**Environmental Monitoring**

## Monitoring Definition

## Environmental monitoring refers to the tools and techniques designed to observe an environment, characterize its quality, and establish environmental parameters, for the purpose of accurately quantifying the impact an activity has on an environment. Results are gathered, analyzed statistically, and then published in a risk assessment and environmental monitoring and impact assessment report.

## What is Environmental Monitoring?

The main objective of environmental monitoring is to manage and minimize the impact an organization’s activities have on an environment, either to ensure compliance with laws and regulations or to mitigate risks of harmful effects on the natural environment and protect the health of human beings.  
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As human population, industrial activities, and energy consumption continues to grow, the continued development of advanced, automated monitoring applications and devices is crucial for enhancing the accuracy of environmental monitoring reports and the cost-effectiveness of the environmental monitoring process.  
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Monitoring programs are published outlines within an organization that detail precisely which elements are being monitored, overall objectives, specific strategies, proposed sampling methods, projects within each strategy, and time frames.  
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Environmental monitoring products and environmental monitoring software, such as Environmental Data Management Systems (EDMS), facilitate the implementation and monitoring of environmental monitoring and assessment programs, which includes a central data management hub, automated environmental monitoring alerts, compliance checking, validation, quality control, and generation of reports on dataset comparisons.

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**Environmental Monitoring Types**

The three main types of environmental monitoring are soil, atmosphere, and water. Some techniques of environmental scanning and monitoring include filtration, sedimentation, electrostatic samples, impingers, absorption, condensation, grab sampling, and composite sampling.  
‍Data collected from these methods of environmental monitoring can be input into a DBMS, where it can be categorized, analyzed, visualized, and create actionable insights that drive informed decision making.  
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* **‍Air Monitoring**:

Environmental data gathered using specialized observation tools, such as sensor networks and [Geographic Information System](https://www.heavy.ai/technical-glossary/gis) (GIS) models, from multiple different environmental networks and institutes is integrated into air dispersion models, which combine emissions, meteorological, and topographic data to detect and predict concentration of air pollutants.

* **Soil Monitoring**:

 Grab sampling (individual samples) and composite sampling (multiple samples) are used to monitor soil, set baselines, and detect threats such as acidification, biodiversity loss, compaction, contamination, erosion, organic material loss, salinization, and slope instability.  
 ***- Salinity Monitoring:***

Remote sensing, GIS, and electromagnetic induction are used to monitor soil salinity, which, if imbalanced, can cause detrimental effects on water quality, infrastructure, and plant yield.  
  
***- Contamination Monitoring:***

Chemical techniques such as chromatography and spectrometry are used to measure toxic elements, such as nuclear waste, coal ash, microplastics, petrochemicals, and acid rain, which can lead to the development of pollution-related diseases if consumed by humans or animals.   
  
***- Erosion Monitoring:***

Monitoring and modeling soil erosion is a complex process in which accurate predictions are nearly impossible for large areas. The Universal Soil Loss Equation (USLE) is most commonly used to try to predict soil loss due to water erosion. Erosion may be due to factors such as rainfall, surface runoff, rivers, streams, floods, wind, mass movement, climate, soil composition and structure, topography, and lack of [vegetation management](https://www.heavy.ai/blog/modeling-monitoring-powerline-tree-strike-risk-at-scale).

* **Water Monitoring:** Environmental sampling techniques include judgmental, simple random, stratified, systematic and grid, adaptive cluster, grab, and passive; semi-continuous and continuous environmental monitoring; remote sensing and environmental monitoring; and bio-monitoring are used to measure and monitor ranges for biological, chemical, radiological, microbiological, and population parameters.

IOT Based Environmental Monitoring

Environmental monitoring solutions have evolved over the years into Smart Environmental Monitoring (SEM) systems that now incorporate modern sensors, Machine Learning (ML) techniques, and the [Internet of Things](https://www.heavy.ai/learn/vast-world-of-iot) (IoT). Technologies such as IoT devices and wireless sensor networks have made advanced environmental monitoring using IoT a more streamlined and Artificial Intelligence-controlled process.   
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Data captured by IoT environmental monitoring sensors from a wide variety of environmental conditions can be integrated via the Wireless Sensor Network (WSN) into one, cloud-based environmental system, in which IoT devices embedded with ML can record, characterize, monitor, and analyze elements in a specific environment.

**Environmental Monitoring Tools**

The important part of any environmental monitoring activity is the kind of equipment or tools used in the process. There are many types of instruments used in environmental monitoring at different stages.

Few tools or equipment are mentioned below used in environmental monitoring:

* **Sampling:** Automated Samplers, high volume samplers,
* **Monitoring:** Air Monitoring Sensors, Data Loggers, Noise Level Meter, water testing sensors, Indoor Air Quality Meters, flue gas monitors, etc
* **Data loggers:** Real time data loggers to receive and store real time environmental data
* **Laboratory tools:** Temperature chambers, various analysers, balances, evaporators, particle counters, pH meters, refractometers etc.

Conclusions

Environmental monitoring of air quality (1-hour TSP and 24-hour TSP) for the Project was performed in February 2003. All the monitoring results complied with the AL levels except four 24-hr TSP exceedances. Since all the 1-hr TSP monitoring results complied with the AL levels, it indicated an acceptable air quality during the operation hours of the Fill Bank. However, a poorer ambient air quality in the Fill Bank could be interpreted from the 24-hr TSP monitoring results. The Contractor was required to follow up all the mitigation measures as recommended in the EIA Report, EP and EM&A Manual. At this stage, provision of covers or hydroseeding on the exposed slopes and more frequent water spraying on the stockpiles and main haul roads are recommended.

2 )Impact noise level monitoring was performed on 21 February 2003. The monitoring results complied with the limit level of 75dB. No complaint was received regarding noise issue.

3) The water quality monitoring was conducted by the Reclamation Project in the reporting month. Data was obtained continuously through CED. In the reporting month, 8 action level exceedances were recorded. However, it was believed that the exceedances were not caused by the operation of the Fill Bank because only a small amount of surface runoff was discharged from the site and a sufficient desilting system including provision of screening facilities and a permanent desilting chamber in the trapezoidal channel was provided.

**‍Recommendations**

According to the environmental site inspections performed in the reporting month, the following recommendations were provided:

Air Quality ·

Increase the frequency of water spraying on haul roads, unloading areas and stockpiles; ·

Provide proper maintenance for the powered mechanical equipment to avoid emission of dark smoke;

· Advise the truck drivers on the speed limit of 10km/hr; · Cover the temporary slope facing north; · Hydroseed completed slopes; ·

Properly operate and maintain the wheel washing bay; and · Install hard paved haul roads.

Construction Noise

· Ensure air compressor and hand held breaker be provided with noise label.

Water Quality

· Reuse wastewater after proper treatment; · Remove stagnant water or provide pesticide; and · Ensure the cleanliness of the trapezoidal and all other surface channels.

Chemical and Waste Management ·

Remove waste materials from site to avoid accumulation regularly;

· Provide chemical waste storage area in accordance with the chemical waste producer registration requirement;

· Avoid waste accumulation, especially after completion of individual construction works;

· Remove unwanted material in the existing stockpiles and avoid further dumping of such material; · Provide and maintain sufficient drip trays for diesel drums, chemical containers and diesel operated generator set; and

· Avoid soil being contaminated during oil replacement and properly remove and store the contaminated soil, if any.

Landscape and Visual

· Erect all the site hoardings/chaining fences in accordance with agreed design at proper location.