The Role of Good Environmental Data Management in Reducing Risk, and the Challenges Involved

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EHS DATA

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Abstract

Most mine sites are required to undertake environmental monitoring to comply with permits and national, international or organisational standards.

However, is simply meeting these requirements enough to minimise risks? Appropriate management of environmental data is essential not only in its use as information throughout the life of an operation, but also in the event it is scrutinised or needs to be relied upon to make a case to either stakeholders or regulators.

This paper examines how responsible management of environmental data helps to mitigate risks and improve efficiency, and details some of the specific challenges involved. There are numerous scenarios in which a mine site will need to use its historical monitoring data many years after it was collected. These range from simply demonstrating environmental commitments to stakeholders to giving timely and adequate attention to and responses to complaints, or to defending a case in the event of an environmental incident.

The first key issue is ensuring the data is reliable through validation, security and auditability. Other challenges include ensuring that monitoring has been completed in accordance with requirements, that appropriate calculations have been performed on this data, and that required reports are submitted on time with the correct information. It is also vital that there are adequate visualisation and interpretation tools to provide meaningful information to the environmental department and others, especially when comparing baseline readings with current performance and how compliant the operation is.

Despite the importance of environmental data management, many mines use spreadsheets to store their data, even though these are difficult to manage, prone to human error, and insecure. When needed, this data is likely to be hard to locate, impossible to validate its authenticity, and, even with careful control, contain to errors and omissions.

Why Should the Mining Industry Complete Environmental Monitoring?

Due to increasing pressures on the environment, governments are increasingly making it obligatory for companies to collect data and report on their environmental performance.

From the National Pollution Inventory (NPI) in Australia, the US Emergency Planning and Community Right to Know legislation and the European Pollutant Release and Transfer Register in Europe, organisations that can impact the environment need to ensure that they have a full overview of their environmental impact before, during and after projects are completed. Also, the British Columbia Ministry of Environment (MOE) share key scientific and technical information with the public through their Environmental Monitoring System (EMS); this means a site's environmental performance can be seen by the public and, in turn, impact public trust and opinion.

Increasingly, mining companies are now required to responsibly decommission and reclaim sites after the project's lifetime. Naturally, this will lead to an increased need for maintaining environmental monitoring activities for a long time after the operations are decommissioned. This means the need for environmental monitoring and good data management is no longer exclusively for the operating phase. Robust data management may actually enable operators to demonstrate stable or pre-mining conditions and, if nothing else, reduce ongoing monitoring needs or potentially cessation.

What Can Happen if an Environmental Monitoring Plan is Not Managed Reliably?

There are many examples of mining companies causing major environmental disasters. The total impact and environmental damage to communities, waterways, land and wildlife following a disaster such as a tailings dam break is huge. Companies held responsible for such damage will, in most countries, face severe financial fines for the accident and for the clean-up over many years. It is also becoming increasingly common for directors and managers to be charged with criminal offences for negligence or irresponsibility.

In general, mining operations occur in areas with naturally high concentrations of heavy metals and pollutants due to geology. Without proper pre- and post-operational pollution inventory data, the company might well be held responsible for naturally occurring substances, which might not have been the case if monitoring data from before the incident had been accurately recorded and reliably managed.

In a specific example from recent history, a tailings dam collapsed, polluting the local water supply and eventually spreading to the ocean many miles from the source, tragically killing a number of local residents caught in the path of the breach.

The operator and its parent companies were held responsible for the damage. Historical data for the area before the disaster were limited, and no background information had been recorded prior to the accident. It has been estimated that the restoration project will cost the organisation multiple billions of £, including fines, and take 15 years to complete.

Public Data Visibility and Environmental Monitoring in British Columbia

The B.C. Ministry of Environment is committed making unbiased scientific data and information accessible.

