

FORM 43-101F1
TECHNICAL REPORT

INSTRUCTIONS

- (1) *The objective of the technical report is to provide scientific and technical information concerning mineral exploration, development and production activities on a mineral property that is material to an issuer. This Form sets out specific requirements for the preparation and contents of a technical report. Item 24 of this Form includes additional requirements for technical reports on development and production properties.*
- (2) *Terms used and not defined in this Form that are defined or interpreted in National Instrument 43-101 Standards of Disclosure for Mineral Projects (the "Instrument") shall bear that definition or interpretation. In particular, the terms "mineral resource" and "mineral reserve" and the categories of each are defined in the Instrument. In addition, a general definition instrument has been adopted as National Instrument 14-101 Definitions which contains definitions of certain terms used in more than one national instrument. Readers of this Form should review both these national instruments for defined terms.*
- (3) *The author preparing the technical report should use the headings suggested in this Form. If technical terms are required, clear and concise explanations should be included.*
- (4) *No disclosure need be given in respect of inapplicable items and, unless otherwise required in this Form, negative answers to items may be omitted. Disclosure included under one heading is not required to be repeated under another heading.*
- (5) *The technical report is not required to include the information in Items 5, 6, 7, 8, 9, 10 and 11 of this Form if a report has been previously filed containing the required information for the properties being reported on and that previous report is referred to in the technical report.*
- (6) *Issuers and authors are encouraged to follow the Guidelines for Technical Reports Disclosing Mineral Exploration and the Mineral Exploration "Best Practices" Guidelines prepared on the recommendation of the TSE-OSC Mining Standards Task Force by a committee comprised of mining and exploration industry professionals and regulators. Drafts of these Guidelines were published and circulated to the Prospectors and Developers Association of Canada for comment in October 1999. It is expected that the Guidelines will be published in final form early in 2000.*

CONTENTS OF THE TECHNICAL REPORT

- Item 1:** **Title Page** - Include a title page setting out the title of the technical report, the general location of the mineral project, the name of the author(s) and the author's professional designation(s) and the effective date of the technical report.
- Item 2:** **Table of Contents** - Provide a table of contents listing the contents of the technical report, including figures and tables.
- Item 3:** **Summary** - Provide a summary which briefly describes the property, location and ownership, the geology and mineralization, the exploration concept, and the status of exploration, development and/or operations. Discuss the author's conclusions and recommendations.
- Item 4:** **Introduction and Terms of Reference** - Include a description of
- (a) the terms of reference;
 - (b) the purpose for which the technical report was prepared; and
 - (c) the sources of information and data contained in the technical report or used in its preparation, with citations if applicable.

INSTRUCTIONS

- (1) *A Canadian securities regulatory authority may request*
 - (a) *an authenticated copy of a document used as a basis for the technical report that is private, unpublished or otherwise not readily available to the public; and*
 - (b) *a translation into English, French or both, as specified by Canadian securities legislation, of a source document used as a basis for the technical report, identifying the translator and any relationship of the translator to the issuer.*

- (2) *This item should include the identification of the issuer for whom the technical report was prepared, and the author's mandate as well as the purpose and scope of the technical report. The extent of the author's involvement including field and office time must be stated. A general description of sources and data should be included. Currency, units of measure and conversion factors should be specified.*

Item 5: Property Description and Location - To the extent applicable, with respect to each property reported on, describe

- (a) the dimensions of the property in hectares or other appropriate units;
- (b) the location, reported by section, township, range and national topographic system designation wherever applicable, or by latitude and longitude;
- (c) the claim numbers or equivalent, whether they are patented or unpatented, or the applicable characterization in the jurisdiction in which they are situated, and whether the claims are contiguous;
- (d) the nature and extent of the issuer's title to, or interest in, the property including surface rights, the obligations that must be met to retain the property, and the expiration date of claims, licences or other property tenure rights;
- (e) the outside boundaries of the property, if legally surveyed;
- (f) the location of all known mineralized zones, mineral resources, mineral reserves and mine workings, existing tailing ponds, waste deposits and important natural features and improvements, relative to the outside property boundaries shown on a map;
- (g) to the extent known, the terms of any royalties, back-in rights, payments or other agreements and encumbrances to which the property is subject;
- (h) to the extent known, all environmental liabilities to which the property is subject; and
- (i) to the extent known, the permits that must be acquired to conduct the work proposed for the property, and if the permits have been obtained.

