

# **DEVELOPMENTS IN INTERNATIONAL MINERAL RESOURCE AND RESERVE REPORTING**

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# DEVELOPMENTS IN INTERNATIONAL MINERAL RESOURCE AND RESERVE REPORTING

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## ABSTRACT

A consistent and reliable international approach to public reporting of a mining company's main assets, its Mineral Resources and Mineral Reserves, has become of increasing importance in recent years with the rapid globalisation of the mining industry. Through the efforts of CRIRSCO<sup>3</sup>, a committee representing national resource / reserve reporting committees in Australia, South Africa, UK/Ireland/W Europe, Canada, USA and Chile, the reporting standards in most "western" countries use almost identical resource and reserve definitions and are generally around 90-95% compatible. New codes based on the CRIRSCO model are being developed or considered in other countries, including Peru and the Philippines. This unified approach has provided the mining industry, regulators and investors with a common framework to report and interpret mineral resource and reserve estimates, thereby facilitating funding to the mining industry through improved investor understanding and confidence. The common reporting standards are reflected in the CRIRSCO International Template, available on CRIRSCO's web site, a document that is kept "live" by reflecting the best of the most recently published CRIRSCO-type National standards.

In a significant exception to this unified industry approach, the USA Securities and Exchange Commission (SEC) requires adherence to its own standard, only partly compatible with CRIRSCO-type standards, with adverse and costly implications for companies listed in the USA. A major industry submission was presented to SEC in April 2005 which, if accepted, would bring about considerable compatibility of CRIRSCO and SEC standards.

The UN Economic Commission for Europe (UN-ECE) has, since 1992, been developing its Framework Classification (UNFC) as a single global system for harmonising all existing national and international resource / reserve reporting systems, covering both government and industry

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requirements and both the hydrocarbon and solid minerals sectors. While few mining companies report their resources and reserves using the UNFC, the system is accepted or is being examined as a basis for reporting by some governments, including those of Russia, China and India. The UN-ECE agreed in 1999 to incorporate CRIRSCO definitions into the UNFC for those categories of resources and reserves used for market-related reporting, but a more recent edition of the UNFC removed or changed the definitions, requiring re-engagement by CRIRSCO to ensure compatibility.

Since 2005, CRIRSCO and the Society of Petroleum Engineers (SPE) have been involved in discussions with the International Accounting Standards Board (IASB), which plans to develop a new Accounting Standard for the Extractive Industries as part of its International Financial Reporting Standards. At the request of the IASB, CRIRSCO and SPE have been examining any potential for convergence of resource / reserve definitions between the mining and hydrocarbon industries.

Each of these systems is described in this paper and high level comparisons made.

## **INTRODUCTION**

CRIRSCO, which was formed in 1994 under the auspices of the Council of Mining and Metallurgical Institutes (CMMI), is a grouping of representatives of National Reporting Organisations (NROs) that are responsible for developing mineral reporting codes and guidelines in Australia (Australasian Joint Ore Reserves Committee - JORC), Chile (Mineral Resources Committee of the Institute of Mining Engineers of Chile), Canada (Canadian Institute of Mining, Metallurgy and Petroleum - CIM), South Africa (South African Mineral Resource Committee - SAMREC), the USA (The Society for Mining, Metallurgy and Exploration Inc - SME), and UK, Ireland and Western Europe (Pan European Reserves Reporting Committee - PERC). The combined value of mining companies listed on the stock exchanges of these countries accounts for more than 80% of the listed capital of the mining industry.

The international initiative to standardise market-related reporting definitions for Mineral Resources and Mineral Reserves had its start at the 15th CMMI Congress at Sun City, South Africa in 1994. The CMMI Mineral Definitions Working Group (renamed CRIRSCO in 2001) was formed after a meeting at that Congress, and was made up of representatives from the

countries listed above (except for Chile, which joined later), with the primary objective of developing a set of international standard definitions for the reporting of Mineral Resources and Mineral Reserves.

In 1997, the five participants reached agreement (the Denver Accord) for the definitions of the two major categories, Mineral Resources and Mineral Reserves, and their respective sub-categories Measured, Indicated and Inferred Mineral Resources, and Proved and Probable Mineral Reserves.

In 1999, agreement was reached with the United Nations Economic Commission for Europe (UN-ECE), which had, since 1992, been developing an International Framework Classification for Mineral Reserves and Resources (UNFC). The agreement led to the incorporation into the UNFC of the CMMI-CRIRSCO resource / reserve definitions for those categories that were common to both systems, i.e. those relevant to market-related reporting. This agreement gave true international status to the CMMI-CRIRSCO definitions.

Following these agreements, an updated version of the Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves (the JORC Code) was released in Australia in 1999 (JORC Code 1999), followed by similar codes and guidelines in USA (SME Guide 1999), South Africa (SAMREC Code 2000), UK / Ireland / W Europe (The Reporting Code, 2001), Peru (Lima Stock Exchange Code, 2003), Canada (CIM Standard Definitions, 2004) and Chile (IIMCh Code, 2004). The JORC Code, prepared by JORC under the auspices of The Australasian Institute of Mining and Metallurgy, Australian Institute of Geoscientists, and Minerals Council of Australia, has played a crucial role in initiating the development of standards definitions for these national codes and guidelines. The JORC Code has been most recently updated in 2004 (JORC Code 2004)

The similarity of the various national reporting codes and guidelines has enabled CRIRSCO to develop an International Template for Reporting of Exploration Results, Mineral Resources and Mineral Reserves (the CRIRSCO Template), which is available on its web site, [www.crirSCO.com](http://www.crirSCO.com). This can act as a model for a code and guidelines for any country wishing to adopt its own CRIRSCO-type reporting standard, after including provisions for country-specific requirements such as those of a legal and investment regulatory nature.

Apart from development of the CRIRSCO Template, some of CRIRSCO's other activities include alignment of CRIRSCO-type resource and reserve definitions with the UNFC, discussions with the International Accounting Standards Board (IASB) on the development of its International Financial Reporting Standard for the Extractive Industries, and discussions with the Society of Petroleum Engineers (SPE) on the possibility of convergence between resource / reserve definitions for the minerals and the petroleum industries.