Mining companies with operations in B.C. face many challenges and responsibilities to minimise environmental impacts. Aspects such as treacherous terrain, lush forests, glacier-fed rivers and streams, and abundance of wildlife all contribute to B.C.'s natural beauty. The potential for damage to nature contributes to the areas of environmental concern for many stakeholder groups, including private citizens and First Nations. There have been many cases in the past where public pressure has delayed or even prevented project approvals. Companies who are not prepared with years of well-established baseline data, as well as strong management plan to ensure permit compliance can be impacted with delays resulting in losses to costs and investor confidence.

List of key risks which can be mitigated

1. Not collecting readings as prescribed by a permit

2. Missing impending compliance breaches by not reading trends

3. Accepting and subsequently reporting incorrect information due to lack of proper validation or calculation

4. Failure to be able to substantiate that data reported has not been tampered with, unless costly re-collation from sources is undertaken

5. Failure to report on time or reporting wrong parameters or locations

6. In the event of a disaster or even a planned release, failure to demonstrate the extent or significance of the pollution relative to previous conditions.

Creating a Structured Monitoring Plan from Permits and Other Obligations

The monitoring required by various site permits is collectively termed a monitoring plan. This plan is repeated regularly throughout the duration of a permit, or until the permit is amended to ensure compliance.

Often the monitoring plan must be interpreted and extracted from the various conditions identified in a sites permit(s). The resulting plan accounts for potentially hundreds of different parameters which must be measured at numerous locations at varying frequencies, from a variety of different measuring instruments, field readings, consultants and laboratories.

Permits and obligations remain important for mine closures and remediation projects which have a long term time frame meaning something more robust than a spreadsheet is required. This ideally lends itself to automation thorough various digital data loggers and meters as well as coherent database system for verification, compliance and analysis. An automated solution might demand some resources for set-up, but once in place an automated system can be used repeatedly and amended simply as needed decreasing the long-term resource allocation for monitoring.

Planning Helps to Ensure All Required Monitoring is Completed on Time

Not only must the plan be managed in terms of what must be done, but also in verifying that it has been done or if reasons have prevented it from being completed. Sometimes issues may arise which mean a sample cannot be completed within a designated time frame, examples include; dry wells where a sample couldn't be taken or accessibility issues in remote locations.

Managing a monitoring plan manually is difficult, in many cases not all sample points require the same set of analyses. Some may require additional lab analyses if field tests exceed set values, others could require more frequent monitoring if analysis results exceed certain value, or special treatment may be required to the samples at some intervals but not others.

Manual checklists and spreadsheets would require constant review and update to ensure the plan is followed as prescribed. With so many samples and different sets of analyses, labs typically use a chain of custody to transfer responsibility from their client once the samples are received. Tracking numbers are assigned, and the operator or consultant must then reconcile the sample results once received, often up to 30 days later. Not only must operators account that all their samples had results returned, but that all the planned parameters and QA/QC samples were analysed.

Additionally, in conformance with internal or required quality checks, a replicate 'anonymous' sample may be delivered to the lab and compared against the 'true' samples. These checks help to ensure the laboratory processes are consistent. Internally driven sample reference numbers can help reconcile the replicate samples to the points they were

taken from. Another QAQC check concerns 'blank' samples, where instrument contamination, container type, environmental conditions, transport, or sample handling can affect the validity of the results. Keeping a 'blank' sample guards against outliers or extraneous results caused by handling practices. Maintaining these results in line with the associated samples shows strong data management and organisation.

In some cases, where automatic loggers are in place, data collection may stop due to instrument error or external factors. Being warned of any missing data means the organisation can review and fix problems before they become issues. Also, data may be collected by loggers at a frequency higher than the permit requires, a good monitoring plan can extract the relevant data from these large streams.

How Automated Validation Gives More Accurate and Intelligent Data

Collation of readings from spreadsheets and other manually created files for reporting is error-prone, increasing the risk of inaccurate reporting. When different labs are involved, different naming conventions for common analytes can cause confusion for anyone who's not a chemist. Combine this issue with the use of multiple units of measure, and managing discrete data streams becomes burdensome.

