

Geology and Mining: Mineral Resources and Reserves: Their Estimation, Use, and Abuse
Appendix Table A1

Appendix Table A1. Information Typically Contained Within Resource or Reserve Reports (adapted from SME, 1999, and AusIMM, 2014)

Criteria		Information contained	Specific application to mineral resources	Specific application to mineral reserves
Contextual information	Purpose of report	Why report was prepared, nature of evaluation, work undertaken, work remaining	See Information contained	See Information contained
	Project description, location, and ownership	Description of commodity, size of project, background information, business arrangements, location (including map; ownership of surface, mineral, access rights, leases, concessions, royalties, and any other liabilities that may affect project)	See Information contained	See Information contained
Project data	Location data	Maps, cross sections, and other 2-D and 3-D visualizations depicting project, including sampling and drill hole locations and surveys, previous workings, etc.	Accurate sample and drill collar locations and other relevant features; downhole surveying reviewed and commented on	See Specific application to mineral resources
	Geologic data	Nature, detail, and reliability of geologic information, including rock types, structures, alteration, and relationships to areas of known mineralization; describe geophysical and geochemical data; support interpretations with geologic maps, cross sections, and block models as appropriate	Focus on drill hole and sample information; discuss drill hole logging method and how geologic data obtained and recorded; discuss significant data that could materially influence resource reporting	See Specific application to mineral resources
Sampling	Methods	Describe sampling approaches, types of samples (e.g., grab, trench, channel, chip, drill core, bulk, etc.); discuss sample quality, representativeness, e.g., drill core recovery, high grading, loss or contamination, or other factors that may bias the sampling; comment on use of sample duplicates or alternative methods of sampling to check sample quality; describe indirect sampling methods (e.g., geophysics) plus uncertainties	Sample quality and quantity is critical to generate precise and accurate resource estimates; attention must focus on this information	See Specific application to mineral resources; adequate sampling quality control and assurance is required for ore reserve reporting, including satisfactory duplicates and blanks, and appropriate statistical analysis
	Sample preparation	Describe laboratory and approaches used for preparation, including subsampling and splitting of samples, crushing, milling, and other size reduction approaches used; whether inadequate or unrepresentative sampling approaches used, and likely effects; were analyses made to verify representative sample preparation (e.g., duplicate analyses from different stages of sample preparation)?	Verification of suitability of sample preparation required for reporting mineral reserves	See Specific application to mineral resources
	Sample analysis	Describe laboratory for sample analysis and methods (e.g., fire assay, ICP-MS, etc.), plus precision, accuracy, and limitations of approaches, including QA/QC data and approaches, and results of round-robin check analyses by laboratory	Verification of analytical techniques and QA/QC programs required for reporting mineral reserves	See Specific application to mineral resources
	Specific gravity and bulk tonnage calculations	Discuss details of specific gravity measurements and assumptions, and how bulk tonnage calculations were made; were different specific gravity values used for different parts of the deposit and why	Specific gravity measurements and bulk tonnage calculations must use approaches that include void spaces, and differences between rock types and alteration zones	See Specific application to mineral resources
Interpretation	Geologic interpretation and block modeling	Describe geologic model and associated inferences; data density and reliability, if data are of sufficient quality and quantity to support statements and calculations made or inferred, and effects on economic potential of deposit	Discuss if data (i.e., density and quantity of data) assures continuity of mineralization and provides adequate database for numerical modeling and calculations required for resource estimation; discuss if interpretations based on data or assumptions and if alternative models considered	See Specific application to mineral resources

Appendix Table A1. (Cont.)

