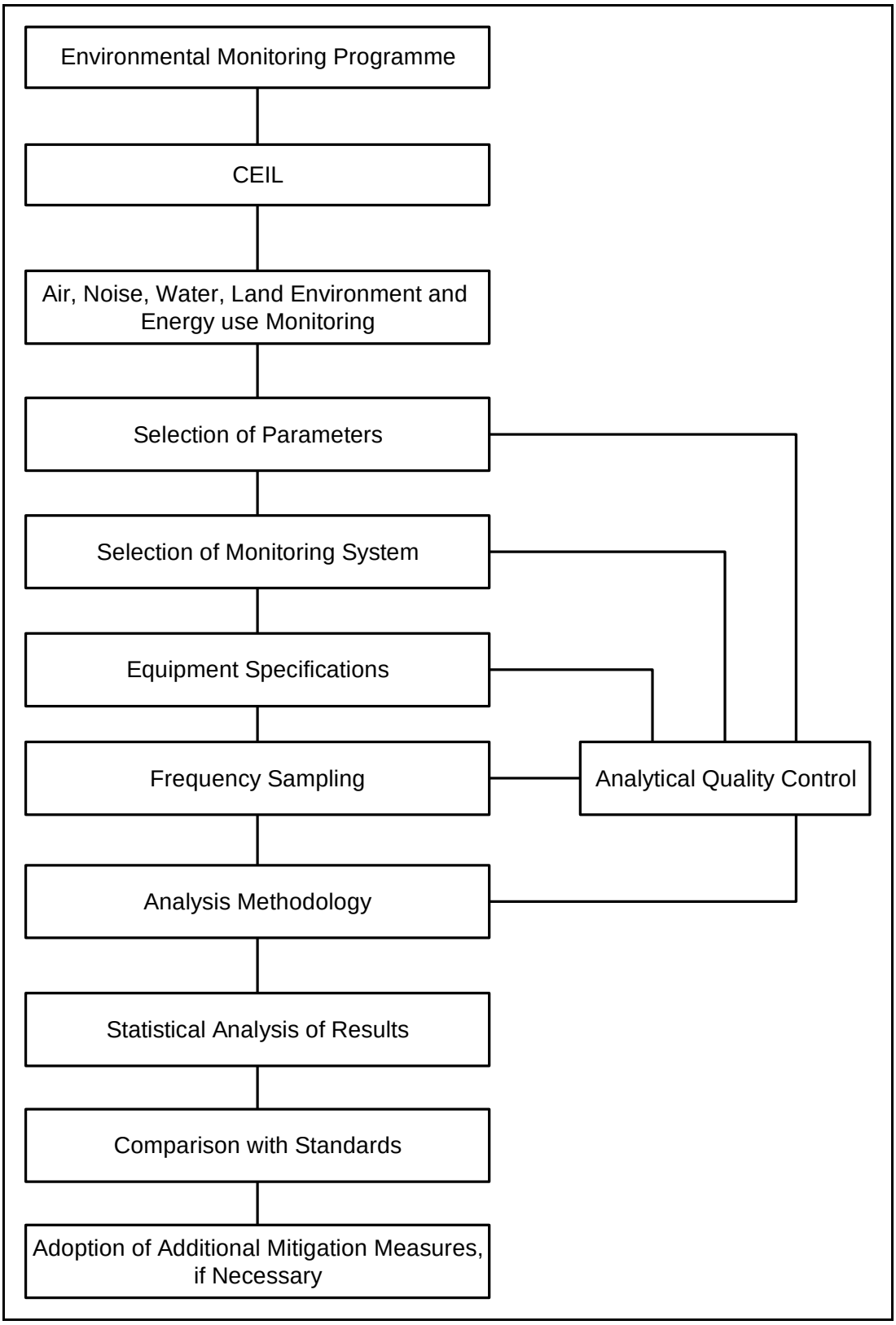

Fig. 6.1: Components of Environmental Monitoring Programme for CEIL

Table 6.3

Overall Environment Monitoring Programme

Component	Project Stage	Parameters	Standard	Location	Frequency	Duration	Institutional Responsibility
Ambient Air Quality	Construction	SPM, RSPM, SO_2, NOx,	NAAQS of CPCB	3 locations with minimum 1 locations in upwind side, more sites in downwind side / impact zone on land only.	Once a month	24 hr/day for 2 consecutive days	Agency/ In-house
	Operation	SPM, RSPM, SO_2, NOx, CO, HC (non-methane)	NAAQS of CPCB	Minimum 6 locations in each field with one on upwind side, two on downwind and one on lateral side.	Twice a week	2 consecutive working days in a week SPM, RSPM, SO_2 and NO_x-24 hrs CO-24 hrs/8 hrs HC-Auto Monitors	Agency / In-house
	Operation	VOC	NAAQS of CPCB	Storage Terminals	Half Yearly	As per standard protocols of CPCB	Agency/ In-house
	Operation	BTEX	NAAQS of CPCB	Storage Terminals	Half Yearly	As per standard protocols of CPCB	Agency/ In-house