## **CRIRSCO-TYPE REPORTING STANDARDS**

**Table 1          Current CRIRSCO-Type National Reporting Standards**

### **Description**

The purpose of the CRIRSCO-type reporting standards is to provide a minimum standard for reporting of Exploration Results, Mineral Resources and Mineral Reserves, and to 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. It achieves this by:

- establishing and prescribing the minimum standards for public reporting of Exploration Results, Mineral Resources and Mineral Reserves;
- setting out a system for the classification of tonnage (or volume) and grade (or quality) estimates as either Mineral Resources or Mineral Reserves and for the subdivision of each into categories which reflect different levels of certainty or confidence;
- specifying the qualifications and experience required for a Competent Person<sup>4</sup>;
- setting out the responsibilities of the Competent Person and companies' Boards of Directors with regard to reporting of Exploration Results, Mineral Resources and Mineral Reserves;
- providing a summary list of the main criteria which Competent Person(s) and others should consider in the course of preparing reports on Exploration Results, Mineral Resources and Mineral Reserves.

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<sup>4</sup> Also known as a Qualified Person in Canada and a Qualified Competent Person in Chile

CRIRSCO-type reporting standards do not regulate the procedures used by Competent Persons to estimate and classify Mineral Resources and Mineral Reserves, nor do they regulate companies' internal classification and/or reporting systems.

Figure 1 shows the general relationship between Exploration Results, Mineral Resources and Mineral Reserves in CRIRSCO-type reporting standards.

**Figure 1 General relationship between Exploration Results, Mineral Resources and Mineral Reserves for CRIRSCO-Type Standards**

The principles of CRIRSCO-type reporting standards can be summarised as Transparency, Materiality and Competence. “Transparency” requires that a public report contains sufficient information, the presentation of which is clear and unambiguous, so that a reader is able to understand the report and is not misled. “Materiality” requires that a public report contains all the relevant information which a reader could reasonably be expected to need in order to make a balanced judgement about the matters being reported. “Competence” requires that the public report is based on work which is the responsibility of a suitably qualified and experienced person who is subject to an enforceable professional code of ethics, i.e. that public reports are based on work undertaken or supervised by a Competent Person.

CRIRSCO-type reporting standards are designed to be applied by, or in close cooperation with, market regulatory authorities (eg stock exchanges and / or securities regulators) in the country in which they operate. These authorities usually have a preference for the integrity of the financial markets for which they are responsible to be based on the premise of cooperative self-regulation, rather than solely on governmental legislation or regulation. In effect, CRIRSCO-type reporting standards, sponsored by national organisations representing professionals, mining companies and other key stakeholders, set the standards for public reporting on Exploration Results, Mineral Resources and Mineral Reserves, while the market regulatory authorities are the vehicles under which such reports are monitored when submitted by stock exchange listed companies.

## **Reasons for the Success of CRIRSCO-Type Reporting Standards**

There are several reasons for the success of the CRIRSCO-type reporting standards:

- simplicity;
- regulatory backing;
- intentional avoidance of excessive prescription;
- Competent Person system;
- industry-friendly but designed with the investor in mind.

### *Simplicity*

The prime purpose of CRIRSCO-type reporting standards is to set standards for reporting to the public. To succeed in this aim, it is essential that the reporting framework and terminology is kept as simple as possible, otherwise investors may become confused, lose confidence and direct their funds elsewhere. Publicly reportable estimates can therefore only be categorised as either Mineral Resources or as Mineral Reserves, and there are only three subdivisions of Mineral Resources and two of Mineral Reserves (Figure 1).

### *Regulatory Backing*

With the exception of the USA, all of the reporting standards listed in Table 1 are supported by the regulatory authorities in their respective countries. In Australia and New Zealand, the JORC Code is incorporated into the appendices of the stock exchanges' listing rules. Similarly, in South Africa, the SAMREC Code is incorporated into the Johannesburg Stock Exchange rules regarding Listing Requirements and Continuing Obligations. In Canada, the CIM Definitions Standards are referenced by National Instrument 43-101, which regulates reporting of mineral assets on Canadian stock exchanges. In the United Kingdom, the United Kingdom Listing Authority has indicated its intention to adopt the CRIRSCO style codes. In Chile, enabling legislation is currently with the National Congress and has strong support from the Ministry of Mines. In Peru, the Code for Reporting on Mineral Resources and Ore Reserves was drawn up by a joint committee headed by the Venture Capital Segment of the Lima Stock Exchange.

### *The Avoidance of Excessive Prescription*

CRIRSCO-type reporting standards are deliberately structured to keep the definitions and mandatory aspects to a minimum and to avoid excessive prescription. Most of the content comprises guidelines and tables designed to assist those preparing estimates and reports on Exploration Results, Mineral Resources and Mineral Reserves, and those making use of the estimates and reports; i.e. CRIRSCO-type reporting standards are principles-based, not “black letter” or “bright line” regulations.

### *Competent Person System*

The avoidance of excessive prescription is possible only because of the Competent Person system. This system, which was first introduced in the 1972 JORC guidelines, defines the requirements to qualify as a Competent Person, provides them with considerable freedom to apply their experience and judgement, but makes them accountable for their actions. This concept of responsibility with accountability gives the standards the necessary flexibility to be applicable to a wide range of situations without the need to become unreasonably prescriptive. Accountability is achieved by requiring Competent Persons to belong to specified professional organisations, usually specific to the country concerned. Importantly, several CRIRSCO nations also maintain lists of Recognised Overseas Professional Organisations (“ROPOs”), which identify foreign professional organisations that are recognised as bodies to which Competent Persons may belong for the purpose of preparing reports on Exploration Results, Mineral Resources and Mineral Reserves for submission to that country’s stock exchanges. This has greatly facilitated the international reciprocity of Competent Persons and the international compatibility of reporting systems.

### *Industry- and Investor-Friendly*

CRIRSCO-type reporting standards are developed by industry<sup>5</sup> in consultation with regulatory authorities and then adopted by the regulatory authorities. The standards are therefore user-friendly to the mining industry and also meet the needs of investors and other readers of reports on Exploration Results, Mineral Resources and Mineral Reserves.

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<sup>5</sup> Although the Lima Stock Exchange headed the joint committee that developed the Peruvian reporting standard, the standard was based almost entirely on the 1999 JORC Code, which was drawn up by mining industry bodies.