Criteria		Information contained	Specific application to mineral resources	Specific application to mineral reserves
Interpretation	Numerical modeling	Detailed descriptions of the numerical modeling approaches used (e.g., inverse distance weighting, Kriging) and assumptions and calculations used to estimate tonnages and grades; outline geologic controls used for resource estimates and if grade cutoffs used (e.g., to remove nugget effects), plus details of computing packages, including parameters used; describe details of geostatistical approaches (including variograms), discuss compatibility with geologic interpretations in report; justify methods used. QC/QP(s) Competent/Qualified Person(s) list previous experience with the use of these geostatistical approaches on similar deposits	See Information contained	See Information contained
Extraction	Mining methods	Describe mining factors that could have an impact on project feasibility	Discuss possible mining methods in order to assess RPEEE	Describe and justify chosen mining methods, including mining rate and plans, equipment, ore control approaches, geotechnical and hydrological information, personnel, and dilution related to waste rock, etc.; discuss open pit or underground mine design, including slope stability, bench heights or mining widths and relationship to cell sizes in block model, strip ratios, rock mechanics, mine design, and ventilation as appropriate
	Mining costs	State reasonable assumptions relating to the cost of mining	See Information contained in order to assess RPEEE	Describe and justify mining costs
	Mineral processing methods	Outline mineralogical or processing factors that may affect project feasibility	Describe mineral processing factors that could affect project feasibility, including discussion of possible processing approaches in order to assess RPEEE	Describe and justify processing method(s), processing capacity and personnel, recovery estimates and basis of these calculations and estimates (e.g., laboratory or pilot plant testing)
	Mineral processing costs	State reasonable assumptions of the costs of mineral processing	See Information contained	Describe mineral processing costs and methods used in detail to determine aspect of economic feasibility of project
	Recovery during mining	State reasonable assumptions of recovery rate during mining	See Information contained in order to assess RPEEE	Estimated tonnages, grades, and mineral abundances must account for dilution during mining and other losses; describe and justify mining-related dilution and other losses
	Recovery during mineral processing	Stated reasonable assumptions of the recovery rate during mineral processing	See Information contained in order to assess RPEEE	Should discuss whether reported tonnages and grades consist of material in situ or whether processing recoveries are considered and included; any reporting of in situ value must be accompanied by information outlining expected mineral processing recovery and associated justifications
	Environmental and social compliance and reclamation	Describe key factors that may adversely affect project	Describe key factors that may adversely affect project feasibility and discuss possible mitigations	Outlining of permits and agreements that are required, including those that have been obtained and an indication that those that are still required can be completed in a timely manner; should include descriptions of environmental and social compliance methods and costs
	Cutoff grade	Justification of the cutoff grade used	See Information contained, absolutely critical to assess RPEE	Description and justification of the methods used to determine cutoff grades

Appendix Table A1. (Cont.)

Criteria		Information contained	Specific application to mineral resources	Specific application to mineral reserves
Feasibility	Other economic considerations	Description of valuable and potentially valuable products, including suitability of products for existing and developing markets	Mineral resources are metal concentrations of economic interest with grade, quality, and quantity, suggesting reasonable prospects for eventual economic extraction; consideration should be given to this definition before the formal reporting of mineral resources and an explanation of the basis of the RPEEE conclusion provided in the public reports	Ore reserves are the economically mineable part of resources that include assessment of material dilution and losses during extraction, available mining, processing, and metallurgical technology, and infrastructure, economic, marketing, legal, environmental, social, and governmental factors; should include descriptions of the products to be sold, whether markets for this product already exist, and whether contrasts for sales or off-taking of products have been agreed or are expected to be easily obtained; justifications of assumptions relating to production cost and value of product need to be outlined, and should consider transport, marketing, and other associated costs; requires a prefeasibility or feasibility study
	Economic feasibility	Should state reasonable assumptions used during assessment of the economic feasibility of the deposit	See Information contained	Detailed descriptions of the approaches used to determine the economic feasibility of the project should be provided
Assurance classification		Description and justification of the criteria used to classify resources or reserves, including whether the data provided are sufficient to assure that the criteria required for mineralized material to be classified as resources or reserves have been met, allowing the reporting of specific quantities and grades	Resources should be sub-classified according to the approach used (e.g., inferred, indicated, or measured); resources reported at higher confidence levels require higher quality information and interpretation, and the confidence of the Competent/Qualified Person(s) in this data should be discussed	Reserves should be subclassified according to the approach used (e.g., probable or proved) as a function of the relative degree of geoscientific assurance in the data available; reserve estimates should not include significant uncertainty relating to the positive economic viability of the project, and only resources at suitable levels (e.g., measured or indicated) can be considered for conversion to reserves; lower confidence resources lack the degree of assurance to be converted directly to reserves without significant additional data as outlined in this table; as for resources, reserves reported at higher confidence levels require higher quality information and interpretation, and the confidence of the Competent/Qualified Person(s) in this data should be discussed
Other considerations		Any other information that is likely to have a significant positive or negative impact on the economic viability of the project; should also include information on the information and further work needed to upgrade unquantified mineralized material to resources and/or resources to reserves	Known information that may positively or negatively impact the prospects for eventual economic extraction should be outlined	Reserve reporting should not include any material impediments to the profitable exploitation of the mineral deposit in question, with geologic, extraction, geometallurgical, and mineral processing, marketing, legal, environmental, social, and governmental requirements all having been met, although reserves do not require that all permits are issued or mining or processing facilities have been constructed; however, reserves require the outlining of a reasonable basis for permitting, construction, etc. so that progression to production can proceed in a timely manner
Qualifications of Competent/Qualified Person(s)		Names and qualifications of the Competent/Qualified Person(s) preparing and reviewing the report; note that there are specific requirements for public reporting in each of the public reporting codes, listing rules and regulations	See Information contained	See Information contained

RPEEE = Reasonable prospects for eventual economic extraction