Item 6: Accessibility, Climate, Local Resources, Infrastructure and Physiography - To the extent applicable, with respect to each property reported on, describe

- (a) topography, elevation and vegetation;
- (b) the means of access to the property;
- (c) the proximity of the property to a population centre, and the nature of transport;

- (d) to the extent relevant to the mineral project, the climate and the length of the operating season; and
- (e) to the extent relevant, the sufficiency of surface rights for mining operations, the availability and sources of power, water, mining personnel, potential tailings storage areas, potential waste disposal areas, heap leach pad areas and potential processing plant sites.

Item 7: History - To the extent known, with respect to each property reported on, describe

- (a) the prior ownership of the property and ownership changes;
- (b) the type, amount, quantity and results of exploration and/or development work undertaken by the owners and any previous owners;
- (c) historical mineral resource and mineral reserve estimates, including the reliability of the historical estimates and whether the estimates are in accordance with the categories set out in sections 1.3 and 1.4 of the Instrument; and
- (d) any production from the property.

INSTRUCTION: If a reporting system other than the one stipulated by the Instrument has been used, the author should include an explanation of the differences and reliability.

Item 8: Geological Setting - Include a description of the regional, local and property geology.

Item 9: Deposit Types - Describe the mineral deposit type(s) being investigated or being explored for and the geological model or concepts being applied in the investigation and on the basis of which the exploration program is planned.

Item 10: Mineralization - Describe the mineralized zones encountered on the property, the surrounding rock types and relevant geological structures, detailing length, width, depth, continuity and the basis for the measurement, together with a description of the type, character and distribution of the mineralization.

Item 11: Exploration - Describe the nature and extent of all relevant exploration work and metallurgical or other testing conducted by, or on behalf of, the issuer on each property being reported on, including

- (a) results of surveys and investigations, and the procedures and parameters relating to the surveys and investigations;
- (b) an interpretation of the exploration information;
- (c) a statement as to whether the surveys and investigations have been carried out by the issuer or by a contractor and, if the latter, identifying the contractor; and
- (d) a discussion of the reliability or uncertainty of the data obtained in the program.

Item 12: Drilling - Describe the type and extent of drilling including the procedures followed and a summary and interpretation of all results. The relationship between the sample length and the true thickness of the mineralization must be stated, if known, and if the orientation of the mineralization is unknown, this must be stated.

Item 13: Sampling Method and Approach - Include

- (a) details concerning sampling including location, number, type, nature and spacing or density of samples collected, and the size of the area covered;
- (b) identification of any drilling, sampling or recovery factors that could materially impact the accuracy and reliability of the results;
- (c) a discussion of the sample quality and of whether the samples are representative and of any factors that may have resulted in sample biases;
- (d) rock types, structural controls, widths of mineralized zones and other parameters used to establish the sampling interval and identification of any significantly higher grade intervals within a lower grade intersection; and
- (e) a summary of the true widths of individual samples or sample composites.

INSTRUCTIONS

- (1) *The issuer may be asked by the Canadian securities regulatory authorities to provide copies of assay and other analytical certificates, drill logs and other information referenced in the technical report or used as a basis for the technical report.*
- (2) *This item refers to all types of sampling the results of which may be reported under any relevant item.*

Item 14: Sample Preparation and Security - Describe sample preparation methods and quality control procedures employed prior to dispatch to an analytical or testing laboratory, and the method or process of sample splitting and reduction and the security measures taken to ensure the validity and integrity of samples taken, including

- (a) details regarding sample preparation, assaying and analytical procedures used, including the sub-sample size, the name and location of the analytical and testing laboratories and whether the laboratories are certified by any standards association and the particulars of any certification;
- (b) a summary of the nature and extent of all quality control procedures employed and check assay and other check analytical and testing procedures utilized, including the results and corrective actions taken; and
- (c) a statement of the author's opinion on the adequacy of sampling, sample preparation, security and analytical procedures.