## **CRIRSCO International Template for Reporting of Exploration Results, Mineral Resources and Mineral Reserves**

The CRIRSCO International Template for Reporting of Exploration Results, Mineral Resources and Mineral Reserves (CRIRSCO Template) is a *pro-forma* product that countries developing their own reporting standards can adopt and adapt to their circumstances by including their own country-specific provisions. It comprises all the elements of the CRIRSCO-type reporting standards listed in Table 1, with those that are national-specific removed. As long as no substantial modifications are made to the non-country specific clauses and guidelines when being adapted, any resulting reporting standard should be 90-95% compatible with existing CRIRSCO-type reporting standards. The CRIRSCO Template also serves as a benchmark for comparison with other international reporting systems, including the UNFC and the Society of Petroleum Engineers (SPE) Guidelines.

As each new or updated national reporting standard within the CRIRSCO “family” is developed, it is reviewed by the other members of CRIRSCO in cooperation with the particular NRO, to ensure that it continues to maintain compatibility with other standards. Any improvements introduced by the most recent standard are then captured and built into the CRIRSCO Template. This rolling process of comparison with previous standards and upgrading by international consensus is highly effective and ensures that changes are kept to a sensible minimum and that the most recent standard and the CRIRSCO Template reflect current ‘best practice’.

### **Emerging CRIRSCO-Type Reporting Standards**

In recent years, CRIRSCO (and JORC) have had discussions with several countries interested in developing CRIRSCO-type reporting standards, including Indonesia, Brazil, Russia, China, Vietnam and the Philippines. Progress has varied from country to country. The 1999 JORC Code has been translated into Spanish, Portuguese, Japanese, Russian and Chinese by parties interested in developing “western” reporting standards in those countries. At the time of writing, the Philippines was in the process of introducing a CRIRSCO-type reporting standard based on the 2004 JORC Code. The availability of the CRIRSCO Template should facilitate the continued

development of these standards, with a flow-on effect in improved investor understanding and confidence.

## USA SECURITIES AND EXCHANGE COMMISSION INDUSTRY GUIDE 7

### Introduction

The USA is the only CRIRSCO country in which the market regulator (the Securities and Exchange Commission - SEC), does not recognise the CRIRSCO-type reporting standard - in this case, the SME “Guide for Reporting Exploration Information, Mineral Resources and Mineral Reserves”. Instead, the SEC requires adherence to its own standard, Industry Guide 7, which lacks compatibility with CRIRSCO-type standards and / or established industry practice in several key areas:

- **Commodity Prices:** If applicable historical prices are available, SEC requires a standardised price to be used equal to the average price which prevailed during the last three years. If applicable historical prices are not available, reasonable forward looking estimates may be used, but must be justified by available information such as current sales contracts.
- **Publication of Mineral Resources:** SEC does not allow estimates other than Proved and Probable Reserves to be disclosed unless (a) such information is required to be disclosed by foreign or state law, or (b) such estimates have been previously provided to an entity that is offering to acquire, merge, or consolidate with, the registrant or otherwise to acquire the registrant’s securities. The term “resources” cannot be used. Material other than reserves can be reported as “other mineralised material”. This term is not defined but is generally understood to be equivalent to a Mineral Resource.
- **Technical and Economic Study Requirements:** SEC defines a reserve as that part of a mineral deposit which could be economically and legally extracted or produced at the time of the reserve determination. For new projects, a feasibility study is required to declare reserves. When reserves are added to an existing project, a mine plan and cash flow analysis may be sufficient. Requirements vary with the mineral being mined. The term “feasibility study” is not defined by the SEC. To clarify these terms the SEC has referred to checklists published by consulting companies

- **Competent Person:** Industry Guide 7 does not include a Competent Person requirement, although the name of the person estimating the reserves must be included in the report.

The key differences are summarised in Table 2.

**Table 2 Key Differences between CRIRSCO-Type Reporting Standards and SEC Industry Guide 7**

Industry Guide 7 is a short (three page) document that originated in the 1980s (and further back, arose from the 1930's economic collapse and resultant gold stock boom), is very general in nature and consequently requires extensive interpretation by SEC staff. These interpretations can only be obtained through questioning during a formal review process. They are only shared privately with the registrant, are not written, transparent or publicly available, and appear to be inconsistent over time or from company to company. For example, Jack Thompson, Vice Chairman of Barrick Gold Corporation, reported at a conference in October 2003 that, as a result of SEC requirements, Barrick had gold reserves totalling 87 million ounces in its Canadian disclosure but only 71 million ounces in its US disclosure (Thompson, 2003).

The SEC's approach to resource and reserve disclosure appears to be driven by its core mission, which is to protect investors. While market regulators in other CRIRSCO countries are also concerned to protect investors, they aim to achieve this by ensuring that the investors are provided with all the information which they and their professional advisers would reasonably require, and reasonably expect to find in a public report, for the purpose of making of a reasoned and balanced judgement regarding the Exploration Results, Mineral Resources or Mineral Reserves being reported. This results in reporting regimes characterised by full and transparent disclosure of all material information, rather than one that is more concerned with restricting the information provided to the investor.

The recent and rapid globalisation of the mining industry and the need for global companies to tap the US capital markets has focussed attention on the SEC's public reporting policies and their inconsistency with those in other countries. In 2003, the SME met with SEC staff in Washington, DC, to determine how the SME could best assist the mining industry in resolving the inconsistencies. It was established that the SME should develop industry recommendations and submit them to the SEC for its consideration. In 2004, the SME formed the SEC Reserves

Working Group / SME Resources and Reserves Committee (the Working Group) to achieve the following objectives:

- Develop an industry position with respect to the four issues listed above plus Permitting and Legal Requirements;
- Update the 1999 SME “Guide for Reporting Mineral Resources and Mineral Reserves”, taking into account the reporting requirements of the SEC and other international reporting standards;
- Present the industry position to the SEC for its consideration.

