Metallurgical Accounting

An introduction to the AMIRA P754 Code of Practice

Over the last year, various articles in MMS Mag have referred to the Amira P754 Code of Practice for Metallurgical Accounting. However, very few (if any) of the articles have explored the code of practice in terms of what the implications are for existing, as well as new, metallurgical operations, should such an operation wish to become compliant. This article is aimed at introducing metallurgical management teams to the code, and is based on the ten principles it contains. But first some background…

By Dr Wynand van Dyk

Background to the code

With the globalisation of companies and world markets, there has been an ever increasing requirement for companies to adhere to good corporate governance principles. These principles were initially focused around financial reporting (for example IFRS and Sarbanes Oxley), and later evolved to triple-bottom-line reporting. However, for mining companies, no act or code of practice existed for the accounting of the metals produced and the metals in the process.

This is indeed peculiar, as the accuracy of metallurgical accounting directly impacts the profit and loss statement of any metallurgical operation. Not only is the metal produced the source of income for the operation, but the cost of sales is directly influenced by possible royalty payments, performance payments, feedstock purchases and environmental penalties. In addition, any metal inventory should be accounted for (and valued) to reflect the associated asset value on the balance sheet of the operation.

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This shortcoming was recognised at the "Challenges in Metallurgical Accounting and Information Management" symposium held in Cape Town during August 2001. AMIRA International subsequently drafted a proposal entitled "P754 – Metal Accounting and Reconciliation", which was accepted by five main sponsors, namely Anglo American, Anglo Platinum, BHP Billiton, Kumba Resources and Rio Tinto.

During August 2004, a team under the leadership of Prof. Peter Gaylard of the University of Cape Town was commissioned to develop a code of practice for metallurgical accounting, culminating in the first release of the code published during October 2005. The code is currently in its third release, dated February 2007.

Although the code has not been formally adopted by any industry association (or sponsor) to date, it is already viewed by many as the industry benchmark/best practice for creating and reconciling metal balances. It has, however, not been accepted by any regulatory bodies, nor is it incorporated in the listing rules of any stock exchanges. The code is therefore not a legal standard in relation to metallurgical accounting and is therefore non-binding. However, as good corporate governance principles are continuously being tightened worldwide, it is only a matter of time before metallurgical accounting will be subjected to the same rigour, discipline and transparency as financial accounting. It can therefore be expected that the AMIRA P754 code of practice will eventually be regarded as highly as the JORC and SAMREC codes produced for the reporting of mineral resources and ore reserves.

At the heart of the proposed code for metallurgical accounting are 10 principles. During April 2008, MMS Consultants developed an easy to use audit system to audit the metallurgical accounting systems of clients against the AMIRA P754 code of practice. In order to make the system user friendly, the 10 principles were re-arranged and/or re-grouped, while maintaining the original intent of the overall code of practice.

Principle 1: Accurate and precise measurements

As with any system, the age old principle of "garbage in, garbage out" applies equally well to metallurgical accounting. However, what makes metallurgical accounting unique is that both the accuracy and precision of each measurement system is important. In order to determine the metal content of a specific stream over a specific time-frame, the gross mass of the stream must be measured. At the same time, a representative sample must be taken from the stream for analysis. This sample needs to be dried and sub-sampled in order to prepare it for the analysis step, followed by the actual analysis.

It is therefore clear that a sample is taken from the overall population, and that such a sample is sub-sampled at least once. Since the accuracy of the measurement is determined by how closely the value of the sample represents the true value of the population, it is clear why the accuracy of the measurement system is so important. However, the precision (or the ability of the measurement system to replicate the measurement value) is just as important, as this drives the standard deviation of the measurement system, which in turn drives the error associated with the system.

All the equipment and procedures used to obtain a measurement in the metallurgical accounting system must therefore be designed to achieve an accurate result,

with traceability back to the relevant international standard units of measure. In addition, the actual accuracy of each system must be measured on at least an annual basis, with the calibration results retained for statistical analysis.

Furthermore, the precision of each measurement system must be monitored on an on-going basis through the application of statistical analysis techniques.