Item 15: Data Corroboration - Include a discussion of

- (a) the quality control steps and data corroboration procedures which have been taken;
- (b) whether the author has corroborated the data referred to or relied upon, specifically including sampling and analytical data;
- (c) the nature of and any limitations on such corroboration; and
- (d) the reasons for any failure to corroborate the data.

Item 16: Adjacent Properties - A technical report that includes a comment on an adjacent property in which the issuer does not have an interest shall clearly distinguish between mineralization on the adjacent property and mineralization that occurs on the issuer's property. If the potential merit of the subject property is predicated entirely or in substantial part on results obtained from work carried out on an adjacent property in which the issuer does not have an interest the known history of the adjacent property shall also be disclosed and the author shall confirm the relevance of such disclosure. The nature of the geology, mineralization and the reported quantity and grade or quality of the mineral resources and mineral reserves on the adjacent property in which the issuer does not have an interest may be disclosed, if

- (a) the statement of geology, mineralization, exploration results, mineral resources, mineral reserves and mining history was publicly announced by the owner or operator of the adjacent property;
- (b) the source of the information and any relationship of the author to the issuer is identified; and
- (c) the technical report states that its author has been unable to corroborate the accuracy of the information and, in bold face type, that the information is not necessarily indicative of the mineralization on the property that is the subject of the technical report.

Item 17: Mineral Processing and Metallurgical Testing - Where mineral processing and/or metallurgical testing analyses have been carried out, include the results of testing and details of sample selection representativity and testing and analytical procedures.

Item 18: Mineral Resource and Mineral Reserve Estimates - Each technical report on mineral resources and mineral reserves shall

- (a) use only the applicable mineral resource and mineral reserve categories set out in sections 1.3 and 1.4 of the Instrument;
- (b) report each category of mineral resources and mineral reserves separately and if both mineral resources and mineral reserves are disclosed, state the extent, if any, to which mineral reserves are included in total mineral resources;
- (c) not add inferred mineral resources to the other categories of mineral resources;
- (d) disclose the name, qualifications and relationship, if any, to the issuer of the qualified person who estimated mineral resources and mineral reserves;
- (e) include appropriate details of quantity and grade or quality for each category of mineral resources and mineral reserves;
- (f) include details of the key assumptions, parameters and methods used to estimate the mineral resources and mineral reserves;
- (g) include a general discussion on the extent to which the estimate of mineral resources and mineral reserves may be materially affected by any known environmental, permitting, legal, title, taxation, socio-economic, marketing, political or other relevant issues;

- (h) identify the extent to which the estimate of a mineral resource and mineral reserve may be materially affected by mining, metallurgical, infrastructure and other relevant factors;
- (i) use only indicated and/or measured mineral resources or proven and/or probable mineral reserves in an economic evaluation, preliminary feasibility study or feasibility study of a mineral project;
- (j) state the grade or quality, quantity and category of the mineral resources and mineral reserves if the quantity of contained metal is reported; and
- (k) when the grade for a polymetallic mineral resource or mineral reserve is reported as metal equivalent, consider and report the recoveries, refinery costs and all other relevant conversion factors in addition to metal prices and the date and sources of such prices.