The SME completed its report in April 2005, including a revision of its “Guide for Reporting Mineral Resources and Mineral Reserves” (referred to as the 2005 Guide) and submitted it to the SEC. The full report can be found on the SME’s web site, [www.sme.org](http://www.sme.org), but the key recommendations with respect to the five issues listed above were:

- **Commodity Prices:** Management’s reasonable and supportable forward looking estimates should be used to estimate reserves. Justification of prices must be documented. Disclosure of the price assumptions is recommended but not obligatory. Reasons for non disclosure must be given.
- **Publication of Mineral Resources:** Mineral Resources can be published and must be classified as Measured, Indicated or Inferred. Classification is the responsibility of the Competent Person. Disclosure is recommended. New definitions are introduced that are designed to clarify and be more restrictive than both those used abroad for mineral resources and those used by the SEC for “other mineralized material”. A Mineral Resource must show reasonable prospects for eventual economic extraction. Such reasonableness must be documented according to specified guidelines. Whenever a Mineral Resource is published, a statement must be made that no assurance can be given that the Mineral Resource will eventually convert to a Mineral Reserve.
- **Technical and Economic Study Requirements:** A Mineral Reserve is the economically mineable part of a Measured or Indicated Mineral Resource. The type of study which must be completed must be determined by the Competent Person. A “Mineral Reserves Declaration Report” must be completed before a reserve is declared. The report is the result of a properly defined, adequately scoped, and professionally executed study of the viability of the project. The Competent Person is responsible for the content of the report. A non-prescriptive

checklist is supplied to assist the Competent Person in determining which technical and economic criteria may need to be taken into account

- **Permitting and Legal Requirements:** Legally enforceable mineral title sufficient to allow exploration, development and extraction is controlled by the reporting entity at the time of determination. If the reporting entity is leasing or sub-leasing the mineral, the lease or sub-lease should be from an entity which controls the required mineral title. There must be a reasonable expectation that all permits, ancillary rights and authorisations required for mining and processing can be obtained in a timely fashion
- **Competent Person:** Reserves and resources must be estimated by, or under the supervision of a Competent Person defined as an engineer, geoscientist or other mining professional who is a member of an approved institution with an enforceable code of ethics, having a minimum of five years experience which is relevant to the style of mineralisation and type of deposit under consideration and to the activity which that person is undertaking.

At the time of writing, the SEC had not formally responded to the report.

### **UNITED NATIONS FRAMEWORK CLASSIFICATION**

The UNECE began work on its UNFC (the latest edition of which is entitled “United Nations Framework Classification for Energy and Mineral Resources”, UNECE, 2003) in 1992 and released the first version in 1997. The UNFC is intended as a universally applicable scheme for classifying energy and mineral resources and reserves, in effect harmonising all existing national and international mineral resource and mineral reserve reporting systems across the full spectrum of governmental and commercial requirements.

The UNFC uses a three-digit number to codify resource and reserve estimates based on the following parameters:

1. degree of economic/commercial viability
2. field project status and feasibility; and
3. level of geological knowledge.

These parameters form three orthogonal axes, creating a three-dimensional classification and codification system as shown in Figure 2

**Figure 2 UNFC Three-Dimensional Classification and Codification System**

In theory, this allows for the existence of over 30 resource and reserve “boxes”, although in practice only a limited number are used.

The main difference between the three-dimensional UNFC approach (Figure 2) and the two-dimensional CRIRSCO approach (Figure 1) is that the CRIRSCO system combines the UN’s Feasibility and Economic axes, on the basis that the two are, in practical terms, inherently linked and that the CRIRSCO system only deals with deposits that have reasonable prospects for eventual economic extraction..

Table 3 shows the main differences between CRIRSCO-type reporting standards and the UNFC.

**Table 3 Main Differences Between CRIRSCO-Type Reporting Standards and the UNFC.**

In 1999 CRIRSCO’s predecessor, the CMMI Mineral Definitions Working Group, reached agreement with UNECE that CMMI definitions would be incorporated into the UNFC for those categories of resources and reserves used for market-related reporting (Mineral Resources, Inferred Resources, Indicated Resources, Measured Resources, Mineral Reserves, Proved Reserves, Probable Reserves). This was a considerable achievement that brought benefits to both UNECE and CRIRSCO.

In November 2001, UNECE established an Ad Hoc Group of Experts on the Harmonization of Energy Resources/Reserves Terminology (the Ad Hoc Group), to oversee further developments of the UNFC.

In 2003 an updated UNFC was produced (UNECE, 2003) without consultation with CRIRSCO and with input from the hydrocarbon industry that failed to take sufficient account of differences between the hydrocarbon and solid mineral industries in the way they report resources and reserves. The result was that the 2004 UNFC lost almost all of its compatibility with CRIRSCO-

type standards, with specific definitions for Measured, Indicated and Inferred Resources and for Probable Reserves disappearing, and the definition for Proved Reserves being changed:

- **UNFC, 2001, definition of Proved Reserves:** “A Proved Mineral Reserve is the economically mineable part of a Measured Mineral Resource. It includes diluting materials and allowances for losses, which may occur when the material is mined. Studies to at least Pre-Feasibility level will have been carried out, including consideration of, and modification by, realistically assumed mining, metallurgical, economic, marketing, legal, environmental, social and governmental factors. These studies demonstrate at the time of reporting that extraction is justified”.
- **UNFC, 2004, definition of Proved Reserve:** “A Proved Mineral Reserve is the economically mineable part of a recoverable quantity assessed by a feasibility study or actual mining activity usually undertaken in areas of detailed exploration (measured recoverable quantity). It includes diluting materials and allowances for losses which may occur when material is mined and milled. Appropriate assessments, which include feasibility studies, have been carried out, and include consideration of, and modification by, realistically assumed mining, metallurgical, economic, marketing, legal, environmental, social and governmental factors. These assessments demonstrate, with a high degree of confidence at the time of reporting, that extraction is justified. A feasibility study or actual mining activity, usually undertaken at the detailed exploration stage, may demonstrate a proved mineral reserve to be economically mineable”.

In response to this, CRIRSCO re-engaged with UNECE and with SPE representing the petroleum industry in an effort to reintroduce compatibility between the UNFC and CRIRSCO-type reporting standards.

While few individual companies report their resources and reserves using the UNFC, the system is accepted or being examined as a basis for reporting by some governments, including those of Russia, China and India. In addition, UNECE has proposed to the United Nations Economic and Social Council (ECOSOC) that the UNFC be recommended for application worldwide. It is therefore necessary for CRIRSCO to maintain its dialogue with UNECE in order to ensure that the UNFC does not fundamentally conflict with CRIRSCO-type reporting standards.

## **COMPARISON OF REPORTING STANDARDS IN CRIRSCO COUNTRIES WITH INDUSTRY GUIDE 7 AND UNFC**

The main similarities and differences between the reporting standards in CRIRSCO countries, SEC's Industry Guide 7 and the UNFC are summarised in Figure 3.

