



Mineral Resource and Mineral Reserve Estimation and Reporting: The Canadian System

Presentation to the American Institute of Professional Geologists
29 November 2022

Reno Pressacco, M.Sc.(A)., P.Geo

global **environmental** and **advisory** solutions



Acknowledgements



Reno Pressacco, M. Sc.(A), P.Geo.
Associate Principal Geologist,
SLR Consulting (Canada) Ltd.

- Thanks and appreciation is extended to our colleagues for their assistance in the preparation and review of this presentation.
- All discussions and opinions discussed in this presentation are those of the author(s) only.

Agenda

- Review of Mineral Resource and Mineral Reserve (MRMR) Estimation and Disclosure Components
- Practice vs Disclosure – The Canadian System
- Introduction of the Canadian Institute of Mining, Metallurgy and Petroleum (CIM) Best Practice Guidelines
- Guidance Examples
- Sources of Additional Information
- Questions

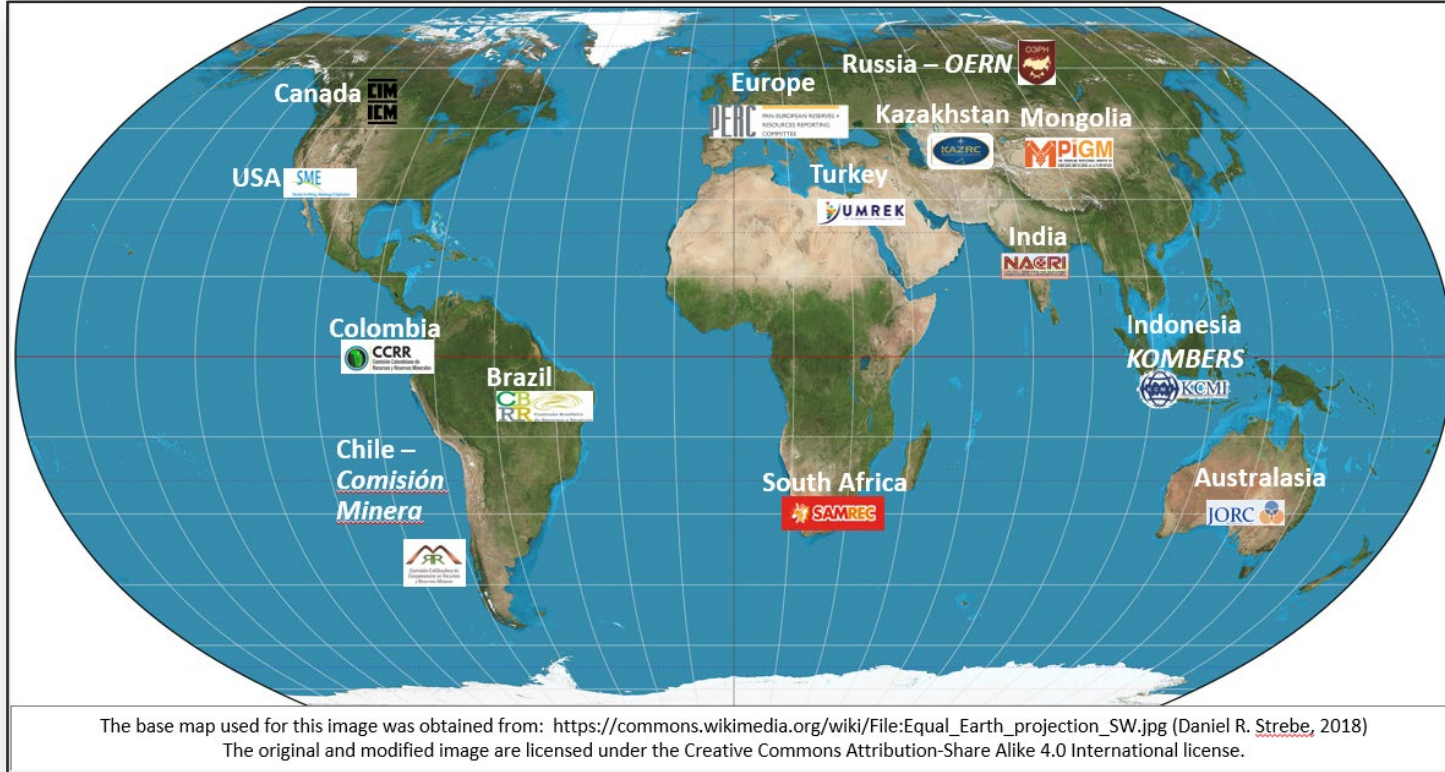
Components of MRMR Estimation and Disclosure

MRMR Estimation Components – Key Concept



- The preparation and reporting of MRMR estimates is typically accomplished in three stages:
- **Stage 1:** definitions of Mineral Resources and Mineral Reserves.
- **Stage 2:** preparation of MRMR estimates.
- **Stage 3:** disclosure of the MRMR estimates (to the public domain).

MRMR Reporting Codes



- The **definitions** of MRMR has become, to a large degree, standardized by the participating members of the Committee for Mineral Reserves International Reporting Standards (CRIRSCO).
- Each of the member countries has established National Reporting Codes/Guidance that are in accordance with the principles of the CRIRSCO Template.

Source: www.crirSCO.com, September 16, 2022

International Reporting Template



- Each of the National Reporting Codes contain the same basic elements that are presented in the CRIRSCO International Reporting Template.
- It is important to note that many of the National Reporting Codes focus on the public reporting aspects.

International Reporting Template

The Standard Definitions in the Template are:

Mineral	Clause 2.2	Page 7
Public Reports	Clause 2.9	Page 8
Competent Person	Clause 3.6	Page 11
Modifying Factors	Clause 4.7	Page 15
Exploration Targets	Clause 5.1	Page 16
Exploration Results	Clause 6.1	Page 17
Mineral Resources 	Clause 7.1	Page 19
Inferred Mineral Resources	Clause 7.4	Page 20
Indicated Mineral Resources	Clause 7.8	Page 21
Measured Mineral Resources	Clause 7.10	Page 21
Mineral Reserves 	Clause 8.1	Page 25
Probable Mineral Reserves	Clause 8.7	Page 26
Proved Mineral Reserves	Clause 8.9	Page 26
Scoping Study	Clause 9.3	Page 31
Pre-feasibility Study	Clause 9.7	Page 32
Feasibility Study	Clause 9.8	Page 33

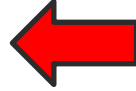
- Each of the National Reporting Codes contain a number of Standard Definitions.
- The definitions include Mineral Resources and Mineral Reserves.

Definition Example – Mineral Resources



THE INTERNATIONAL REPORTING TEMPLATE
November 2019

7. REPORTING OF MINERAL RESOURCES



Definition

7.1 A Mineral Resource is a concentration or occurrence of solid material of economic interest in or on the Earth's crust in such form, grade or quality and quantity that there are reasonable prospects for eventual economic extraction.

