Coal

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Preamble
Coal depositional environments and processes for coal accumulation include aspects that are fundamentally different from those that apply to most other mineral deposits, especially to metals deposit equivalents. Because of these geological factors and since coal is a low unit-value, bulk mining material, some procedures for the documentation of the geology and resources of coal deposits have evolved that are specific to the needs of the coal Industry. Geological Survey of Canada Paper 88-21, "A Standardized Coal Resource/Reserve Reporting System for Canada", is referenced by National Instrument 43-101 for the preparation of MRMR estimates on coal deposits. GSC Paper 88-21 outlines definitions, concepts and parameters used to determine coal resource and reserve quantities, and provide a framework to facilitate consistent categorization of coal quantities found within various depositional and tectonic regimes.

With respect to coal MRMR estimation and reporting, the standards in GSC Paper 88-21 supersede the preceding Best Practice Guidelines. GSC Paper 88-21, includes some concepts and procedures that are significantly different from those of the CIM Standards. While it is essential that the full text of GSC Paper 88- 21 be consulted for details, the four major differences between the preceding Best Practice Guidelines and GSC Paper 88-21, apply to the following aspects:

- Resource/Reserve Classification;
- Economic Evaluation Reports;
- The application of mining criteria to coal resource estimation; and
- Methods and Procedures of Evaluation

Definitions and Concepts

Unlike the CIM Standard, GSC Paper 88-21 describes a coal resource classification system with four subdivisions. The four classes include Measured, Indicated, Inferred and Speculative. The list in this order represents decreasing available data for resource evaluation and a progressive decrease in the confidence level that can be given to the estimates that are made. The inclusion of the Speculative class recognizes that coal deposits tend to be geologically continuous over much larger areas than most other types of mineral deposits, even if the character of the coal zones change through such processes as "splitting" and "seam thinning". The criteria that should be applied to the determination of each coal class are fully described in GSC Paper 88-21.

In GSC Paper 88-21 the distinction between the classification of estimated coal tonnage depends on whether work to determine the economic merits of the deposit has been completed or not. This work specifically includes mining engineering evaluations and, most importantly, the preparation of an appropriate cash flow analysis. These aspects are normal components of both feasibility studies and preliminary feasibility studies. When GSC Paper 88-21 was prepared, no distinction was made between these studies, and the existence of either was intended to be the basis for the definition of resources as reserves.

To be able to define reserves in a given coal deposit, it is necessary to have performed at least a preliminary feasibility study on the deposit. GSC Paper 88-21 specifies the use of numerous mining criteria for the definition of in place coal tonnage estimates as resources. While there is an economic element associated with the application of each of these, the use of them for resource estimation purposes is not intended to define the economic merits of a particular coal deposit nor to be used as a substitute for the completion of a feasibility study.

The use of these criteria is only intended to limit the inclusion of resource material to that which may qualify as, or have potential to be classified as a reserve in the future. The parameters address both underground and surface mining methods and include criteria for limits to seam thickness, depth and distances from points of observation. The determination of density in coal is also discussed. For surface mining resource estimation, values for the limits to cut-off strip ratios are also provided.

Resource Database

Potential mining targets for coal often cover very large areas compared with those of metal equivalents. It is quite common to have drilling data for a single mining target with hundreds or even thousands of drill holes. Different evaluation aspects of a single mineable deposit, such as geophysical logging, mapping, drilling, coal quality and geotechnical data collection, may also be obtained in different exploration programs or seasons. These aspects may impede the practical ability to incorporate all exploration data for a particular mining deposit into a single, fully integrated database; it is frequent industry practice to perform coal evaluations using several separate databases.

Methods of Testing and Analysis

The Coal Industry generally uses “ASTM standards Volume 05.06 - Coal and Coke” as its standard relating to all its analysis of coal and related products. The standards in this volume cover the areas of sampling, sample preparation, assaying and data presentation. ASTM (the American Society for Testing and Materials), founded in 1898, is a scientific and technical organization formed for “the development of standards on characteristics and performance of materials, products, systems, and services; and the promotion of related knowledge.” It is the world’s largest source of voluntary consensus standards.

The Society operates through a system of main technical committees and subcommittees whose function is to review and update the standards where necessary that ensure balanced representation among producers, users, general interest, and consumer participants.

Reference: Annual book of ASTM standards Volume 05.06 Coal and Coke. ASTM stands for American Society for Testing and Materials. Accurate coal tonnage estimates are very dependent on the use of the correct factors for volumetric conversion. GSC Paper 88-21

includes a discussion of this issue and the use of bulk density values to make the correct conversion. It is important the QP realize that Bulk Density and Specific Gravity of coal are parameters with very different values. In no circumstances should specific gravity values be used as a substitute for bulk density to estimate coal tonnage. Geophysical logging of coal exploration holes should be performed as best practice in jurisdictions where it is not legally required. QA/QC procedures for these activities should be followed.

Geological Interpretation

A fundamental concept in coal resource classification under GSC Paper 88-21 is the geological complexity of a deposit, which determines the parameters used to categorize resources according to the probable mining method, assurance of existence and feasibility of exploitation. Geological complexity addresses differences in the complexity of seam geometry within coal deposits. These differences may result both from sedimentary processes at the time of deposition and from subsequent deformation, which may have folded and faulted the coal measures. Primary categories are termed low, moderate, complex and severe. The low category is further subdivided into three subdivisions termed A, B and C based on the sedimentologically controlled complexity of seam geometry.

Production / Reserve Reconciliation

The QP should ensure that in operating mines, appropriate procedures are in place and maintained to monitor production results. In particular, the operating data that relate to the factors and parameters by which in-place reserves are converted to recoverable and saleable reserves should be collected and reviewed on a regular basis. These should include but not be limited to:

- bulk density
- minimum mineable coal thickness
- maximum parting thickness
- waste rock dilution
- mining recovery factors
- processing recovery factors
- environmental considerations

In more complex geological settings, detailed structural information obtained during production activities may give cause to a re- interpretation of adjacent mineral reserves. At least once a year, the QP should review the results of the production monitoring program and re-evaluate the validity of the parameters used in the MRMR estimates.