

## Minimum Report Contents for Engineering Studies

<u>DESCRIPTION</u>	<u>Conceptual (Scoping) Study</u>	<u>Prefeasibility Study</u>	<u>Feasibility Study</u>
<b>INTRODUCTION</b>			
<b>Location, Topography and Climate</b>			
Site Location Map	Basic map	Preliminary map showing claims and boundaries	Detailed map showing all claims and boundaries
Topography Map	Basic map showing site topography	Preliminary map showing site topographic features	Detailed topographic map; aerial surveys verified with ground controls and surveys
<b>Property Ownership</b>			
	Review of property lease	Review of property lease; claims list provided mineral rights known	Property lease and rights secured and controlled; claims list and map provided; mineral rights secured
<b>Current Status and History</b>			
Historical Chronology	Basic presentation	Full presentation	Detailed presentation
Past Production (if any)	Basic presentation	Full presentation	Detailed presentation
<b>EXPLORATION AND GEOLOGY</b>			
<b>Geologic Description</b>			
Review	Preliminary review	Preliminary site-specific analysis	Detailed site-specific analysis
Data Posting	Review of available existing maps	Detailed geologic mapping with cross-sections	Deposit well-defined with three dimensional mapping, geologic maps, long sections, level plans
Geologic Assessment	Preliminary	Basic assessment and review	Detailed assessment of structures/rock contacts, alteration, mineralization, deposit trends
Mineralogical Sampling & Analysis	Limited sampling; preliminary assessment	Preliminary mineralogical sampling and analysis; preliminary mineralogical study	Detailed mineralogical sampling and mapping; detailed mineralogical study
<b>Drilling, Sampling and Assaying</b>			
Drill Hole Parameters	Wide spaced drilling as appropriate	Initial in-fills of wide spaced drilling; preliminary grid patterns	Close spaced drilling on a detailed grid pattern to support calculated reserve categories
Underground Drilling Samples	Review of existing data	Drilling if accessible	Detailed drilling if accessible
Drilling/Assay Data	Preliminary; some outcrop samples	Geophysical and geotechnical sampling; test pits	All sampling programs complete
	Preliminary check of existing drill hole data	Check of drill holes (coordinates, elevations, angles etc.), check assays, angled hole vs vertical hole comparison; assay flow diagram, dependable database	Check of drill holes (coordinates, elevations, angles, etc.), check assays, angled hole vs vertical hole etc.), check assays, angled hole vs vertical hole comparison, twin hole drilling; assay flow diagram; validated database
Condemnation Drilling	None	None	Areas under waste dumps, tailings and plant drilled
<b>RESOURCES AND RESERVES (Internationally Recognized Standards (see note 1))</b>			
<b>Resources</b>			
	Indicated and Inferred	Measured, Indicated, and Inferred	Indicated and Measured
Geologic Controls	Assumed	Established from geologic data and/or variograms	Well established from geologic data