The location, quantity, grade or quality, continuity and other geological characteristics of a Mineral Resource are known, estimated or interpreted from specific geological evidence and knowledge, including sampling.

Mineral Resources are subdivided, in order of increasing geological confidence into Inferred, Indicated and Measured categories.

Code

7.2 All reports of Mineral Resources must satisfy the requirement that there are reasonable prospects for eventual economic extraction (i.e., more likely than not), regardless of the classification of the Mineral Resource.

7.3 Estimates of non-economic mineralisation (where there are no reasonable prospects for eventual economic extraction) do not qualify as Mineral Resources (or Mineral Reserves) under the definitions of this Template.

Guidance

The term 'reasonable prospects for eventual economic extraction' implies a judgement (albeit preliminary) by the Competent Person in respect of all Modifying Factors. In other words, a Mineral Resource is not an inventory of all mineralisation drilled or sampled, regardless of cut-off grade, likely mining

- The definitions provide the conditions by which a Mineral Resource or a Mineral Reserve may be declared.
- Note the continued focus on the public reporting aspects.

Mineral Resource/Mineral Reserve Definition Example



CIM Definition Standards for Mineral Resources & Mineral Reserves

Prepared by the
CIM Standing Committee on Reserve Definitions
Adopted by CIM Council May 19, 2014

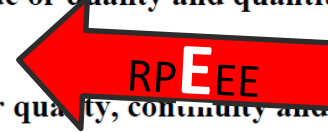
Canadian Institute of Mining, Metallurgy and Petroleum
Suite 1250, 3500 de Maisonneuve Blvd. West
Westmount, Quebec H3Z 3C1 CANADA
Tel.: (514) 939-2710 Fax: (514) 939-2714
mrmr.cim.org | www.cim.org

Mineral Resource

Mineral Resources are sub-divided, in order of increasing geological confidence, into inferred, indicated and measured categories. An Inferred Mineral Resource has a lower level of confidence than that applied to an Indicated Mineral Resource. An Indicated Mineral Resource has a higher level of confidence than an Inferred Mineral Resource but has a lower level of confidence than a Measured Mineral Resource.

A Mineral Resource is a concentration or occurrence of solid material of economic interest in or on the earth's crust in such form, grade or quality and quantity that there are reasonable prospects for eventual economic extraction.

The location, quantity, grade or quality, continuity and other geological characteristics of a Mineral Resource are known, estimated or interpreted from specific geological evidence and knowledge, including sampling.



- In Canada, the Standard Definitions are provided in the CIM Definition Standards for Mineral Resources and Mineral Reserves (2014).
- These are identical to the CRIRSCO Standard Definitions (RPEEE).

Mineral Resource/Mineral Reserve Definition Example

Item 1300 Definitions

§ 229.1300 (Item 1300) Definitions.

As used in this subpart, these terms have the following meanings:

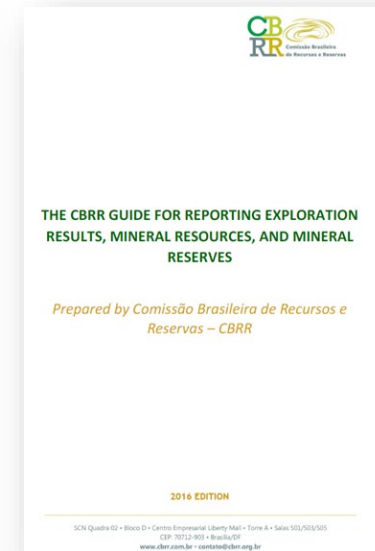
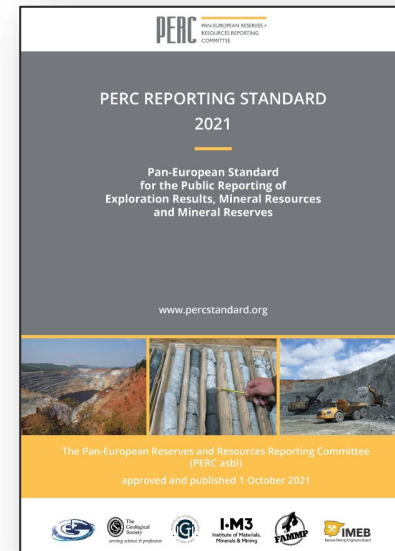
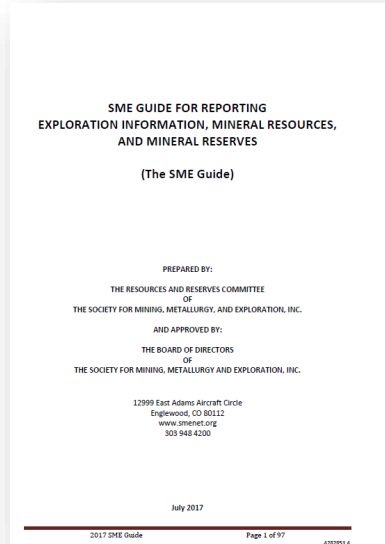
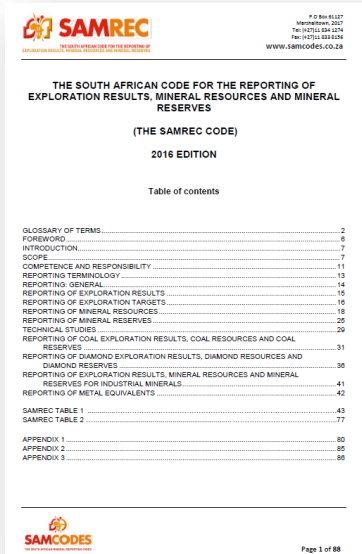
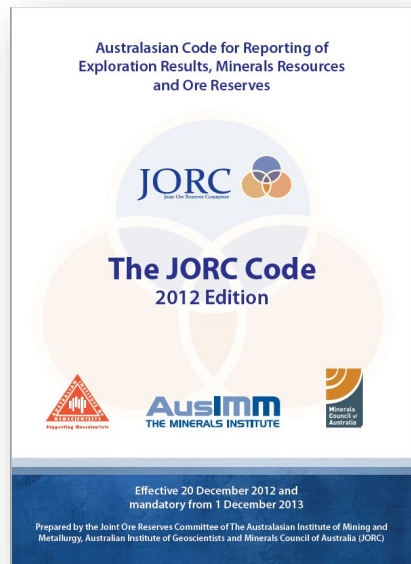


Mineral resource is a concentration or occurrence of material of economic interest in or on the Earth's crust in such form, grade or quality, and quantity that there are reasonable prospects for economic extraction. A mineral resource is a reasonable estimate of mineralization, taking into account relevant factors such as cut-off grade, likely mining dimensions, location or continuity, that, with the assumed and justifiable technical and economic conditions, is likely to, in whole or in part, become economically extractable. It is not merely an inventory of all mineralization drilled or sampled.