INSTRUCTIONS

- (1) *The methods and procedures to be used in estimating mineral resources and mineral reserves are the responsibility of the authors preparing the estimate.*
- (2) *A statement of tonnage or volume and grade or quality is an estimate and should be rounded as appropriate to reflect the fact that it is an approximation.*
- (3) *An issuer that is incorporated or organized in a foreign jurisdiction may file a technical report that utilizes the mineral resource and mineral reserve categories of the JORC Code, USGS Circular 831 or IMM system provided that a reconciliation to the mineral resource and mineral reserve categories set out in sections 1.3 and 1.4 of the Instrument is filed with the technical report and certified by the author. The reconciliation must also address the confidence levels required for the categorizations in section 1.3 and 1.4 of the Instrument.*

Item 19: Other Relevant Data and Information - Include any additional information or explanation necessary to make the technical report understandable and not misleading.

Item 20: Interpretation and Conclusions - Include the results and reasonable interpretations of all field surveys, analytical and testing data and other relevant information. Discuss the adequacy of data density and the data reliability as well as any areas of

uncertainty. A technical report concerning exploration information shall include the conclusions of the author. The author must discuss whether the completed project met its original objectives.

Item 21: Recommendations - If successive phases of work are recommended, each phase must culminate in a decision point. The recommendations shall not apply to more than two phases of work. The recommendations shall state whether advancing to a subsequent phase is contingent on positive results in the previous phase. Provide particulars of the recommended programs and a breakdown of costs for each phase.

Item 22: References - Include a detailed list of all references cited in the technical report.

Item 23: Date - Include the effective date of the technical report on both the title page and the page of the technical report that is signed. The date of signing must also be included on the signature page.

Item 24: Additional Requirements for Technical Reports on Development Properties and Production Properties - Technical reports concerning development properties and production properties shall also include

- (a) Mining Operations - information and assumptions concerning the mining method, metallurgical processes and production forecast;
- (b) Recoverability - information concerning results of all test and operating results relating to the recoverability of the valuable component or commodity and amenability of the mineralization to the proposed processing methods;
- (c) Markets - information concerning the markets for the issuer's production and the nature and material terms of any agency relationships;
- (d) Contracts - a discussion of whether the terms of mining, concentrating, smelting, refining, transportation, handling, sales and hedging and forward sales contracts or arrangements, rates or charges are within market parameters;
- (e) Environmental Considerations - a discussion of bond posting, remediation and reclamation;
- (f) Taxes - a description of the nature and rates of taxes, royalties and other government levies or interests applicable to the mineral project or production, revenues or income from the mineral project;

- (g) Capital and Operating Cost Estimates - capital and operating cost estimates, with the major components being set out in tabular form;
- (h) Economic Analysis - an economic analysis with cash flow forecasts on an annual basis using proven mineral reserves and probable mineral reserves only, and sensitivity analyses with variants in metal prices, grade, capital and operating costs;
- (i) Payback - a discussion of the payback period of capital with imputed or actual interest;
- (j) Mine Life - a discussion of the expected mine life and exploration potential.

Item 25: Illustrations -

- (1) Technical reports shall be illustrated by legible maps, plans and sections. All technical reports shall be accompanied by a location or index map and more detailed maps showing all important features described in the text. In addition, technical reports shall include a compilation map outlining the general geology of the property and areas of historical exploration. The location of all known mineralization, anomalies, deposits, pit limits, plant sites, tailings storage areas, waste disposal areas and all other significant features shall be shown relative to property boundaries. All maps, drawings and diagrams that have been created by the author, in whole or in part, and that are based on the work that the author has done or supervised, must be signed and dated by the author. Where information from other sources, either government or private, is used in preparing these maps or diagrams, the source of the information must be named.
- (2) If adjacent or nearby properties have an important bearing on the potential of the property under consideration, their location and any mineralized structures common to two or more such properties shall be shown on the maps.
- (3) If the potential merit of a property is predicated on geophysical or geochemical results, maps showing the results of surveys and their interpretations shall be included in the technical report.
- (4) Maps shall include a scale in bar form and an arrow indicating North. Information taken from government maps or from drawings of other engineers or geoscientists shall be acknowledged on the map.

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TECHNICAL REPORTS
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