Component	Project Stage	Parameters	Standard	Location	Frequency	Duration	Institutional Responsibility
Source emissions	Construction	Particulates, SO_2, NOx, CO, HC	Emission standards of CPCB/GPCB	DG sets, heavy earth equipment	Once in a month	As per standard protocols of CPCB	Agency/ In-house
	Operation	Particulates, SO_2, NOx, CO, HC (non-methane)	Emission standards of CPCB/GPCB	Each stack	Once in a month	As per the recommendations of GPCB	Agency/ In-house
Noise level	Construction	L_{eq} day, L_{eq} night, dB(A)	CPCB noise standards	2 to 4 locations representing different receptors/land use	Once every season-Summer, Winter, Post-monsoon during construction period	24 hour reading with a frequency of 10 minutes every hour for 2 non-consecutive days per week for 2 weeks per season	Agency/ In-house
	Operation	L_{eq} day, L_{eq} night, L10, L50, L90 dB(A)	CPCB noise standards	In and around the storage terminals including work zone conc.	Once every season-Summer, Winter, Post-monsoon	24 hour reading with a frequency of 10 minutes per hour for 2 non-consecutive days per week for 2 weeks per season	Agency/ In-house

Component	Project Stage	Parameters	Standard	Location	Frequency	Duration	Institutional Responsibility
Water quality	Construction / Operation	Physico-chemical parameters, Nutrients and Organic parameters, heavy metals	Relevant water quality and standards	3-4 locations in and around the terminal	Once every season – Summer, Winter, Post-monsoon.	One grab samples from each groundwater source	Agency/ In-house
Waste Water quality	Operation	Physical-chemical parameters, Nutrients and Organic parameters, heavy metals	Same as above	Inlet and outlet of each ETP units	Once in 15 days.	Composite flow-weighted sampling	Agency/ In-house
Soil Quality	Construction	Particle size distribution, Texture, pH, Electrical conductivity, CEC, Alkalinity metals, SAR, Permeability, Water holding capacity, Porosity	Contaminant threshold level given by USEPA	- At all stockyard locations, construction machinery parking / refueling / maintenance locations	At the start and end of construction activity at the relevant location	Sample every season till construction phase is complete	Agency/ In-house

Component	Project Stage	Parameters	Standard	Location	Frequency	Duration	Institutional Responsibility
Ecology	Pre-construction	Monitoring of tree felling	Number to be felled as laid out in project detail design	At all locations/sections where tree is felled	During tree felling		Agency/ In-house
	Operation	Survival rate of plantation		At locations of compensatory plantation and landscaping	Annually	For 3 years after operation starts	Agency/ In-house
Health	Construction / Operation	All relevant parameters including HIV	National Health Policy	In Terminals and other work areas	Regular check ups	Every Month	Agency/ In-house
Solid/ hazardous wastes	Construction	Depending on type of wastes	Contaminant threshold level given by USEPA	- At accidental spill sites - Over burden dumps	- In the event of an accident - Once during the construction period	One time sample	Agency/ In-house
	Operation	Depending on type of wastes	Contaminant threshold level given by USEPA	- At accidental spill sites - Solid waste disposal location	- In the event of an accident - Once during each season	One time sample	Agency/ In-house

Component	Project Stage	Parameters	Standard	Location	Frequency	Duration	Institutional Responsibility
Energy usage	Construction / Operation	Energy audit report	Bureau of Energy Efficiency (BEE)	All location of terminals	Annual audits and periodic checks during operational phase	Every month	Agency/ In-house
Traffic Volume	Construction	Road Traffic volume, characteristics and speed	As per relevant IRC specifications	At all artery roads leading to construction site	1 day hourly counts	Thrice in a year marking peak, medium and low construction activity at the site	Agency/ In-house