Principle 2: Data management
A metal accounting system must be capable of extracting process data from various sub-systems (for example PLC or DCS systems and a laboratory management system) with minimal human intervention, thereby ensuring "one version of the truth" and complete transparency back to the source of all data. This can only be accomplished by following the principle of "single point entry of data", followed by the integration of the relevant data to a single user interface. As spreadsheets should be avoided as far as possible, various commercially available software packages have recently become available to answer this need.

Principle 3: Procedures
In too many instances, the responsibility for the metallurgical accounting system is delegated to a junior metallurgist, who invariably has to rewrite an existing spreadsheet to accomplish his/her goal. This doom-loop is usually required, as the system was poorly documented in the first place, with limited procedures being available and the previous spreadsheet not being user friendly. Apart from the requirement of documenting the accounting procedures, the code of practice contains calculation procedures for plant recovery and efficiency. The procedures must be applied consistently at all times and must contain clear rules for the handling of erroneous data.

Principle 4: Audits and risk management
As with financial accounting, the metallurgical accounting system must be subjected to regular internal and external audits against the procedures documented under principle 3 above. Exception reports must be created for any deviations. In addition, the entire system must be subjected to regular and frequent management reviews. Such reviews must include a formal risk assessment and associated recommendations for risk mitigation when the agreed risk level is exceeded. During the risk review process, the levels of accounting uncertainty for each target element should be formally approved based on the financial risk associated with the agreed uncertainty.

Principle 5: Reporting
Without clear, concise and timeous reports, all the effort expended in generating accurate metallurgical accounts will be in vain. Any anomalies, inconsistencies and problem areas in the reported data should be highlighted automatically. The reports must be "cast in stone" and any alteration of data must be clearly logged. The annual metallurgical accounts must be reviewed and signed off by the metallurgical accounting committee and approved by the audit committee or board of the company.

Principle 6: Governance
Under the code, a competent person with the relevant experience and expertise should be appointed who will accept the overall accountability for the system. The competent person should be independent from the operation concerned and must review and approve all changes to the metallurgical accounting system. Furthermore, authority levels must be clearly defined for any changes in the source data of the system, and such changes must be supported by documented technical evidence as to why the changes are required. Ultimately, changes should be signed off by the competent person, and changes resulting in a material impact on the financial accounts must be submitted to the audit committee for final approval.

Principle 7: Data validation, reconciliation and metal balance
The metallurgical accounting system must produce a commodity/metal balance for the operation, based on a full check-in, check-out system (i.e. all streams into and out of the operations are measured, sampled and analysed). Due to the inherent inaccuracies of the measurement systems, the check-in, check-out system will create an imbalance which should be treated as an unaccounted for loss or gain.

Furthermore, the system should be capable of automated data validation of the source data to minimise the occurrence of spurious errors.

About the author

Dr van Dyk was one of the thought leaders for the Lonmin automated metallurgical accounting system, which was featured in the November 2007 issue of MMS Mag. In addition, he has more than 15 years of project management, process design and operational experience in the mining industry, and is currently a process consultant at MMS consultants.

Principle 8: Accuracy and the propagation error
Each measurement of metal content contains some error/uncertainty due to the reasons described under principle 1 above. The level of error/uncertainty associated with each target element, as well as the error associated with the reported recoveries, must be calculated and reported to the audit committee of the company. Similarly, the uncertainty associated with the stock take must be calculated and reported.

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Principle 9: Stock and unaccounted losses/gains
The calculated in-process inventory of metal must be confirmed on at least an annual basis by a physical stock-take. As described under principle no 7, the check-in, check-out system coupled with the physical stock-take will produce an imbalance in metal, which should be declared as an unaccounted loss or gain. The necessary procedures and authorities required to adjust stock levels should therefore be in place.

Principle 10: Quality and continuous improvement
As with any system, a formal continuous improvement programme must be in place around the metallurgical accounting system. The programme should focus on identifying any source of bias in the individual measurements, as well as increasing the precision (and thereby reducing the error level) of measurements.

From the above discussion it should be clear that the requirements of the AMIRA P754 Code of Practice demand much more than just an automated software system. Without a clear overarching strategy in place, significant time and effort can be wasted in an attempt to achieve compliance. MMS Consultants is well positioned to assist metallurgical operations with either training, audits or the development of a strategic route map to achieve compliance in as cost effective a manner as possible.

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