Tonnage Factors	Preliminary assessment if available	Preliminary analysis and determinations	Detailed analysis and determinations
Statistical Analysis	Not performed	Preliminary analysis and determinations	Detailed analysis and determinations
Geostatistical Analysis	Not performed	Preliminary analysis and determinations	Detailed analysis and determinations
<b>Reserves</b>			
Calculation Parameters	Only resources estimated	Proven and Probable	Proven and Probable
Cut off Grade (COG) Equations	Usually no reserves are estimated	Known or estimated	Detailed analysis and determinations
	Usually no reserves are estimated	Calculated from floating cone parameters	Optimized using mining/processing parameters
<b>MINING</b>			
Mining Method	Assumed between open pit and underground	Specific method identified	Method and mine plan finalized
Open Pit Mine Plan			
Pit Slopes	Assumed	Preliminary estimates by rock type and basic geotechnical data	Defined by geotechnical data from structural mapping and oriented core holes
Pit Design	Simple outline of final pit	Preliminary pit design from optimized analysis; preliminary haul road incorporated	Detailed pit designs with phases and access for equipment operation
Waste Dumps	Simple outline of final dumps	Preliminary design for total waste tonnage; incremental and final outline of dumps	Dump sites identified from geotechnical data; final waste tonnages determined with incremental phases, yearly and final dump outlined
Underground Mine Plan	Assumed mining system; general outline of mine plan and development	Preliminary mining system identified from geologic and geotechnical data preliminary outline of mine plan and development including mine access	Specific mining system identified from geologic and geotechnical data; detailed outline of mine plan and development including mine access
Production Schedule	Basic schedule based on assumed mine life	Yearly and mine life ore and waste tonnages and grade	Detailed annual schedules showing ore / product quality and waste tonnages and grades
Capital Cost Estimate	Order-of-magnitude, factored or from similar operations	Preliminary equipment list; budget or historical price quotes; some factoring	Detailed equipment list; firm price quotes for all major equipment items; all capital items identified
Operating Cost Estimate	Order-of-magnitude; factored or from similar operations	Quantified estimates for labour, power and consumables; budget or historical price quotes for unit prices; some factoring	Detailed engineering estimate by project area based on quotes and studies
<b>PROCESSING</b>			
<b>Ore Sampling and Test Work</b>	Minimal sampling; conduct lab bench scale process characterization tests on collected samples (if available)	Sampling of core; preliminary bench scale testing to determine preliminary recoveries, ore characterization and processing parameters for flow sheet development	Sampling of core for different ore body zones; confirm flow sheet; comprehensive beneficiation test program to determine recoveries, ore/product characterization and finalize processing parameters

