COMMITTEE FOR MINERAL RESERVES INTERNATIONAL REPORTING STANDARDS

ICMM
International Council on Mining & Metals

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CRIRSCO Best Practices

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Workshop on Polymetallic Nodules Resource Classification
International Seabed Authority & Ministry of Earth Sciences, Government of India
Goa, India, October 2014

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Presentation Outline

- Best practices in the public reporting of Exploration Results, Mineral Resources and Mineral (Ore) Reserves
- Best practice in the estimation, classification and monitoring of Mineral Resources and Mineral (Ore) Reserves
- Canada's additional activities
- Australia's additional activities
- Other activities

CRIRSCO

- CRIRSCO's main objective is to promote best practice in the international public reporting of Mineral Exploration Results, Mineral Resources and Mineral Reserves.

- CRIRSCO is an international advisory body without legal authority, relying on its constituent members to ensure regulatory and disciplinary oversight at a national level.

- It recognises the truly global nature of the minerals industry and the agreed need for international consensus on reporting standards.

CRIRSCO Members and Potential Members

Current Members	Potential New Members	
Australasia (JORC)	Argentina	Scandinavia
Canada (NI 43-101, CIM)	China	Colombia
Chile (Certification Code)	Indonesia	
Europe & UK (PERC)	Mongolia	
Russia (NAEN)	Peru	
South Africa (SAMREC)	Philippines	
USA (SME)	Turkey	

Best Practices in Public Reporting

- Represented by each of the CRIRSCO member countries' codes / standards, and the International Reporting Template
- Main purpose of these codes / standards is to:
  - Provide minimum standard for reporting of Exploration Results, Mineral Resources and Mineral (Ore) Reserves
  - Ensure that Public Reports on these matters contain all the information which investors and their advisers would reasonably require for the purpose of making a balanced judgement regarding the results and estimates being reported
- Underpinned by Competent or Qualified Person system, which is based on concept of **Responsibility with Accountability**

Best Practices in Estimation, Classification and Monitoring

- Achieved by:
  - Table 1 of most codes / standards and International Reporting Template providing a checklist of all important criteria
  - Separate Best Practice guidelines (Canada)
  - Support for industry publications which provide up to date, peer reviewed technical papers on best practice (Australia)
  - General body of industry publications

Table 1 of Reporting Standards

Sampling Techniques and Data	Sampling techniques I Drilling techniques I Drill sample recovery I Logging
	Sub-sampling techniques / sample preparation I Quality of assay data & laboratory tests
	Verification of sampling and assaying I Sample security I Location of data points
	Data spacing and distribution I Orientation of data in relation to geological structure
	Audits or reviews
Reporting of Exploration Results	Mineral tenement and land tenure status I Exploration done by other parties. Geology.
	Drill hole Information I Data aggregation methods
	Relationship between mineralization widths and intercept lengths
	Diagrams I Balanced reporting I Other substantive exploration data I Further work.

Table 1 of Reporting Standards

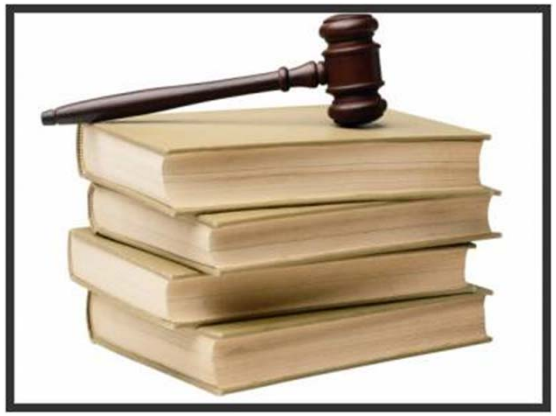
Estimation and Reporting of Mineral Resources	Database integrity I Site visits I Geological interpretation I Dimensions
	Estimation and modelling techniques I Moisture I Cut-off parameters
	Mining factors or assumptions I Metallurgical factors or assumptions
	Environmental factors or assumptions I Bulk density I Classification
	Audits or reviews I Discussion of relative accuracy/ confidence
Estimation and Reporting of Ore Reserves	Mineral Resource estimate for conversion to Ore Reserves I Site visits I Study status
	Cut-off parameters I Mining factors or assumptions I Metallurgical factors or assumptions
	Environmental I Infrastructure I Costs I Revenue factors I Market assessment
	Economic I Social I Classification I Audits or reviews I Other
Estimation and Reporting Diamonds & Other Gemstones	Indicator minerals I Source of diamonds I Sample treatment I Carat I Sample grade
	Reporting of Exploration Results I Grade estimation for reporting Resources / Reserves
	Value estimation I Security and integrity I Classification