### **Figure 3 Comparison Between Reporting Standards in CRIRSCO Countries, Industry Guide 7 and UNFC.**

## **INTERNATIONAL ACCOUNTING STANDARDS BOARD DEVELOPMENT OF NEW ACCOUNTING STANDARD FOR THE EXTRACTIVE INDUSTRIES**

Since 2004, CRIRSCO has been involved in discussions with the IASB, which, through a research project, is examining the development of a new Accounting Standard for the Extractive Industries as part of its International Financial Reporting Standards (IFRS). The SPE has been similarly involved representing the oil and gas industry. The primary focus of the IASB research project is to consider:

- how resources and reserves should feature on the balance sheet (perhaps as assets measured at their fair values or as aggregations of the historic costs associated with the exploration, evaluation and development); and
- what resources and reserves disclosures should accompany or be included in the financial report.

Currently, IFRS do not clearly address the treatment of mineral resources or reserves even though most stakeholders recognise that knowledge about a company's resources and reserves is the most important information about a mining or exploration company. Nevertheless, such information is used for a variety of purposes in reporting under IFRS including, but not limited to, determining exploration success to justify the carry forward of exploration and evaluation costs, the amount of goodwill acquired in a business combination, the depreciation and/or impairment of capitalised costs, and the amount of rehabilitation provisions. It follows that the definitions of mineral resources and reserves and how those definitions are applied are central to financial reporting by mining companies.



CRIRSCO's initial involvement was to provide the IASB Board and its research team with information and briefings on reporting standards used by the mineral industry world-wide and, more specifically, on definitions for mineral resources and reserves. More recently, CRIRSCO has been asked by the IASB to examine the potential for convergence of resource and reserve definitions with the hydrocarbon industry (see below) and to work with it to provide high level, non technical guidance on resource and reserve definitions for the accounting profession.

This engagement with international standard setters on behalf of the mining industry is one of CRIRSCO's most important responsibilities (and is one of the main drivers for CRIRSCO's current program to restructure and provide itself with the mandate, resources, support and funding to properly undertake such functions). With the general global acceptance of IFRS, it is essential that CRIRSCO remains engaged with IASB to ensure that the eventual Accounting Standard for the Extractive Industries is compatible with the best interests of mining companies and their stakeholders, and is aligned with the CRIRSCO Template and the various current national reporting standards.

### **POTENTIAL FOR CONVERGENCE OF RESOURCE AND RESERVE DEFINITIONS BETWEEN THE SOLID MINERALS AND HYDROCARBON INDUSTRIES**

It has become clear to CRIRSCO and the SPE that organisations like the UNECE and IASB have a perception that the solid minerals and hydrocarbon industries are essentially the same and that their resource and reserve definitions should be either identical or highly compatible. Arising from the initial discussions with the IASB, that organisation asked CRIRSCO and the SPE to examine the potential for convergence of their resource and reserve definitions and related terminology. UNECE has expressed interest in the outcome of any such reviews.

CRIRSCO and the SPE began discussions in late-2005 in a spirit of friendly cooperation but with no guarantees as to outcomes. The solid minerals and hydrocarbon industries have long histories and their respective resource and reserve reporting systems are well understood and accepted by their stakeholders. Any changes to bring about greater convergence of their systems would have to be approached cautiously and with wide consultation with all interested parties.

The exercise started with the "mapping" of the SPE Guidelines (Petroleum Reserves and Resources Classification, Definitions, and Guidelines, currently being revised) to the CRIRSCO Template. The following summary draws largely on documents prepared as part of this exercise mainly by John Etherington, Chair of the Definitions Sub-Committee of the SPE Oil and Gas Reserves Committee with input from N Weatherstone of CRIRSCO and others.

Hydrocarbon and mining activities have many elements in common. Minerals and petroleum are both natural occurring materials that are non-renewable and thus subject to depletion. While the scale of projects is variable, the exploration, development and production phases in these industries face similar risks and uncertainties. Not unexpectedly, therefore, there are similarities in the classification systems developed to allow consistent communication of expected results internally to management and externally to government agencies and, for publicly traded companies, to investors. Moreover, it is expected that the regulatory rules concerning such public disclosures would contain similar requirements.

Despite the above similarities, there are some significant differences that impact assessment processes and potentially the classification systems applied.

Petroleum includes all hydrocarbons whether in gaseous, liquid, or solid phase in their native state. Petroleum is divided into conventional deposits (discrete accumulations that are significantly affected by hydrodynamic influences) and unconventional deposits (accumulations pervasive throughout a large area that are not (currently) affected by (natural) hydrodynamic influences). Minerals are restricted to solid materials that are not generally mobile in their native state and that include a wide spectrum of materials (metals, industrial minerals, gemstones, uranium and fossilised organic material (coal)). These differences result in different approaches to extraction and processing, which in turn impact on how the raw materials are assessed and classified prior to extraction and processing.

The classification of both minerals and hydrocarbons can be traced back to a common origin, being the system recommended by V.E. McKelvey in a US Geological Survey paper published in the early 1970's and captured graphically in the "McKelvey Box" diagram (Figure 4).

#### **Figure 4 The “McKelvey Box” (after V E McKelvey, 1976)**

In this classical diagram, the horizontal axis denotes geological certainty while the vertical axis denotes the degree of economic feasibility. Thus, all assessments recognise three major categories: Undiscovered, Discovered (Identified) Economic and Discovered Sub-Economic. Both the CRIRSCO system and the SPE system are ultimately derived from the “McKelvey Box”.

Figure 5 is a high level comparison of the SPE and CRIRSCO classifications using the same orientation of the certainty axes. While initial inspection would indicate significant alignment of classes and categories, more detailed comparisons of the associated definitions is required.

#### **Figure 5: Preliminary Comparison of Hydrocarbon and Minerals Classifications**

The category terminology in resources is complicated since SPE defines three cumulative scenarios (but no terms for discrete increments) while CRIRSCO uses terms for discrete increments (but has no terms for cumulative scenarios). Proved and Probable Reserves in both systems generally appear to denote similar discrete certainty categories, but this requires closer investigation. The CRIRSCO system does not recognise a reserve equivalent of Inferred Resources (similar to SPE Possible Reserves) as the certainty is considered insufficient for reporting purposes.

The SPE philosophy is to create a logical technical classification system that can accommodate diverse regulatory systems and portions may be referenced by individual regulatory agencies. In fact, to date it has been heavily influenced by SEC disclosure rules. Although the “SPE system” is used internally by many companies and treated as an international standard, it has not been directly referenced or incorporated in regulatory disclosure systems.