## Minimum Report Contents (continued)

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<b>Process Engineering and Design</b>			
Production Rate and Product(s)	First estimate of production rate and product(s)	Preliminary mining and processing rates and plant product(s)	Fixed mining and processing rates and plant product(s)
Design Basis	Preliminary using factored estimates	General design basis; preliminary engineering drawings; trade-off studies optional	Complete design basis; basic engineering drawings essentially complete; trade-off studies performed
Design Concept	Outline of design criteria and specifications incorporating area/regional climatic conditions	Design criteria established for construction site incorporating known site climatic conditions	Design specifications defined incorporating known site climatic conditions
Process Description	General	Narrative; 1 to 2% of detail engineering complete	Detailed; 5 to 15% of detail engineering complete
Layout	Approximate geographic locations and site map; no general arrangement drawings	Optimization of facility locations on site map showing topography; simple general arrangement drawings of major equipment items	Exact geographic locations on site map with topography; detailed general arrangement drawings; detailed layout of all facilities
Flow Sheets	Assumed flow sheet from known processes; simple block diagram	Establishment of probable flow sheet from preliminary test work data; major process flow diagrams; initial determinations of material and heat balances	Detailed flow sheet based on comprehensive beneficiation test program, detailed equipment list; diagrams for all process flows; material and heat balances finalized
Civil Work	Rough topographic maps; no soil conditions considered or quantities estimated	Rough topographic maps; soil conditions report for foundation determinations; basic preliminary quantities	Detailed topographic maps with soil conditions identified for foundation design, ladings and quantities
Equipment Specifications	Major equipment items listed	Preliminary listing of major equipment items with initial sizing and specifications	Complete listing of major equipment items with detailed sizing's and specifications
Architectural	None	Sketches	Exterior elevations only
Piping/HVAC	None	Preliminary P & ID	Major & P & ID
Electrical Distribution	None	Basic one-line diagram	All design one-line diagram
Motors	None	General description	Detailed list of major items with horsepower
Instrumentation	None	General description	Detailed list of components
<b>INFRASTRUCTURE</b>			
<b>Facilities</b>	General overview with types of support facilities described	All required support facilities identified, sizes and quantities estimated	All necessary support facilities identified, sized and coasted
<b>Communications</b>	Communications requirements identified	Communications systems study	Communications licensing and standards known
<b>Power</b>	Overview of power availability and regional unit power costs	Power sources and requirements identified; unit costs obtained from power source	Power requirements and unit costs derived from detailed engineering study; unit costs from quotes
<b>HYDROLOGY</b>			
<b>Water Sources</b>	Estimated using regional data	Preliminary hydrology study	Specific water source identified
<b>Water Usage</b>	Factored plant volume and unit costs	Required plant water volumes and unit costs estimated	Requisite plant volumes and unit costs derived from detailed engineering/geotechnical studies
<b>Dewatering</b>	Dewatering parameters identified	Dewatering parameters estimated	Dewatering parameters confirmed and plan defined
<b>ENVIRONMENTAL</b>			
<b>Setting</b>	Preliminary evaluation of project setting for potentially significant environmental or permitting constraints for site data	Preliminary evaluation of the project's impact on the environment; schedule of environmental and/or other permitting requirements; evaluated project setting for potentially significant environmental and/or permitting constraints from site data	Characterization of all the project's potential impacts on the environment; finalize schedule of environmental and/or other permitting requirements; evaluate project setting for potentially significant environmental and/or permitting constraints
<b>Data</b>	Collect and review all available, existing data for environmental studies assessments or audits; regulatory inspections, waste handling practices, management plans, and all applicable environmental laws and regulations; no social, training or safety programs identified	Collect and review available environmental data from existing databases for environmental studies, assessments or audits; regulatory inspections, waste handling practices; management plans; and all applicable environmental laws and regulations; plans; initiate baseline data gathering social, training, and health / safety programs identified	All requisite environmental data for project are identified; site sampling and analyses are complete; detailed review of the type, scope and schedule for producing environmental and/or government reports; comprehensive gathering and evaluation of baseline environmental conditions; social, training, and health/safety programs confirmed
<b>EIS/Ea</b>	None	Draft EIS/Ea initiated	Draft EIS/EA submitted to regulatory authorities
<b>Reporting and Plans</b>	Conceptual plans for managing any identified environmental issues	Preparation of environmental plans and monitoring programs; preliminary sediment and erosion control plan; conceptual reclamation plan; evaluation of acid rock drainage; geotechnical stability review of waste dumps and tailings dam; preliminary impact mitigation plan; preliminary spill and emergency response plan	Environmental characteristics used in project design; environmental plans and monitoring programs are finalized; sediment and erosion control plan; management plan finalized for solid and hazardous wastes; finalize impact mitigation plan; geotechnical stability analysis of all major facilities; finalize reclamation plan; final analysis of acid rock drainage; finalize spill and emergency response plan
<b>Monitoring</b>	Not considered	Outline of a site environmental monitoring plan	Complete environmental monitoring plan
<b>PERMIT REQUIREMENTS</b>	General overview	Comprehensive overview and listing of required permits	Detailed evaluation of all pertinent environmental and permitting requirements and schedule for obtaining operating licence
<b>PROJECT DEVELOPMENT SCHEDULE</b>			
Development Plan	Development period and mine life estimated	Development period and overall schedule estimated; mine life determined development schedule set	Detailed development schedule; mine life known; development schedule finalized