An automated system can store physical limits and not allow values outside a desired range (e.g. pH = 0 to 14), or outlier checking can be a moving limit. E.g. Mean of the past 2 years + 20% or mean +2 standard deviations. There is inherent need for flexibility to define data boundaries specific to the parameter and sample point (and even data source), because each combination with have different variance, normal boundary norms and accuracies.

Automation lends itself to allow for alerts regarding data input success or failure. There can be an alert that new data was committed, a summary of exceedances and breaches, and many other alerts to system processes. In this way, processes for importing and validating data can be automated, with signals indicating to the users on items that need attention. An automated system can also highlight data duplicates in case of user error either uploading a site visit twice or inputting the same data multiple times.

Pollution Alerts in Response to Rising Levels/Breaches

With an automated solution, it is possible to check all incoming data not only for abnormalities, but also for trends indicating rising pollution levels. An early alert increases the chance of mitigating pollution and accidents before they happen. A system should be able to automatically recognise increasing pollution and act on predefined processes, for example, by sending warning emails to relevant staff.

Why Security and Audit Trails are Important

Transparency of data collected and reported is key to maintaining the right to operate, particularly in environmentally sensitive areas where data is routinely scrutinised and available to the public. A system should offer a full audit trail for data updates and changes, indicating what any previous values were, and who changed them. The ability to store lab reference numbers and associated embedded PDFs for lab certificate files, adds further credibility and auditability to the data. This aspect of an automated system is one of the principal advancements over spreadsheet data tracking.

Ensuring Accurate Reports are Sent on Time

The falsification of reports risks litigation, financial fines and damage to the reputation of the company. Following the automation of data collection and validation, a management system can greatly reduce the risks of inadequate or inaccurate reporting. An accurate report might sometimes require that the collected data is reviewed prior to submittal. A system that automatically executes required and planned calculations can also enable review and rework if the data is deemed inadequate.

Often, many reports must be submitted on a schedule. A system can schedule and send an email with the required report to relevant staff or even directly to regulators. By using an automated system for delivery, there can also be a history (log) of reports sent, thus ensuring a library of generated and presented reports.

Managing Follow-on Tasks in the Event of a Breach

A workflow can be generated in an automated system which outlines the steps required following a breach. This workflow will be sent to designated user following the breach and track its completion.

Why Reliable Monitoring Data is Vital for the Mining Industry

The best way to decrease the risk of criminal charge in the event of an accident is to demonstrate a proper due diligence process and to implement an environmental management system.

Conclusions

Many mines will aim to adhere to the conditions of their permit and conduct the required monitoring, but they may fail to ensure it is completed on time with the correct data and analysis. Once recorded, some mines do not then store the results in a designated system so they cannot be retrieved if required. Having an effective and efficient system in place to manage monitoring, from planning to storing the results for analysis and reporting, is essential for several reasons. Firstly, to ensure you can prove you did everything possible to prevent it; secondly, to ensure you have plans in place to minimise the impact of your activities on the environment.

The financial risks of not having a proper environmental planning and management system for monitoring in place can be hugely significant, with Directors now at risk of being prosecuted, it has never been so important for companies to ensure they are effectively recording, monitoring and acting on data to avoid government intervention, damage to their reputation and even prosecution. Using an environmental monitoring management solution can benefit the company and its directors by:

a) Helping to ensure the plan for monitoring is adhered to and none missed

b) Reducing the risk of compliance breaches by configurable warning system

c) Increasing confidence by accurate and up-to-date reports to relevant stakeholders

d) Reducing the risk of lawsuits by maintaining a coherent audit trail of all data

e) Reducing the risk of extended responsibility by a secure and verifiable storage of historic and present environmental data

f) Removing many sources of human error by automating many tasks such as calculation, validation and reporting.

Significant monitoring plans can take time to set up and require managing, however once in place the automation provided saves a considerable amount of time and resources. It also provides an organisation with a secure, error-free system to simplify their environmental monitoring and reporting which in turn ensures their environmental accountability and ensures compliance.