

Metal Accounting

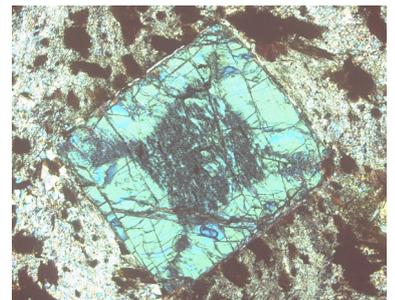
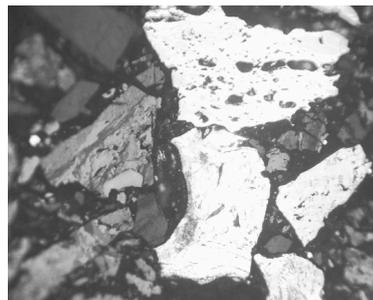
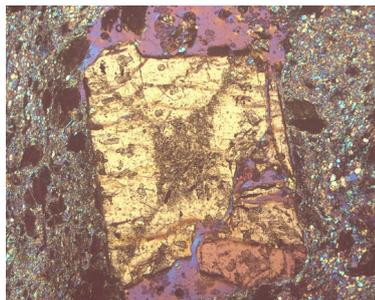
Introduction

Metallurgical accounting is an essential component for processing operations and entails tracking and measuring the progression and distribution of the target mineral/metal of interest throughout the operating process. The main purposes for this are operational and financial in nature as listed below:

- > To closely monitor key process efficiency indicators, such as recovery, that inform operational decision making
- > To ensure that accurate and precise data is reported in the financial accounts of mining and metallurgical operations, in toll treatment agreements and joint ventures; this is an indicator of best practises in metal accounting

Metal accounting spans over a wide range of technical areas namely:

- > Sampling
- > Analysis
- > Mass and volume measurements
 - Stockpiles measurement
 - Flow measurements
- > Mathematical and statistical analysis
- > Geological modelling (reconciliation)
- > Effluent characterisation



The AMIRA P754 Code of Practice for Metal Accounting

The AMIRA P754 Code of Practice for Metal Accounting was developed in the early 2000s with the objective being to develop a set of standards and guidelines for use in industry that would facilitate improving the “auditability and transparency of metal accounting from mine to product” (Gaylard, et al., 2009) thereby promoting good corporate governance.

The aim of the developed code of practise is:

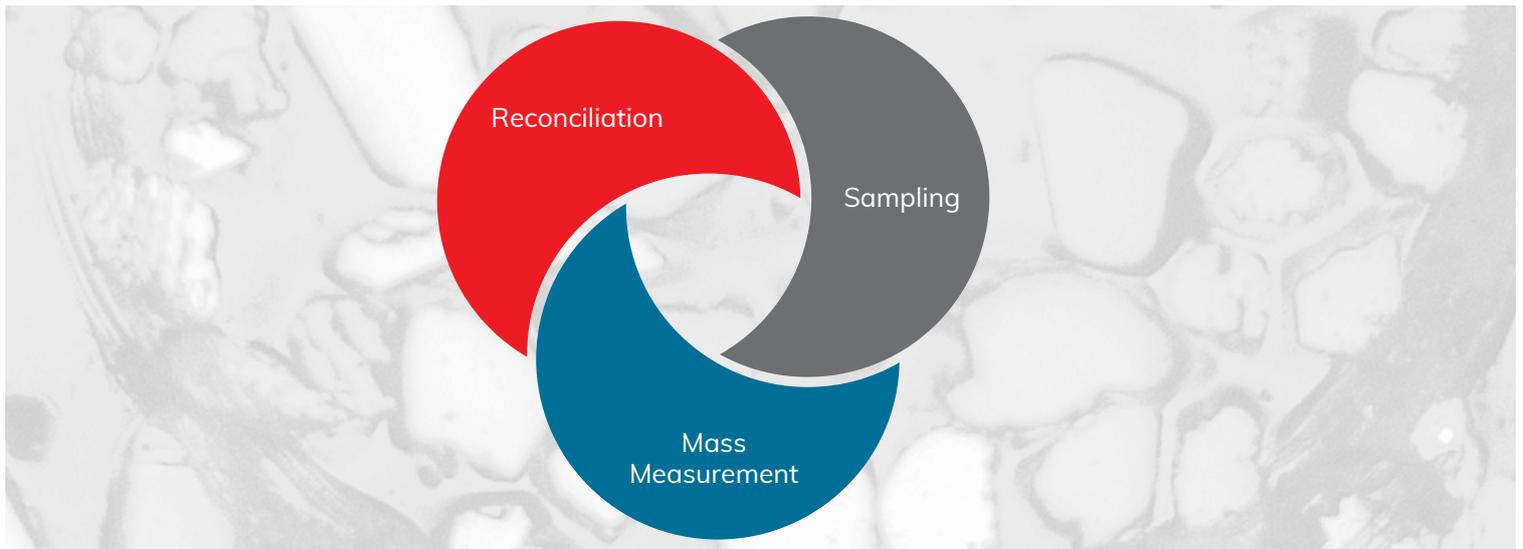


to provide standard generic procedures and guidelines for obtaining credible figures of metal quantities processed and produced, and methods for obtaining a Metal Balance, and to be recognised and accepted as the Industry standard for best practice in this area” (Gaylard, et al., 2009).

