The Hidden Cost of Poor Sampling in Mineral Processing Plants

Why Sampling Accuracy Directly Impacts Operational Performance and Profitability

Sampling is often viewed as a routine operational requirement within a mineral processing plant.

However, few processes have a greater influence on metallurgical accounting, reconciliation, process optimisation and financial reporting than representative sampling.

Every grade calculation, recovery figure and production report relies on the assumption that the sample accurately represents the material being processed.

When that assumption is incorrect, the consequences extend far beyond the laboratory.

Poor sampling can quietly influence operational decisions, reduce confidence in metallurgical data and ultimately cost mining operations significant amounts of money.

Sampling: The Foundation of Reliable Data

Modern mineral processing plants generate vast amounts of operational data.

This information is used to:

- Measure plant performance
- Calculate recoveries
- Monitor product quality
- Evaluate process efficiency
- Support metallurgical accounting
- Report production figures

Yet every one of these calculations begins with a sample.

If the sample is not representative, the resulting data becomes unreliable regardless of how accurate the laboratory analysis may be.

Accurate analysis of a poor sample still produces poor information.

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The Hidden Nature of Sampling Errors

One of the greatest challenges associated with sampling errors is that they are often difficult to detect.

Unlike equipment failures, sampling errors rarely generate alarms or immediate operational disruptions.

Instead, they gradually influence:

- Grade reporting
- Recovery calculations
- Metal balances
- Reconciliation results
- Production forecasts

Because the effects accumulate over time, operations may unknowingly make decisions based on inaccurate information for months or even years.

Recovery Losses and Process Optimisation

Metallurgists rely on sampling data to identify process inefficiencies and opportunities for improvement.

When sampling is inaccurate, plants may:

- Overestimate recovery performance
- Underestimate recovery losses
- Misidentify process bottlenecks
- Implement ineffective process changes

This can result in valuable opportunities for optimisation being missed.

In some cases, operations may spend significant capital addressing the wrong problem because the underlying data is flawed.

Reconciliation Challenges

One of the most common symptoms of poor sampling is poor reconciliation.

Operations often struggle to reconcile:

- Geological models
- Mine production figures
- Plant feed grades
- Concentrate production
- Final metal output

While many factors can contribute to reconciliation challenges, sampling bias is frequently overlooked.

A small sampling error introduced at the beginning of the process can create substantial discrepancies throughout the metallurgical accounting system.

Financial Consequences

The financial impact of sampling errors is often underestimated.

Consider a large mineral processing plant handling hundreds of thousands of tonnes of ore per month.

Even a small error in reported grade can influence:

- Revenue forecasting
- Production reporting
- Metal accounting
- Resource evaluation
- Investment decisions

Over time, seemingly insignificant inaccuracies can translate into substantial financial exposure.

For operations processing high-value commodities such as platinum group metals, gold or copper, the cost of poor sampling can be particularly significant.

Operational Decision-Making

Plant operators and metallurgists make daily decisions based on process information.

Examples include:

- Reagent additions
- Grinding adjustments
- Flotation optimisation
- Throughput management
- Maintenance planning

When the underlying sampling data is inaccurate, operational decisions become increasingly difficult to justify.

Good decisions require good information.

Good information begins with representative sampling.

The Importance of Reliable Sampling Systems

A properly designed sampling system should:

- Collect representative samples
- Minimise bias
- Preserve sample integrity
- Operate consistently
- Support long-term reliability

This requires attention to:

Mechanical Design

Correct cutter geometry and sampling methodology.

Sample Handling

Controlled transfer and collection of sample material.

Automation

Reliable operation and repeatable sampling cycles.

Maintenance

Routine inspections and preventative maintenance programmes.

Auditing

Periodic verification of system performance and sampling integrity.

Sampling Should Be Viewed as an Investment

Many operations focus on the cost of installing and maintaining a sampling system.

However, the more important consideration is the cost of poor sampling.

A reliable sampling system provides:

- Improved metallurgical accounting
- Better reconciliation
- Greater operational confidence
- More informed decision-making
- Enhanced process optimisation
- Reduced financial risk

Viewed in this context, sampling becomes one of the most valuable investments within the process plant.

The Role of Go-Belt® Sampling Systems

For more than 35 years, T.K.O Engineering has specialised in the design, manufacture, installation, refurbishment and maintenance of Go-Belt® Sampling Systems.

Our systems are designed to provide representative samples that support:

- Accurate metallurgical accounting
- Reliable reconciliation
- Improved operational decision-making
- Long-term process optimisation

With more than 100 successful installations across gold, platinum, copper and coal operations, T.K.O Engineering continues to support mining companies through reliable sampling solutions engineered for demanding operating environments.

Conclusion

Poor sampling rarely appears on a balance sheet as a direct expense.

Instead, it influences countless operational and financial decisions throughout the life of a mining operation.

The true cost of poor sampling is often hidden within:

- Recovery losses
- Reconciliation discrepancies
- Incorrect process adjustments
- Reporting inaccuracies
- Missed optimisation opportunities

For modern mineral processing plants, representative sampling is far more than a compliance requirement.

It is a critical component of operational performance, financial confidence and long-term profitability.

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