The CRIRSCO philosophy is to support and coordinate national and international reporting standards that are already, or potentially will be, adopted by all major market regulators. This proactive approach by the mining industry has been very successful, as has been discussed earlier in this paper.

The different approaches to assessment arising from the differing characteristics of solid minerals and hydrocarbon deposits are presented diagrammatically in Figure 6.

### **Figure 6 Comparison of Assessment Approaches**

Given an initial single well penetration, petroleum analysts would create a model with a wide continuous range of potential in-place volumes where the total extent is modelled based on sufficient geological, pressure, seismic information and prior analogs. Thus even in initial stages of discovery, analysts project a low, best and high estimate of in-place hydrocarbons. Moreover, by applying an analog development program (and an associated forecast recovery efficiency), the in-place distribution can be translated into an expected recoverable/sales volume and underlying production and cash flow schedule.

In the early post-discovery stages, these accumulations are classified as Contingent Resources and the distribution of recoverable volume estimates can be expressed by three deterministic scenarios (low/best/high) or a continuous probability distribution based on probabilistic analysis techniques. As additional information (more wells, seismic) is acquired and engineering studies are refined, the range of potential recoverable volumes narrows. At some stage, studies indicate a reasonable chance that the accumulation will support one or more commercial exploitation projects. Once all contingencies for development have been resolved and that project is committed to proceed, the associated recoverable volumes are transferred to the Reserves class and the three scenarios are labelled 1P/2P/3P and the intervening increments are labelled Proved, Probable and Possible.

Given the mobile nature of the typical hydrocarbon material, it is logical that any discovered area must have a continuous probability distribution of recoverable quantity estimates. Wherever a project is defined based on commercial maturity as either reserves or contingent resources, the estimate inherently has an underlying certainty distribution and thus there is always a 1P downside case and a 3P upside case. Thus there are always three categories of estimates that may or may not be related to physical accumulation boundaries, and a best estimate quantity is estimated; the range could include variations in both in-place estimates and recovery efficiency.

In a mining project, a single core hole could not be used as the basis for this type of analysis. Based on geological and analog information, analysts may have a very rough expectation of the limits of the deposit but only after obtaining an extensive grid of drill hole information could there be any realistic judgment of deposit extent and internal grade variation. Assuming that such a model would give reasonable expectation of an economic mining project, the expected tonnage and grade that could be recovered from that area drilled could be classified as an Inferred Mineral Resource. As the drill grid size is decreased and grade spatial variation is better modelled, portions of the original Inferred area may be classified as Indicated and / or Measured Resources. Once engineering studies for mine and facilities design are complete and all other modifying factors are considered (usually a Pre-Feasibility study), a portion of the Mineral Resources may be converted to Proved and Probable Mineral Reserves. No Possible Reserves are defined since the information that underlies the comparable Inferred Resources is usually insufficient to allow inclusion in engineering feasibility studies.

Given the non-mobile nature of the deposits in mining, it is not logical to apply the cumulative scenario approach used in petroleum assessments. In the minerals approach each category has a physical boundary related to sample density. Deposits undergoing commercial development may have a Proved Reserves area and an adjacent Probable Reserves area, with both undergoing extraction. In some cases the deposit being mined may only have Probable Reserves. There may be laterally or vertically adjoining areas where potential mine extensions exist, but if lacking completion of appropriate technical and economic studies, they are retained as Measured or Indicated Mineral Resources. If sufficient sample density is not available in these adjoining areas, the quantities projected are Inferred Resources and would not normally be subject to a feasibility study until increased sampling converted all or part to at least the Indicated category.

In summary, while there is much that is similar between the solid minerals and hydrocarbons industries, there is also much that is different. Discussions between CRIRSCO and the SPE will continue during 2006 with the target of late 2006 to advise the IASB of the likelihood and extent of any convergence of the respective resource and reserve reporting systems. A possible outcome is that no meaningful convergence will be achievable in the short to medium term. In this case, CRIRSCO and the SPE will cooperate to produce high level guidance on resources and reserves that may be appropriate for inclusion in a new Accounting Standard and that would encompass the existing CRIRSCO and SPE reporting systems at a lower level.

## **CONCLUSIONS**

There have been extensive developments in national and international reporting standards for Exploration Results, Mineral Resources and Mineral Reserves in recent years. Through the efforts of CRIRSCO and the National Reporting Organisations in participating countries, the reporting standards of Australasia, Canada, Chile, Peru, South Africa, UK/Ireland/Western Europe and USA (excluding the SEC) are over 90% compatible. This has brought about greater stakeholder understanding and certainty, facilitated the flow of investor funding and improved the ability of mining companies to operate confidently in non-domestic markets. While much has been achieved, the rapid globalisation of the mining industry and the activities of national and international organisations such as the SEC, UN, IASB and SPE mean that CRIRSCO must maintain a proactive position and constant engagement in order to ensure that the best interests of the mining industry are properly represented in these important forums. For its part, the mining industry must accept that such constant, high level, representation can no longer be left to a small group of dedicated and hard-working volunteers, as CRIRSCO has been since its inception 12 years ago. The industry must now be prepared to actively support and fund a more rigorously constituted and mandated CRIRSCO, so that it is able to build on the considerable gains made and to advance the interests of the mining industry well into the future.

## **ACKNOWLEDGEMENTS**

This paper is based partly on CRIRSCO documents prepared by, or in conjunction with, other members of the committee. Those same CRIRSCO members have also kindly reviewed a draft of this paper, and the authors gratefully acknowledge the assistance of Ferdi Camisani, John Clifford, John Postle, John-Michel Rendu, Gordon Riddler, Peter Stoker and Edmundo Tulcanaza. The section on comparisons between the mining and hydrocarbon industries draws heavily on documents prepared by John Etherington, Chair of the Definitions Sub-Committee of the SPE Oil and Gas Reserves Committee, to whom the authors express their gratitude. Finally, the authors' ability to contribute to CRIRSCO activities is only possible through the generous support of their employers, AMC Consultants Pty Ltd (Stephenson) and Rio Tinto plc (Weatherstone).

## DEDICATION

This is the first CRIRSCO paper published since the untimely passing of Norman Miskelly in late 2005. Norman, a past-Chairman, Deputy Chairman and long-serving member of JORC, was the first Convenor of the CMMI Mineral Definitions Working Group which later evolved into CRIRSCO. Although CRIRSCO has always been a team effort, it was largely through Norman's foresight, energy and commitment that it achieved the considerable success that it now enjoys. Norman was a man of great personal warmth and charisma, and the authors and their fellow-committee members have been most fortunate to have benefited from his friendship and guidance. *Vale* Norman.