10 Principles of metal accounting (Foundational basis of the AMIRA Code, simplified)

- 1 Accurate mass and metal content measurement must be incorporated into a metal accounting system (full Check In-Check Out system) providing an ongoing metal/commodity balance; system should consist of a one-way transfer of information.
- 2 Metal accounting system must be transparent; all system inputs must be clear
- 3 Accounting calculation procedures must be aligned with code guidelines, well documented and understood by all users
- 4 The metal accounting system must undergo regular internal and external auditing to ensure compliance to code guidelines
- 5 Timeous reporting of accounting results; all accounting related investigations must include a detailed investigation report where management’s rectification responses are included
- 6 Clear procedures must be in place for instances where provisional data, due to long result turnaround times, is used and/or where rogue data from incorrect data transfer or equipment malfunction is detected
- 7 The metal accounting system must allow for data verification, metal/mineral reconciliation, error detection and measurement of data accuracy
- 8 Mass measurement, sampling and analyses must lie within specified target accuracies
- 9 Physical stock takes must be regularly performed to verify in-process metal/mineral inventory figures; procedures must define how stock adjustments (unaccounted losses or gains) are treated
- 10 The occurrence of biases from measurement, sampling and analysis activity must be rapidly identified, minimised and/or eliminated

Three Major Components of Metallurgical Accounting



Sampling, Sample Management & Analysis

Sampling, sample management and analysis procedures should minimise the occurrence of sampling biases as mentioned in Pierre Gy's sampling theory.

Sampling practises must adhere to code specifications to ensure that representative samples are taken. The minimum requirement for processing operations is to utilise mechanical auger sampling systems that can sample the entire surface area of the measured material through its entire depth.

Sample management involves ensuring that the labelling, handling and storage of samples is up to standard. This ensures that samples retain their chemical composition throughout the sampling process to give accurate results when analysed. Analytical laboratories must be clear on the analytical methods and QA/QC procedures utilised for sample analysis.

Mass Measurement

Mass measurement entails determining the mass or instantaneous flow rate of a component at a particular time in dry tons. The accuracy of the mass measurement results must lie within predefined limits. Important factors that have bearing on the level of accuracy of mass measuring equipment include:

- > Design and selection of mass measurement equipment
- > Certification and calibration of mass measurement equipment
- > Housekeeping and general maintenance of mass measurement equipment
- > Representative moisture measurement
- > Bulk and slurry density measurement

Reconciliation

Reconciliation involves conducting a comparison of metal/mineral estimates from different sources, i.e. comparing process estimates with geological model estimates. This process ensures that a balance across the value chain is conducted (Check In-Check Out system). Values are expected to lie within a defined range to be deemed acceptable.

Regular auditing of a mining operation's mineral resource is recommended to ensure that practises are maintained and data is reconcilable.

References

Gaylard, P. G. et al., 2009. *Extending the Application of the AMIRA P754 Code of Practice for Metal Accounting*. Johannesburg, The Southern African Institute of Mining and Metallurgy, pp. 15-38.

Gaylard, P. G., Randolph, N. G. & Wortley, C. M. G., 2014. Metal accounting and corporate governance. *Journal of The Southern African Institute of Mining and Metallurgy*, Volume 114, pp. 83-90.

Our Value Proposition

VBKOM is a provider of innovative business and technical consulting services and solutions for the mining and capital-intensive industries. We challenge ourselves to apply fresh thinking and to utilise our experience and technology in pioneering new ways to deliver forward-thinking solutions.

We offer complete multi-disciplinary economic studies for blue-chip mining houses, junior miners and financial institutions across the full range of mineral commodities. Due to VBKOM's diverse pool of expertise, we can offer our clients specialised skills within a one-stop-shop culture. Our engineering, risk, and project management capabilities as well as simulation and decision support expertise, make us an ideal partner to the mining, petrochemical, agricultural, and construction industries.

Our focus on long-term client relationships combined with our technical skills ensures that our clients can fully optimise their value chain.

At VBKOM the quality of our work is guided by a simple philosophy – our success is driven only by the success of our clients and the achievement of our professionals. By using cutting-edge technology and the most advanced computer modelling systems on the market our technical expertise comes unrivalled. Our capacity and continuity have earned us the trust of some of the world's most prestigious mineral resource companies. By staying true to our core values; by utilizing our vast project-specific experience and qualifications; along with applying proven world-class methodologies and processes the VBKOM team is a dynamic, flexible and innovative team with a track record standing as solid proof of our competitive edge in our field.

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