## Minimum Report Contents (continued)

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Project Master Schedule	Estimated showing start and end of construction; Gantt bar chart of major work elements	Gantt bar chart with overall time frames; schedule outline for detailed engineering; QA/QC program outlined; preliminary construction schedule preliminary project execution plan	Gantt bar chart with overall time frames and project flow planning; detailed project level schedule showing project deliverables and detailed engineering; CP schedule; major milestones identified; project control system outlined; QA/QC and safety program finalized preliminary project procedures manual; project design basis finalized
<b>CAPITAL COST ESTIMATE</b>			
<i>Basis</i>			
<i>Civil Structural</i>			
<i>Architectural</i>			
<i>Piping/HVAC</i>			
<i>Electrical</i>			
<i>Instrumentation</i>	Order-of-magnitude based historic data or factoring	Estimates from historical factors, percentages and vendor quotes based on materials volumes	Detailed from estimates; engineering 15 to 25% complete, multiple vendor quotes
<i>Construction Labor</i>			
<i>Construction Labor Productivity</i>			
<i>Material Volumes/Amounts</i>			
<i>Material/Equipment Pricing</i>			
<i>Infrastructure</i>			
<i>Contractors</i>	Included in unit cost or as a percentage of total cost	Percentage of direct cost by cost area for contractor; historic for subcontractors	Written quotes from contractor and subcontractors
<i>EPCM</i>	Percentage of estimated construction cost	Percentage of detailed construction cost	Calculated estimate from EPC(M) firm
<i>Pricing</i>	FOB mine site including all taxes and duties	FOB mine site including all taxes and duties	FOB mine site including all taxes and duties
<i>Owner's</i>	Historic estimate	Estimate from experience factored for similar project	Estimate prepared from detail zero based budget
<i>Environmental Compliance</i>	Factored from historic experience	Estimate from experience factored for similar project	Estimate prepared from detail zero based budget for design engineering and specific permit requirements
<i>Escalation</i>	Typically not considered	Based on company's current budget percentage	Based by cost area with risk
<i>Working Capital</i>	Factored from historic experience	Estimate from experience factored for similar project	Estimate prepared from detail zero based budget
<i>Accuracy</i>	+/- 50%	=/- 25%	=/- 15%
<i>Contingency</i>	25%	15%	10%
<b>OPERATING COST ESTIMATE</b>			
<i>Basis</i>	Order-of-Magnitude estimate	Estimates for unit rates and quantified estimates with some factoring	Detailed from zero-based budget; minimal factoring
<i>Operating Quantities</i>	General	Quantified by estimates with some factoring	Detailed estimates
<i>Unit Costs</i>	Historic unit costs and factoring	Estimates for labor, power and consumables; some factoring	Letter quotes from vendors; minimal factoring
<i>Accuracy</i>	+/- 35%	+/- 25%	+/- 15%
<b>ECONOMIC EVALUATION</b>			
<i>Financial Analysis</i>	Preliminary assessment of principal economic parameters	Assessment of the principal economic parameters	Full assessment of all principal economic parameters
<i>Commodity Price(s)</i>	Estimated based on 3yr average minimum	Estimated based on 3yr average minimum	Estimated based on 3yr average minimum or detailed market studies
<i>Royalties and Taxes</i>	Preliminary assessment	Preliminary analysis	Detailed analysis with tax authority opinion
<i>Smelting, Refining and Freight</i>	Historic data	Budgetary quotes	Firm quotes
<i>Cash Flow Analysis</i>	Simple cash flow	Preliminary cash flow	Formal, detailed cash flow
<i>Economic Criteria</i>	Simple IRR and NPV (pre-and after-tax)	Preliminary IRR and NPV (pre-and after-tax)	Fully defined IRR, NPV, ROI, and payback period (pre-and after-tax)
<i>Sensitivity Analysis</i>	Basic analysis to minimal amount of project variables	Preliminary to selected key project variables	Numerous analysis to all key project variables
<b>RISK EVALUATION</b>			
<i>Risk Assessment</i>	General overview	Fatal flaw analysis	Formal Monte Carlo analysis and fatal flaw analysis
<i>Project</i>	Preliminary overview of geology, and environmental	Preliminary environmental, country, permitting, technology, and business, detailed geology and engineering	Detailed geology, engineering, environmental, legal, permitting, country, technology, business, and financial

Note 1: Internationally Recognized Standards included:

1. Canadian National Instrument 43-101 and 43-101 CP
2. Australasian Code for Reporting of Mineral Resources and Ore Reserves – prepared by the Joint Ore Reserve Committee (JORC)
3. U.S. Securities & Exchange Commission Industry Guide 7
4. SME Guide for Reporting Exploration Information, Mineral Resources and Mineral Reserves

Pincock, Allen & Holt is a consulting and engineering firm serving the international mineral resource industry. Your comments and suggestions are always welcome.

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