- Regulation SK-1300 also adopts a set of standard definitions that are closely aligned with the International Reporting Templates, with some differences (RPEE vs RPEE).

International Public Reporting Codes/Guides



Definitions



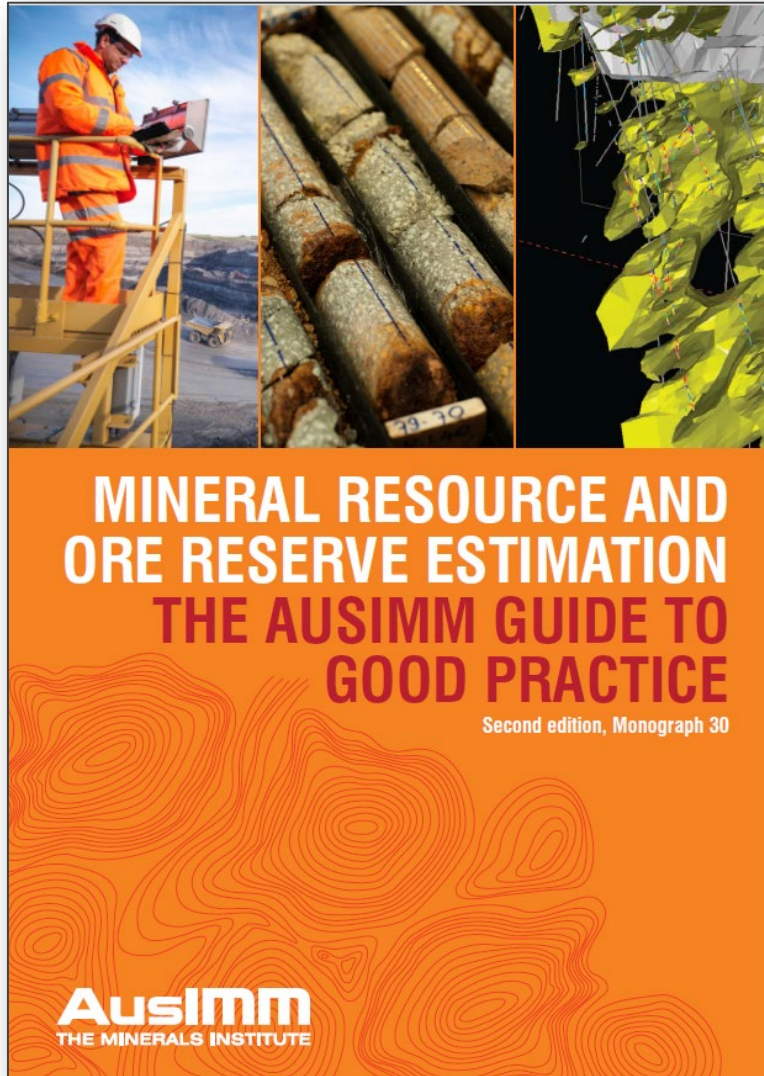
??



Reporting of Results

- While each of the Codes/Guides use standard MRMR Definitions, they provide little guidance on **Best Practices** for Mineral Exploration or preparation of MRMR estimates.

International Best/Good Practices Documents



CIM Estimation of Mineral Resources and Mineral Reserves Best Practice Guidelines

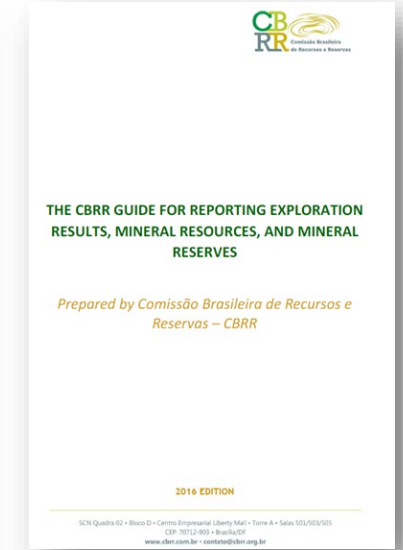
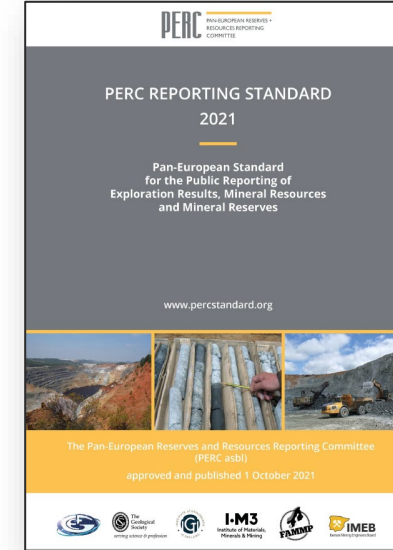
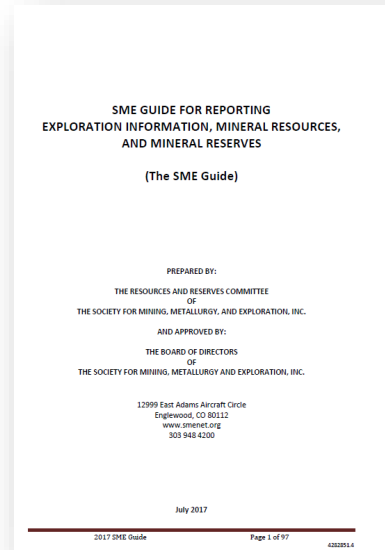
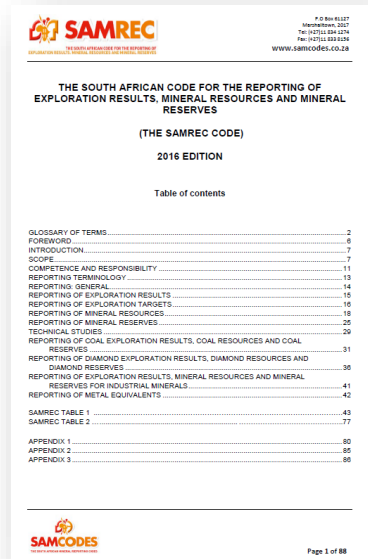
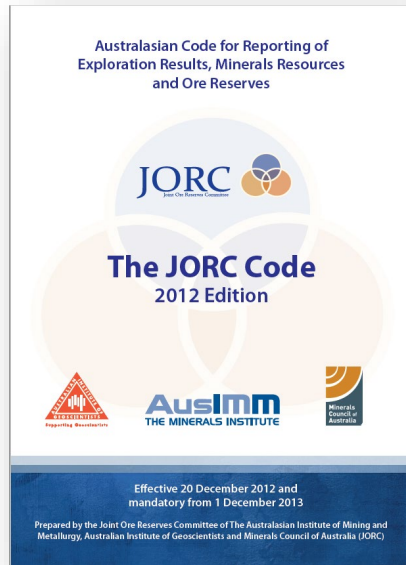
Prepared by the
CIM Mineral Resource and Mineral Reserve Committee

Adopted by the CIM Council on November 29, 2019

The Canadian Institute of Mining, Metallurgy and Petroleum
Suite 1250, 3500 de Maisonneuve Blvd. West
Westmount, Quebec H3Z 3C1 CANADA
Tel.: (514) 939-2710 Fax: (514) 939-2714

- Only Canada and Australia provide guidance regarding the **PRACTICE** with respect to Mineral Exploration and preparation of Mineral Resource and Mineral Reserve estimates.