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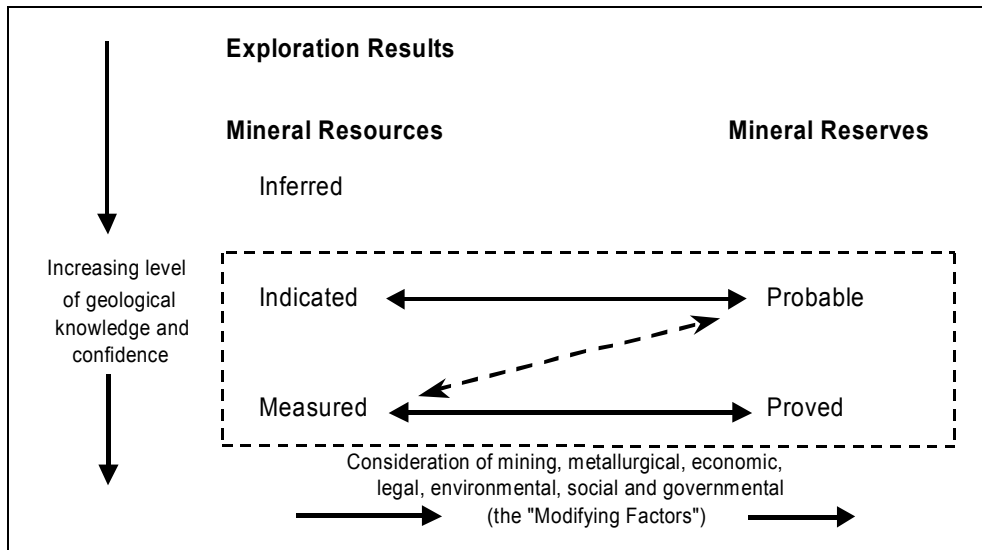
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# DEVELOPMENTS IN INTERNATIONAL MINERAL RESOURCE AND RESERVE REPORTING

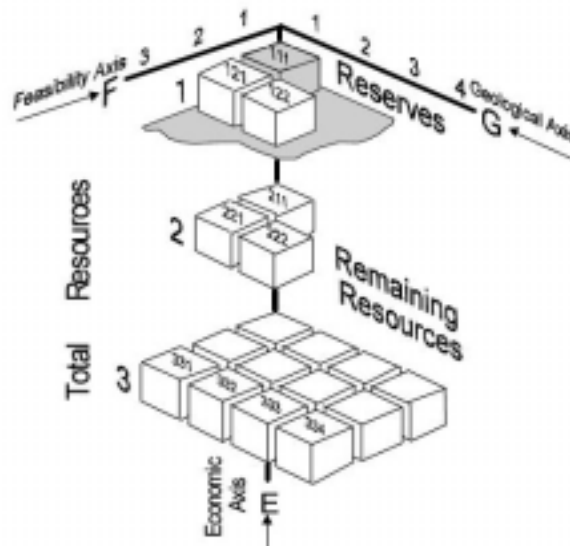
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## Figures and Tables

**Figure 1 General relationship between Exploration Results, Mineral Resources and Mineral Reserves for CRIRSCO-Type Standards**



**Figure 2 UNFC Three-Dimensional Classification and Codification System**

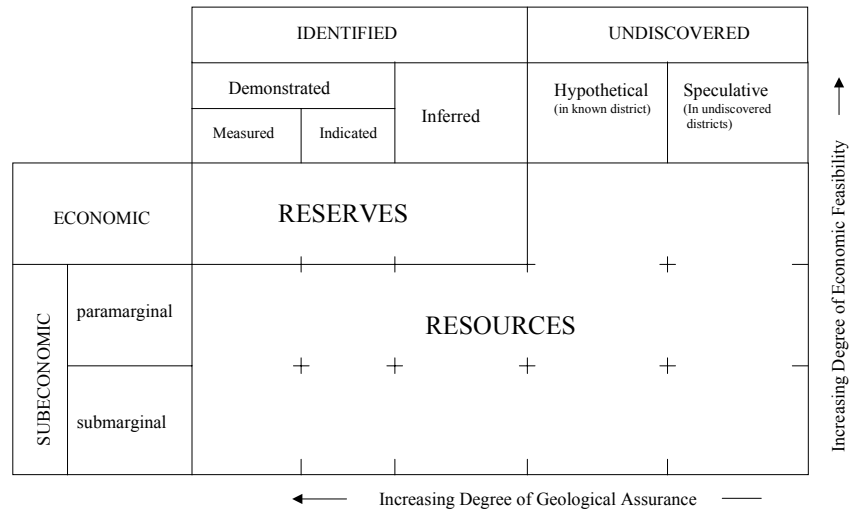


**Figure 3 Comparison Between Reporting Standards in CRIRSCO Countries, Industry Guide 7 and UNFC.**

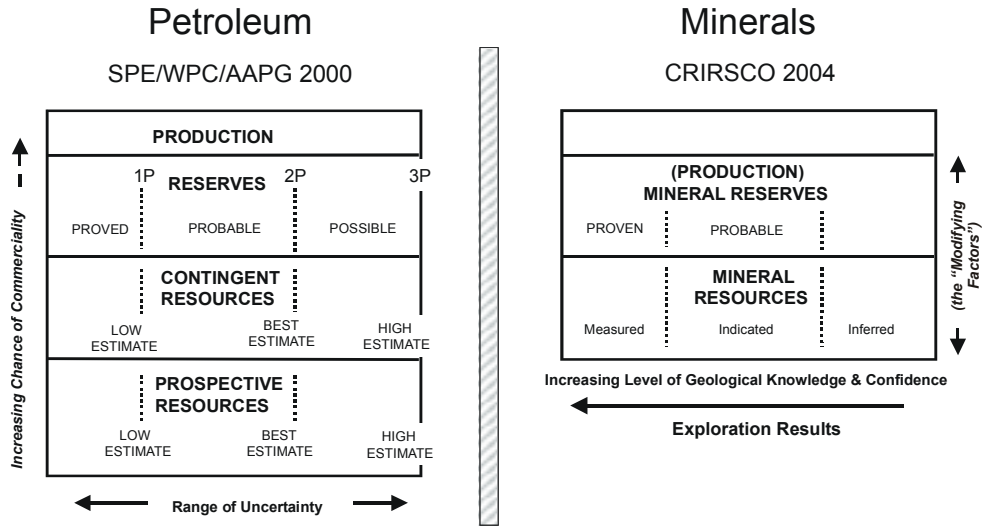
	Australasia	Canada	South Africa	UK/W Europe	Chile	Peru	USA – SME	USA - SEC	UNFC
Adoption of CRIRSCO-type standard	√	√	√	√	√	√	√	X	X
Reporting standard recognised by national regulator	√	√	√	√	√	√	X	√	X
Competent Person requirement	√	√	√	√	√	√	√	X	X
Reporting of Mineral Resources allowed	√	√	√	√	√	√	√	X*	√
Inferred Resources allowed in economic studies	√	X*	√	√	√	√	√	X	√
Level of study required for Mineral Reserves	1	2	1	2	2	1	1	3	1
Commodity price process specified by regulator	X	X	X	X	X	X	X	√	X
ROPO-type reciprocal system	√	√	√	√	X	X	X	X	X