Canadian NI 43-101

- "*Standards of Disclosure for Mineral Projects*".
- Set of rules and regulations under the Securities Act.
- Governs how mining companies publically report and display technical information about their mineral projects to the Canadian public.
- Requires that disclosure is based on reliable information, reflecting professional opinions, using standardized terms and definitions.
- Purpose is to protect investors and enhance the accuracy and integrity of public reporting in the mining industry.

Core Principles of NI 43-101

Qualified Person



Standards & Best Practices

Technical Report

"Disclosure with professional accountability"

Canadian Mining Technical Standards and Best Practice Guidelines

- CIM Definition Standards for Mineral Resources and Mineral Reserves (2014).
- CIM Estimation of Mineral Resources and Mineral Reserves Best Practice Guidelines (2003).
- CIM Exploration Best Practice Guidelines (2000).
- CIM Best Practice Guidelines for Mineral Processing (2011).
- CIMVAL Standards and Guidelines for Valuation of Mineral Properties (2003).
- GSC Paper 88-21: A Standardized Coal Resource/Reserve Reporting System for Canada (1988).

Australia
AusIMM Good Practice Monographs

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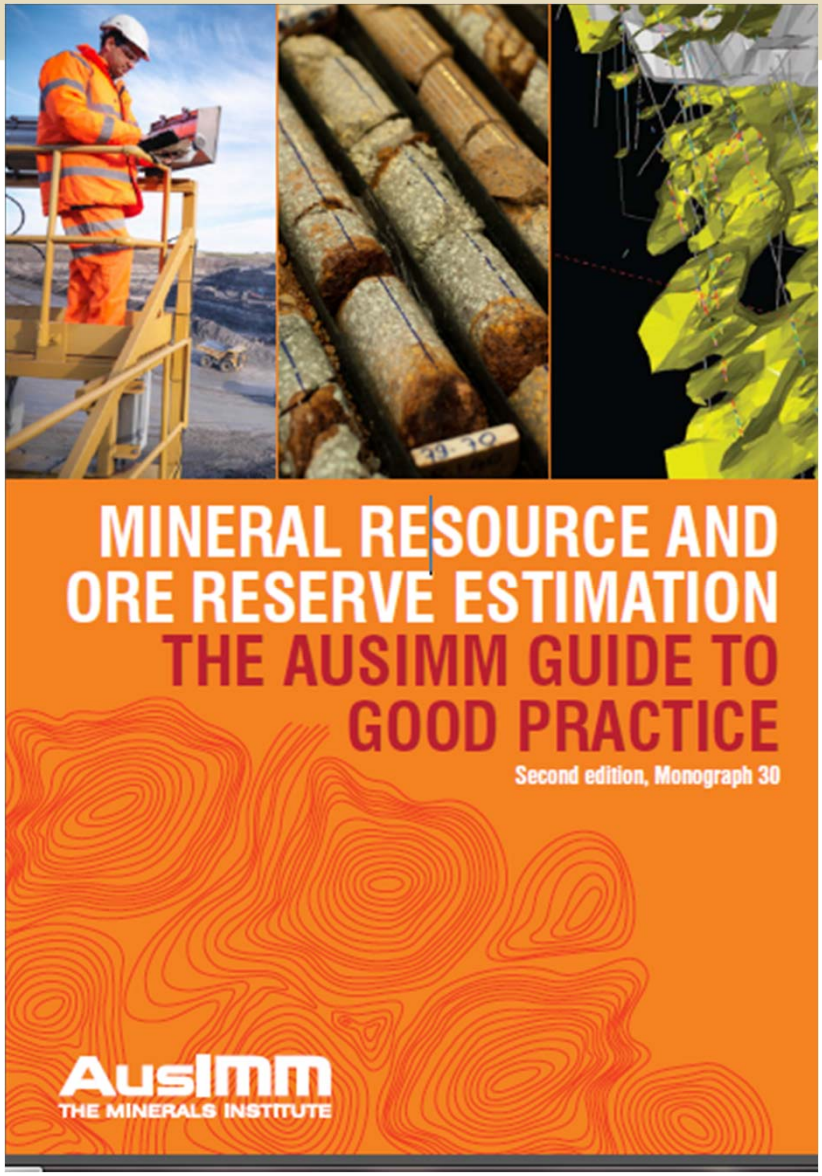