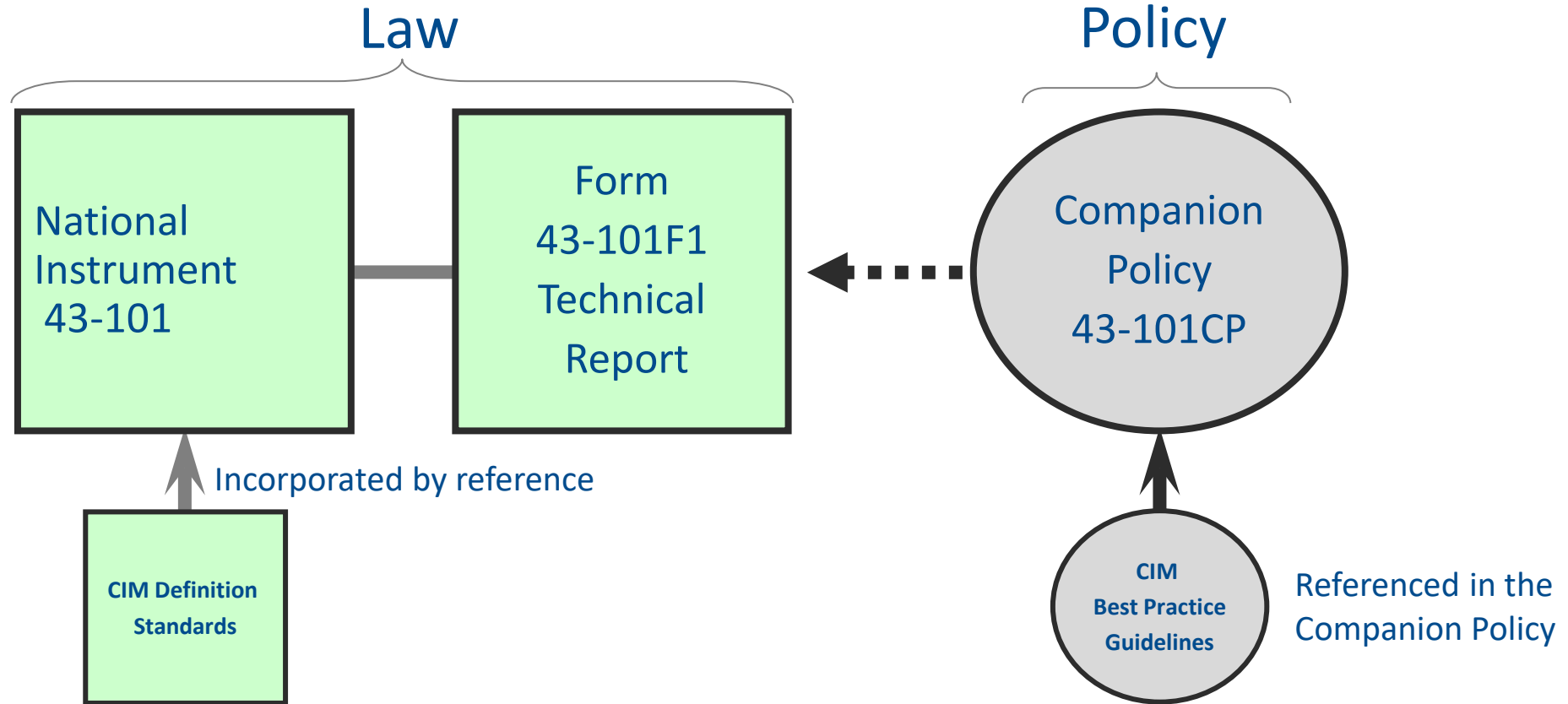
International Public Reporting Codes/Guides



- Each of International Reporting templates/guides also provide guidance for the **Public Reporting** of Exploration Results and MRMR.
- Disclosure is commonly accomplished via a checklist or Table 1.
- In Canada, disclosure must be done in accordance with National Instrument 43-101 and 43-101F1 Form of the Technical Report.
- In the United States, disclosure must be done in accordance with SK-1300 (supersedes Industry Guide 7).

Practice vs Disclosure – The Canadian System

Disclosure Under Canadian Regulatory Structure



Use of the CIM Definition Standards are required under securities legislation (NI 43-101).

CIM BP Guidelines are policy documents, not law. Canadian regulators may query disclosure that does not appear to conform with industry best practices.

Disclosure Under United States Regulatory Structure



66344 Federal Register / Vol. 83, No. 246 / Wednesday, December 26, 2018 / Rules and Regulations

SECURITIES AND EXCHANGE COMMISSION

17 CFR Parts 229, 230, 239, and 249

[Release Nos. 33–10570; 34–84509; File No. S7–10–16]

RIN 3235–AL81

Modernization of Property Disclosures for Mining Registrants

AGENCY: Securities and Exchange Commission.

ACTION: Final rule.

SUMMARY: We are adopting amendments to modernize the property disclosure requirements for mining registrants, and related guidance, currently set forth in Item 102 of Regulation S–K under the Securities Act of 1933 and the Securities Exchange Act of 1934 and in Industry Guide 7. The amendments are intended to provide investors with a more comprehensive understanding of a registrant’s mining properties, which should help them make more informed

part 229, subpart 229.1300 (“subpart 1300 of Regulation S–K”), amending 17 CFR 230.436 under the Securities Act, amending Form 1–A,³ amending Form 20–F,⁴ and rescinding 17 CFR 229.801(g) and 229.802(g) under the Securities Act and Exchange Act.

