Data Management and Metadata: The impact on Metallurgical Accounting

In any metallurgical accounting system, process data must be gathered from various sources, including plant historians, SCADA/DCS systems, laboratory information systems and even manual entries. The collation, management and processing of such diverse data typically requires the majority of the effort in generating the metal accounts for a company.

By Dr Wynand van Dyk

WITHOUT a well designed data management system, which includes the management of metadata associated with the process data, significant risk can be added to the accuracy and precision of the metallurgical accounts, not to mention time and human effort to compile the accounts. No wonder this key aspect is at the heart of the second principle of the AMIRA P754 code of practice for metallurgical accounting.

Automated data management

The aim of a metallurgical accounting data management system should be to integrate process data from various sources into a single data file and user interface. For example, the system should integrate mass flow data residing in the plant historian and assay data residing in the LIMS system, into a single data file. Although this sounds easy, one should bear in mind that the resolution and timestamps of such data can differ vastly. Whereas the mass flow data is collected in real-time at millisecond resolution from the PLC/DCS, the assay data is typically available after 2 to 3 days and is based on an 8 hour composite shift sample. The data management system should therefore be able to roll-up and integrate the data as per the predefined metallurgical accounting periods.

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The data management system should furthermore obtain the data from the various source input systems without human intervention, thereby ensuring a single source of data entry and preventing spurious errors during manual data transcription. In addition, the system should also have drill-down capacity to the raw data in order to enable the analysis of errors inherent in the raw data.

Judged against these requirements, it must be said that most of the metallurgical accounting systems used by mining companies today fall considerably short of the AMIRA P754 Code of Practice. This is mainly due to the majority of mining companies still relying on people using spreadsheets to integrate process data and to generate their metallurgical accounts.

The use of spreadsheets introduces significant risk into the metallurgical accounting system, as cross-file links are easily corrupted, they do not allow for controlled data entry and users can inadvertently type over data. More importantly, human beings are prone to making spurious errors during manual data transcription. In addition, very few spreadsheet based metallurgical accounting systems collect metadata.

Metadata

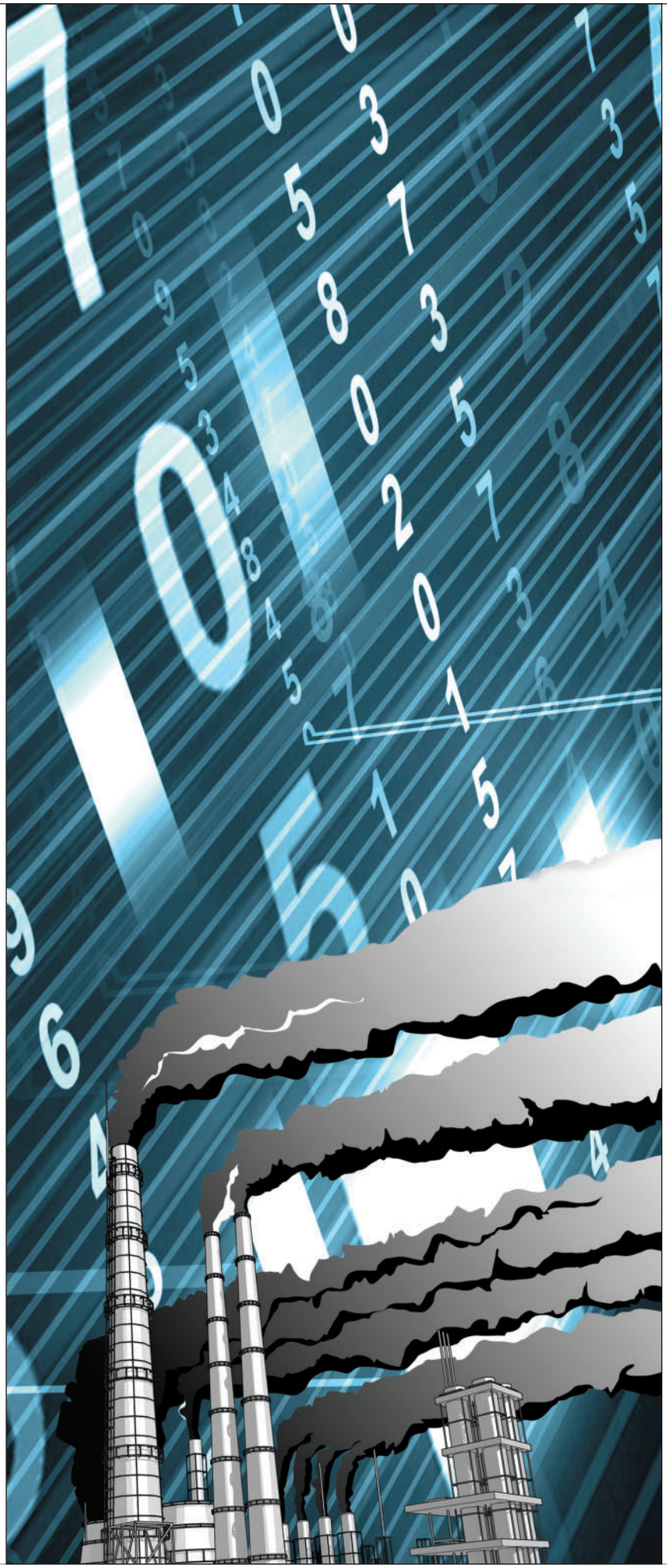
Metadata can be defined as data about the data that is being used for the various calculations in the metallurgical accounting system. Metadata should be collected to ensure:

- transparency of the data
- that limitations of the data are apparent, and
- to enable the accuracy of the data to be determined

The first set of metadata which should be collected is the metadata associated with the measurement and sampling systems of the primary metallurgical accounting points. The data should include a description of the equipment being used, as well as any changes made to such equipment, including maintenance tasks conducted. In addition, all data obtained during equipment calibration must be recorded in the data management system. Such data should be used for statistical analysis to assess any bias present, and to calculate the precision of the equipment and the likely error associated with the measurement and sampling equipment.

The second set of metadata which should be collected is the metadata associated with the sample preparation and analysis process. The data should include how a sample is prepared and the analytical procedure being used, including any modifications to such procedures. In addition, the precision, accuracy, repeatability and reproducibility of the method and the limits of detection must be determined from the calibration data which is stored in the data management system.

The third set of metadata which should be collected is the metadata associated with the data management and data processing system per se. This metadata should include a clear description of the different stages of how the data is collected and processed, including all the algorithms and statistical analysis being used. In addition, all calculation formulas (and changes thereto) must be documented.



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Software pitfalls

Given all of the above requirements, it is easy to see why there has been a significant increase in metallurgical accounting software systems (and vendors) available in the market – it is simply not possible to manage all of this data, and all the calculations involved, in a manual spreadsheet environment. It is therefore strongly recommended that mining companies invest in such software systems as a step on the journey toward becoming compliant with the AMIRA P754 code of practice.

However, these systems are not without pitfalls:

- By removing humans from the data collation and data entry process, the manual data validation role (albeit based on experience and "gut feel") disappears. The system should therefore include an automatic data validation function, based on built-in statistical techniques and range-checking of data.
- Data and documentation files must be backed-up on a regular basis, with the same rigor as is being applied in the financial systems of the company.
- Lastly, disaster recovery systems must be thoroughly tested and the results documented.

By keeping these pitfalls in mind, a well-designed data management software system can significantly reduce the risks associated with data collation and integration in the highly complex environment of metallurgical accounting.

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Dr van Dyk was one of the thought leaders for the Lonmin automated metallurgical accounting system, which was featured in the December 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.