AusIMM Monograph 30. Chapter 2 – Papers on Resource Database

1. “Design Principles of Relational Databases and Management of Data Flow for Resource Estimation”
2. “Sampling and Analysis Protocols and Their Role in Mineral Exploration and New Resource Development”
3. “Geological Data Collection for Reliable Coal Resource Estimation”
4. “A Review of the Reliability and Validity of Portable X-Ray Fluorescence Spectrometry (pXRF) Data”
5. “How Sampling Biases Can Induce Decision-Makers to Make Wrong Decisions – An Introduction to Qualitative Sampling Theory”
6. “Practical Considerations and Shortcuts in Sampling”
7. “Geostatistical Criteria for Choosing an Optimal Ratio between Quality and Quantity of Samples – Method and Case Studies”
8. “Measurement of Bulk Density for Resource Estimation – Methods, Guidelines and Quality Control”
9. “Collection of Geotechnical Data from Drill Holes”
10. “Use and Abuse of Oriented Drill Core”

AusIMM Monograph 30. Chapter 4, Papers on Mineral Resource Estimation

1. “Mineral Resource Estimation of the Brockman 4 Iron Ore Deposit in the Pilbara Region by Rio Tinto Iron Ore”
2. “Multivariate Iron Ore Deposit Resource Estimation – A Practitioner’s Guide to Selecting Methods”
3. “Tropicana Gold Mine, Western Australia – A Case Study of Non-Linear Mineral Resource Estimation”
4. “Estimation of Underground Mineral Resources at the Sunrise Dam Gold Mine – A Case Study in Risk Management”
5. “Mineral Sands – Some Aspects of Evaluation, Resource Estimation and Reporting”
6. “A Practitioner’s Guide to the Identification, Classification and Estimation of Inventory Coal and Coal Resources”
7. “A Practitioner’s Guide to Recoverable Resource Estimation Using Localised Uniform Conditioning”
8. “Resource Estimation in Folded Deposits – A Review of Practice and Case Studies”
9. “Drilling of Mineral Resources – Towards Better Investment Decisions”

AusIMM Monograph 30. Chapter 6 – Papers on Ore Reserve Estimation

1. “Feasibility Studies – Scope and Accuracy”
2. “Reflections on Front-End Loading in Mine Project Development”
3. “Whittle Optimisation – The Money Mining Methodology and Its Impact on Ore Reserves”
4. “Maximising the Value of Open Pit Gold Reserves – Where Are We Getting It Right?”
5. “Block Caving Software – Practical Applications”
6. “Reserve Estimation for Block Cave Mines Using PCBC”
7. “Geotechnical Modifying Factors to Be Considered When Determining the Status of Longwall Reserves”

Other Activities

- All CRIRSCO-aligned countries encourage Competent / Qualified Persons to become proficient in the estimation of Mineral Resources and Reserves
- In Canada, CIM will release drafts of new Best Practice Guidelines for Prefeasibility Study and Feasibility Study in December 2014
- In Russia, geology and mining practice is integrated in the State expertise methodological documents for various types of minerals, which guide the estimation of Russian mineral deposits
- In USA, SME is in the process of preparing a best practice manual

Best Practices in Exploration, Resource & Reserve Estimation of Polymetallic Seabed Nodules

- **Suggested that, if a small group or sub-committee is appointed to produce recommendations on the extension of the IRT to polymetallic seabed nodules, it also be charged with developing Best Practice Guidelines on exploration, Mineral Resource and Mineral Reserve estimation for polymetallic seabed nodules.**


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Thank You