Table of Contents

I. Introduction

A. Summary of, and Commenters’ Principal Concerns Regarding, the Commission’s Proposed Revisions to the Current Mining Property Disclosure Regime

B. Summary of Principal Changes to the Final Rules

II. Final Mining Property Disclosure Rules

A. Consolidation of the Mining Disclosure Requirements

1. Rule Proposal

2. Comments on the Rule Proposal

3. Final Rules

B. Overview of the Standard for Mining-Related Disclosure

1. The Threshold Materiality Standard

2. Treatment of Vertically-Integrated Companies

3. Treatment of Multiple Property

2. Current Regulatory Framework and Market Practices

B. Analysis of Potential Economic Effects

1. Broad Economic Effects of the Final Rules and Impact on Efficiency, Competition, and Capital Formation

2. Consolidation of the Mining Disclosure Requirements

3. The Standard for Mining-Related Disclosure

4. Qualified Person and Responsibility for Disclosure

5. Treatment of Exploration Results

6. Treatment of Mineral Resources

7. Treatment of Mineral Reserves

8. Specific Disclosure Requirements

9. Conforming Changes to Certain Forms Not Subject to Regulation S–K

V. Paperwork Reduction Act

A. Background

B. Summary of Collection of Information Requirements

C. Estimate of Potentially Affected Registrants

D. Estimate of Reporting and Cost Burdens

VI. Final Regulatory Flexibility Act Analysis

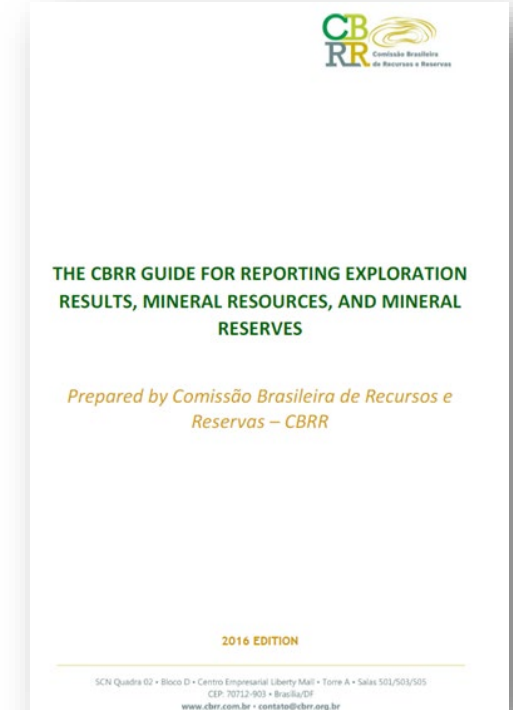
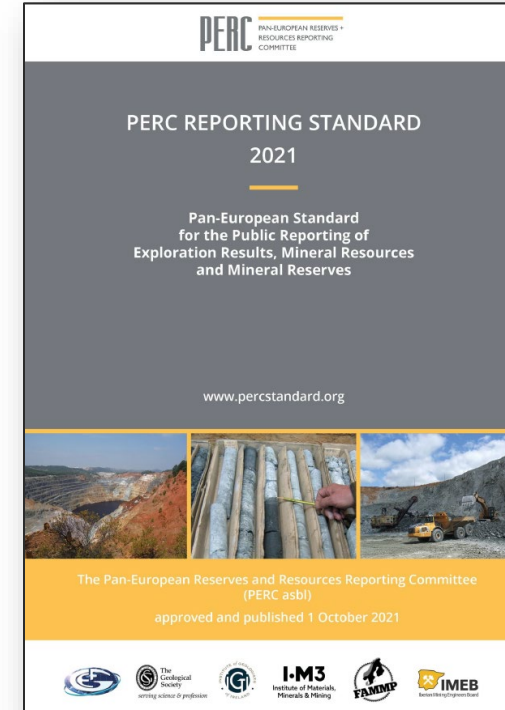
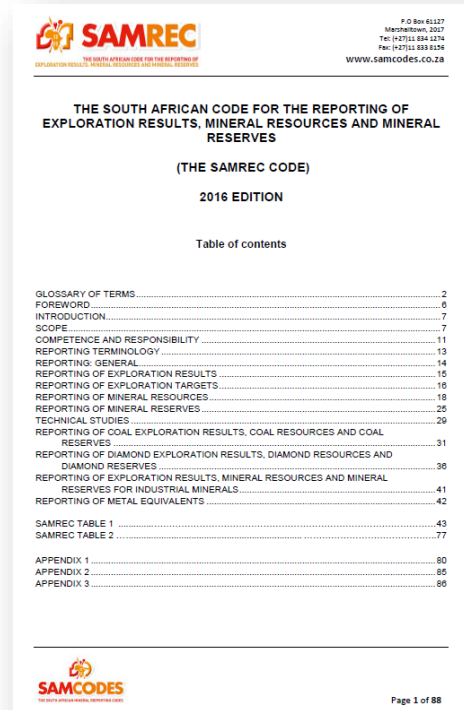
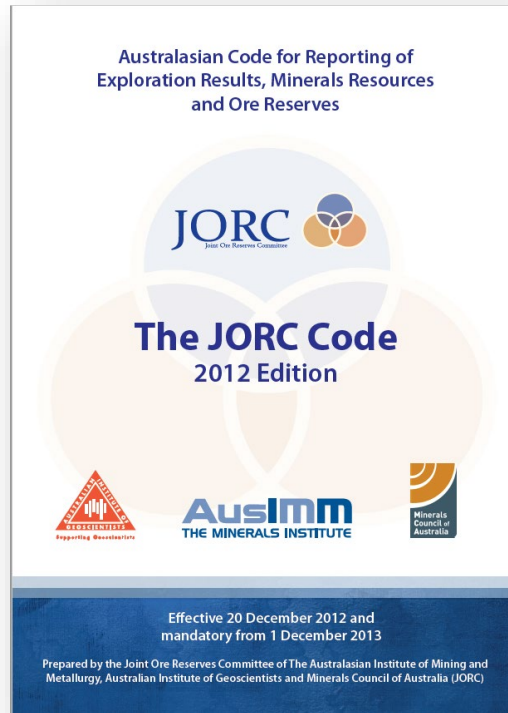
A. Need for, and Objectives of, the Final Rules