Level of study: 1 = appropriate assessments and studies as determined by Competent Person  
 - 2 = pre-feasibility study - expected (UK/W Europe) or required (Canada, Chile)  
 3 = feasibility study for new projects  
 ROPO = Recognised Overseas Professional Organisation  
 X\* = Allowed in certain restricted circumstances

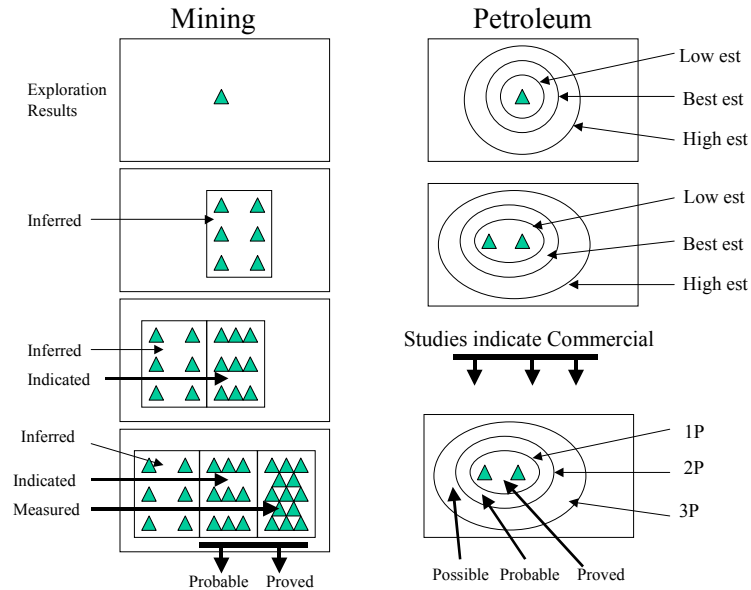
**Figure 4 The “McKelvey Box” (after V E McKelvey, 1976)**



**Figure 5: Preliminary Comparison of Hydrocarbon and Minerals Classifications**



**Figure 6 Comparison of Assessment Approaches**



**Table 1 Current CRIRSCO-Type National Reporting Standards**

Country	Standard	First Published	Latest Edition	Responsible Organisations
Australasia	Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves (JORC Code)	1989	2004	Australasian Joint Ore Reserves Committee, supported by The Australasian Institute of Mining and Metallurgy, Minerals Council of Australia, Australian Institute of Geoscientists
Canada	CIM Definition Standards on Mineral Resources and Mineral Reserves	2000	2004	Canadian Institute of Mining, Metallurgy and Petroleum.
Chile	Code for the Certification of Exploration Prospects, Mineral Resources and Ore Reserves.	2004	2004	Institute of Mining Engineers of Chile, supported by Chilean Mining Ministry, National Association of Mining, National Association of Geologists and Engineering National Association
South Africa	South African Code for Reporting of Mineral Resources and Mineral Reserves (SAMREC Code)	2000	2006 ( <i>in prep</i> )	South African Mineral Resource Committee, supported by South African Institute of Mining and Metallurgy, South African Council for Natural Scientific Professions, Geological Society of South Africa, Geostatistical Association of South Africa, South African Council for Professional Land Surveyors and Technical Surveyors, Association of Law Societies of South Africa, General Council of the Bar of South Africa, Department of Minerals and Energy, Johannesburg Stock Exchange, Council for Geoscience, South African Council of Banks, Chamber of Mines of South Africa
Peru	Code for Reporting on Mineral Resources and Ore Reserves	2003	2003	Joint Committee of the Venture Capital Segment of the Lima Stock Exchange, supported by mining institutions, professionals and specialists in mining exploration.
UK/Ireland/ Western Europe:	Code for Reporting of Mineral Exploration Results, Mineral Resources and Mineral Reserves (The Reporting Code)	1991	2001	Pan-European Reserves Reporting Committee, supported by Institute of Materials, Minerals and Mining, Geological Society of London, Institute of Geologists of Ireland, European Federation of Geologists, with industry and stock exchange representation.
USA	Guide for Reporting Exploration Information, Mineral Resources and Mineral Reserves	1992	1999	Committee on Resources and Reserves of the Society for Mining, Metallurgy, and Exploration, Inc.

**Table 2 Key Differences between CRIRSCO-Type Reporting Standards and SEC Industry Guide 7**

<b>CRIRSCO-type</b>	<b>SEC Industry Guide 7</b>
Can report resources and reserves	Can only report reserves
Commodity prices are based on the Company's reasonable forecasts	Commodity prices generally required to be average of last three years
Technical/economic study required for declaration of reserves	Feasibility study required for declaration of reserves for new projects
Competent Person requirement	No Competent Person requirement

**Table 3 Main Differences Between CRIRSCO-Type Reporting Standards and the UNFC.**

<b>CRIRSCO-type</b>	<b>UNFC</b>
Two dimensional framework (geological and technical / economic axes)	Three dimensional framework (geological, technical (feasibility) and economic axes)
Five possible categories of resources and reserves	Over 30 possible categories of resources and reserves, though many not used
Market-related reporting only	Government and market-related reporting
Competent Person requirement	Studies must be undertaken by a person with appropriate (but not specified) qualifications.
Commonly used by "Western" banks, international mining companies etc.	Not commonly used by "Western" banks, international mining companies etc.