B. Significant Issues Raised by Public Comments

C. Small Entities Subject to the Final Rules

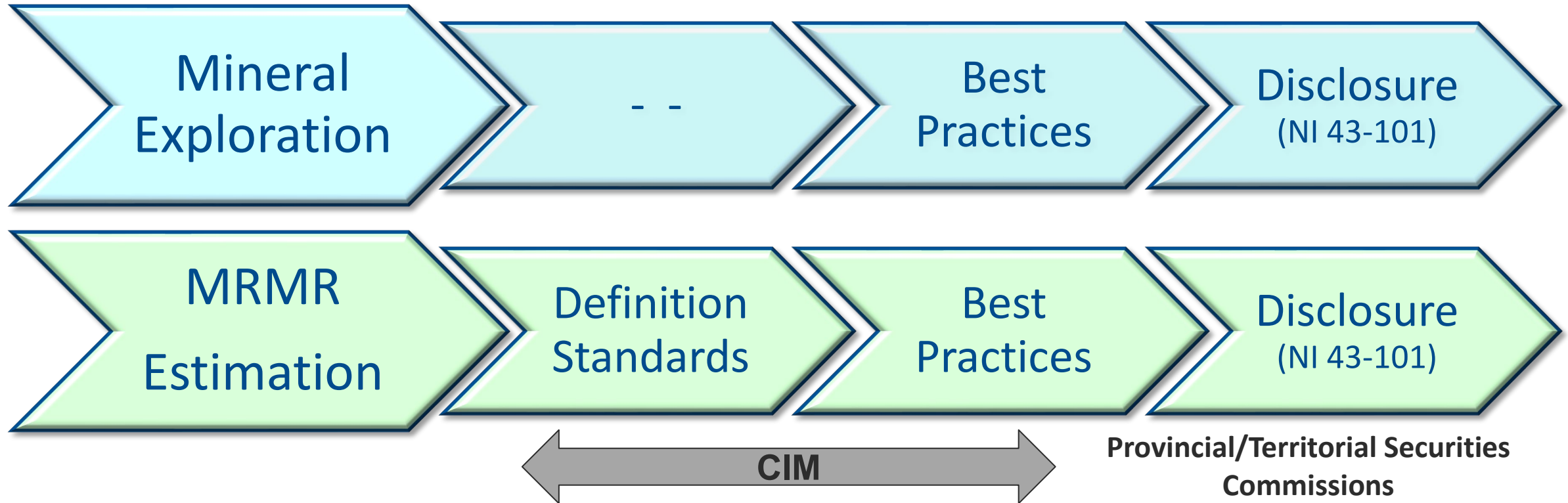
- For comparison, in the United States, disclosure of information relating to mining properties is also regulated under securities legislation - Regulation SK-1300.
- No document exists that provides guidance on practice.

International Disclosure



- The form of disclosure of information is provided in each of the countries' reporting templates (e.g. Table 1) are often governed by the various stock exchanges.

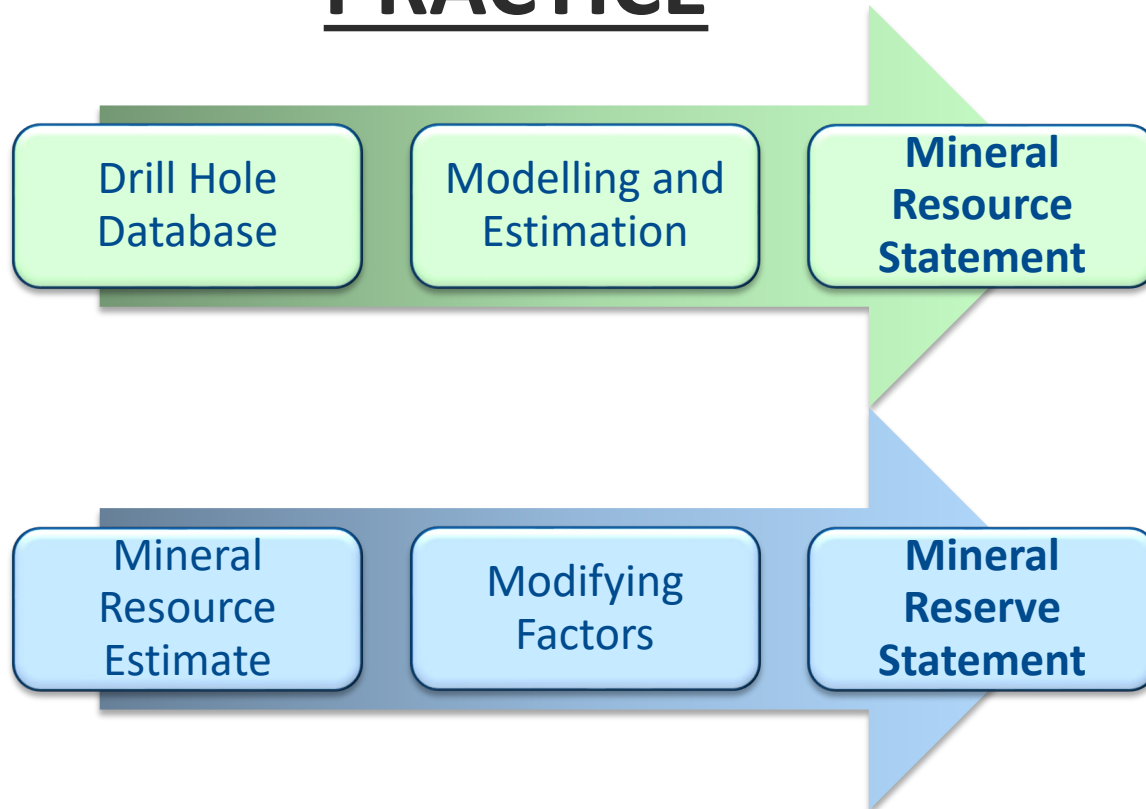
Canadian Standards, Best Practices and Disclosure Structure



- The Canadian structure employs the CIM Definition Standards (2014) for MRMR, but also provides guidance on Best Practices for Mineral Exploration and MRMR estimation. Public disclosure of technical and scientific information is governed by NI 43-101.

Practice vs Disclosure – The Canadian System

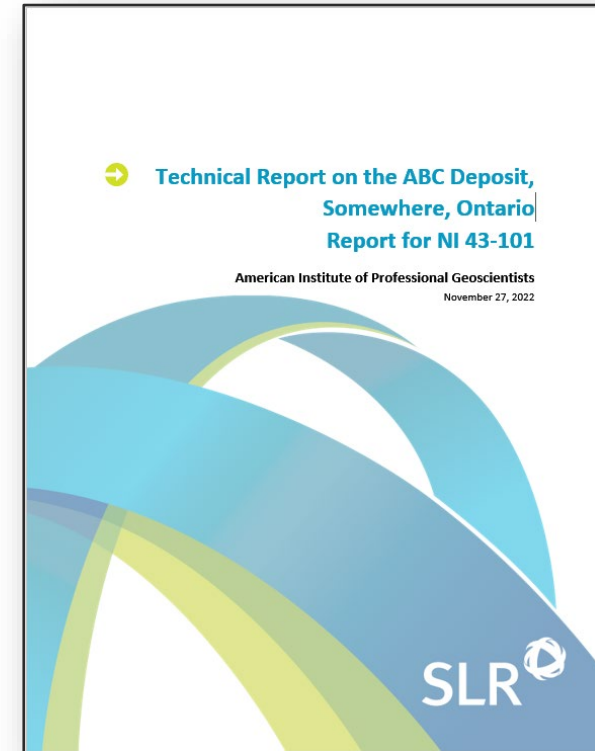
PRACTICE



The CIM MRMR Best Practices Guidelines provide general guidance on the practices used for the preparation of MRMR estimates.

global **environmental** and **advisory** solutions

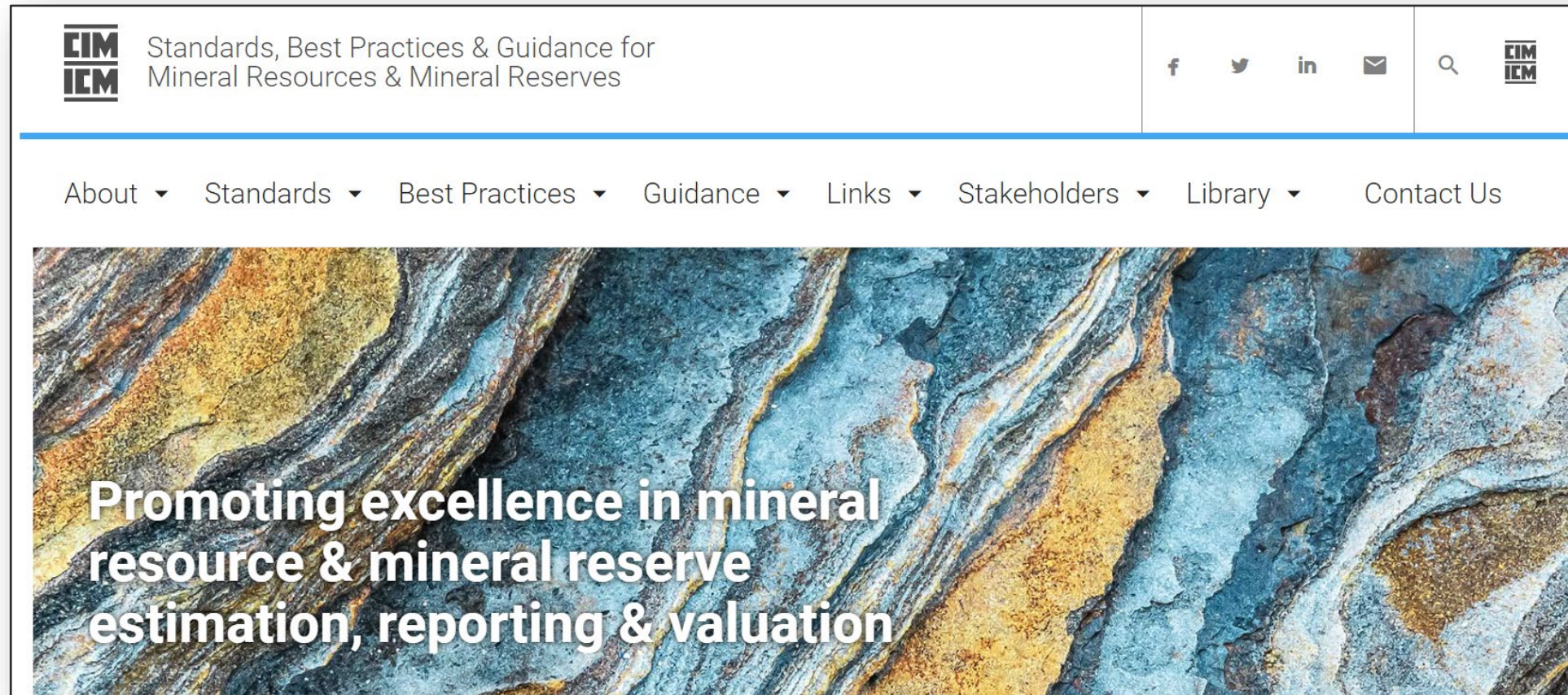
DISCLOSURE



Disclosure of the results of MRMR estimates to the public domain must be carried out in compliance with National Instrument 43-101.

CIM Best Practices Guidelines

CIM Mineral Resource and Mineral Reserve Webpage



- Information relating to Standards, Best Practices & Guidance for Mineral Resources and Mineral Reserves can be found on the CIM website at: <https://mrmr.cim.org/en/>

global **environmental** and **advisory** solutions



CIM Best Practice Guidelines



CIM Mineral Exploration Best Practice Guidelines

Prepared by the
CIM Mineral Resource and Mineral Reserve Committee
Adopted by CIM Council November 23, 2018

2018



CIM Estimation of Mineral Resources & Mineral Reserves Best Practice Guidelines

Prepared by the
CIM Mineral Resource & Mineral Reserve Committee
Adopted by CIM Council November 29, 2019

2019

www.mrmr.cim.org/en/best-practices

Canadian Institute of Mining, Metallurgy and Petroleum
Suite 1250, 3500 de Maisonneuve Blvd. West
Westmount, Quebec H3Z 3C1 CANADA
Tel.: (514) 939-2710 Fax: (514) 939-2714
mrmr.cim.org | www.cim.org

Canadian Institute of Mining, Metallurgy and Petroleum
Suite 1250, 3500 de Maisonneuve Blvd. West
Westmount, Quebec H3Z 3C1 CANADA
Tel.: (514) 939-2710 Fax: (514) 939-2714
mrmr.cim.org | www.cim.org

- Copies of the Best Practices Guidelines are available **at no cost** from the CIM website.

CIM BP Guidelines - Status

- One of the mandates of the CIM MRMR Committee is to maintain and update the Best Practices Guidelines.

Best Practice Guideline	Status
Mineral Exploration	Updated November 2018
Mineral Resources and Mineral Reserves	Updated November 2019
Environment, Social, and Governance (new)	Public Comments Received
Industrial Minerals	Draft update in progress
Coal	Initial stage of update
Uranium	Initial stage of update
Lateritic deposits	Last updated 2003
Lithium brines	Last updated 2012
Placer deposits	Last updated 2003
Potash	Last updated 2003
Rock-hosted diamonds	Last updated 2008

Principle Based Guidance

Principle Based Guidance

- The Best Practices guidelines are intended to provide principle-based guidance to assist professional geoscientists (or equivalent) and engineers (or equivalent) in the preparation and execution of mineral exploration programs and for preparation of MRMR estimates.
- They are based on well-established principles that represent the views and experiences of many practitioners throughout our industry.
- **The guidelines are NOT prescriptive.** They are designed to rely on the judgement and experience of the individual practitioner so as to provide the flexibility required to tailor the practices and procedures to the deposit-specific situation.

MRMR Guidance Example (Chapter 7.14.3.7 Economic Model)

"An annual schedule of the cash flows is derived from the items listed under Economic Criteria. For clarity, in the context of these MRMR Guidelines, the economic model is constructed for the sole purpose of evaluating and demonstrating the economic viability of the selected technical parameters, in support of the Mineral Reserve statement."

Summary of
a principle
or concept.

"To ensure that the DCF model is a fair evaluation of the economic viability of the selected technical parameters, it is considered good practice to use the same metal price(s) or value for preparation of the base case Mineral Reserve economic model as used to prepare the tonnage and grade estimates in the production schedules."

"If the metal price(s) or value assumptions used for the economic base case differ from the price assumptions used to prepare the production schedules and the Mineral Reserve statements, the Practitioner should:

Best
practice and
guidance.

- explain the reasons for the different price assumptions, and*
- provide the DCF metrics at the price assumptions used to determine the production schedules and the Mineral Reserve statements."*

Additional
guidance
and source
of
information.

"Guidance regarding the selection of metal prices (or values) for use in the preparation of Mineral Reserve estimates has been presented in CIM (2015), as amended from time to time."

Exploration Guidance Example (Chapter 6 (b))

b) Retained Drilling Samples



The program should retain and archive a representative fraction of the drill hole material for future reference. On exploration-stage properties, retaining drill hole material and unused sample material remaining from the assaying program is generally made a routine part of a drilling program. Any time material is not retained, the geoscientist should document the reason why it was not retained. When considering the long-term storage requirements of this material, the geoscientist should be aware of his or her responsibilities for such material which may differ by jurisdiction: the local mining statute may mandate preserving, disposing, or destroying cores or cuttings. In jurisdictions that do not regulate retention and storage of these materials, the geoscientist should still consider any potential future uses of the material.

When conducting drilling programs for discovery-stage properties, the geoscientist should consider the future requirements for metallurgical, geotechnical, and

CIM Mineral Exploration Best Practice Guidelines

November 23, 2018

- The CIM Mineral Exploration BP Guidelines provide guidance on many aspects relating to exploration for mineral deposits in Canada.

Additional Information

CIM Library (www.cim.org)

The screenshot shows the CIM Library website. The header includes the CIM ICM logo, the text "Canadian Institute of Mining, Metallurgy and Petroleum", and links for "FR", "Log in", and "JOIN". The navigation menu includes "About Us", "Membership", "Library", "Events", "Communities", "Professional Development", and a search icon. The "Library" section is highlighted with a red box and contains the following links: "Technical Resources", "Bookstore", "Canadian Metallurgical Quarterly", "Canadian Mining Data Hub", "CIM Academy", "CIM Journal", "CIM Technical Paper Library", "Conference Proceedings", "OneMine", "Reproduction Permission Request", "Industry Resources", "Canada Mining Innovation Council", "Canadian Mining Hall of Fame", "Global Action on Tailings", "Global Mineral Professional Alliance", "The Mining Association of Canada", "Mining Industry Human Resources Council (MiHR)", "Rare Earth Elements & Chromite", "MRMR", "STANDARDS, BEST PRACTICES & GUIDANCE FOR MINERAL RESOURCES AND MINERAL RESERVES", "CIM Estimation of Mineral Resources & Mineral Reserves Best Practice Guidelines", "Standards", "Best Practices", "Guidance", "Valuation", and "CRIRSCO".

- Additional information relating to MRMR estimation is available to CIM members from the website's library section.

global **environmental** and **advisory** solutions

CIM Journal Articles

GEOLOGY

1

The checkerboard effect and mineral resource reporting of underground mineral resources

R. Pressacco and W. E. Roscoe

SLR Consulting (Canada) Ltd., Toronto, Canada

<https://doi.org/10.1080/19236026.2021.1902203>

ABSTRACT The goal of a Mineral Resource statement is to estimate the in-situ tonnage and grade that might reasonably be expected to be extracted using the contemplated mining methods. Despite the transition by the mining industry to the use of computer-aided methods for preparing Mineral Resource estimates, the fundamental realities of complying with the CIM Definition Standards requirement of “Reasonable Prospects for Eventual Economic Extraction” (RPEEE) have not changed. Computer-aided block modeling can result in an irregular, patchwork of blocks above and below cutoff grade, termed the checkerboard effect. In such cases, for underground mining methods, strict application of a block cutoff grade does not consider the impact of any internal dilution blocks that may be present, while also potentially including blocks above cutoff grade that may not have sufficient spatial continuity. Considering the block dimensions relative to the selectivity of the potential underground mining method, this can result in material errors in Mineral Resource statements. The impact of the checkerboard effect varies from deposit to deposit. While several techniques are currently employed by Mineral Resource practitioners to ensure compliance with the RPEEE requirement of a Mineral Resource, practitioners are encouraged to develop additional methods and techniques that provide reasonable results.

■ **KEYWORDS** Block model, Checkerboard effect, Constraining surfaces, Constraining volumes, Internal dilution, Mineral resources, Reasonable prospects, Underground mining method

- Several papers about industry leading practice have recently been published in the CIM Journal.
- This paper discusses the potential impacts of the reporting bias that can result when using block cut-off grades alone for preparing Mineral Resource statements.
- CIM Journal, Volume 12, 2021 – Issue 2

CIM Journal Articles

GEOLOGY

1

Considerations for using historical geoscientific information in mineral resource estimation

R. Pressacco , L. Evans, and W. E. Roscoe
SLR Consulting (Canada) Limited, Toronto, Canada

<https://doi.org/10.1080/19236026.2022.2045458>

ABSTRACT In many cases, mineralization discovered by prior owners of a mineral property may have been considered to be too low grade to be of potential economic interest at that time. Changes in market conditions over time often warrant a review of the economic potential of historical exploration results. Therefore, any available historical geoscientific information can be of great value because it can save the cost and time required to completely replicate the historical data. As qualified persons (QPs) are ultimately responsible for all data used to prepare a mineral resource estimate, they bear the obligation of carrying out appropriate due diligence and validation of all information and historical work prior to their use for estimation. The task of assigning acceptance criteria rests upon the QP. Considering the wide range of possible scenarios, a detailed listing of acceptance criteria is far beyond the scope of this paper. Generally speaking, the acceptance criteria for using historical data will by necessity vary on a case-by-case basis. In all cases, the QPs are encouraged to fully document the criteria used to establish the acceptance criteria. This paper discusses some of the various actions that QPs may consider for validating historical data.

■ **KEYWORDS** Data validation, Geoscientific data, Historical data, Mineral resources

- This paper shares authors' opinions on items to consider when contemplating the use of historical geoscientific data for the preparation of a Mineral Resource estimate.
- CIM Journal, Volume 13, 2022 – Issue 2

Wrapping Up

Summary

- There are three components to MRMR estimation and disclosure: definitions, estimates, and disclosure of results.
- A number of countries have adopted a common set of standard definitions relating to MRMR.
- Disclosure is accomplished either by means of reports (NI 43-101 or SK-1300) or by means of Table 1.
- While many jurisdictions provide guidance relating to definitions and disclosure, few provide guidance relating to the practice of preparing MRMR estimates.

Summary – continued

- Disclosure of information relating to mineral properties in Canada and the United States is governed under securities legislation.
- Scientific and technical disclosure in both jurisdictions is supported by a Technical Report (Canada) or Technical Report Summary (United States).
- In the author's opinion, both these reports provide an enhanced level of disclosure relative to a Table 1 summary.
- In addition, the Canadian system differs in that it provides guidance to practitioners for preparation of MRMR estimates by means of a series of Best Practice Guidelines.

Questions ?

Contact Us

www.slrconsulting.com



Reno Pressacco

t +1 (416) 947-0907
e rpressacco@slrconsulting.com



Luke Evans

t +1 (416) 947-0907
e levans@slrconsulting.com