

International Standards for Reporting of Mineral Resources and Reserves - Status, Outlook and Important Issues

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Abstract

Developing and maintaining international standards for the reporting of Mineral Reserves, Mineral Resources and Exploration Results is important. With an increasingly globalised mining industry, the commodity wealth of countries attracting strong political attention and the impact that minerals have on the financial, accounting and investment communities, the need for common terminology and understanding across country boundaries and language barriers has never been higher.

Within countries many minerals reporting systems have been established: some by governments for governments, others by professional and industrial bodies for commercial use. The problem is that these systems don't 'talk' to each other; just like children of different countries, they come from different backgrounds and speak different languages. This was not so much of a problem in the past as presumably within country borders, there was a general understanding of how the various systems operated and related to each other. Now, however, the globalisation of the mining industry, shown by cross border mergers and acquisitions, corporate listings on multiple international stock exchanges and increasing investment by foreign countries in the developing countries of Asia, Africa and South America, means that an international language is needed to describe the assets of mining companies, and ultimately the mineral wealth of countries.

This paper discusses the current status in the development of international standards for reporting Mineral Reserves, Mineral Resources and Exploration Results. It provides a little bit of history, examines current activities and future trends, and identifies some of the issues that need to be addressed to achieve real international understanding of the categories of mineralisation that underpin the mining industry and its ability to supply the increasing demands of its consumers.

What is a standard?

What do we mean by a standard? A dictionary definition will probably include phrases such as "something very widely used and generally regarded as authoritative; implying a level of quality or excellence that is accepted as the norm or by which actual attainments are judged; principles or values that govern behaviour". In the minerals industry many of these words would be familiar to those striving to improve standards of minerals reporting. Since the early 20th century when American President Herbert Hoover was a mining engineer, there have been numerous attempts to develop 'systems', 'codes' and 'guidelines' to define the various categories of resources and reserves. Nowadays, 'systems' tend to be government driven and apply to classifications of mineralisation, whether economic or not, discovered or not, but of use in defining the potential mineral wealth of a country for the future. Codes are often referred to as 'must do' documents, and are commonly linked to the regulations of the country involved. 'Guidelines' are 'should do' documents; often issued in support of Codes or as standalone documents to direct users towards current best practice in reporting. In practice the aims of the three types are very similar even if the resulting documents may look quite different from country to country. Collectively, systems, codes and guidelines add up to the standards that apply in a particular country or jurisdiction.

Although mining is historically important in many countries such as Poland and Russia as a supplier of raw materials to industry, until recently the focal point of the mining industry lay in the main mining countries of 'the West'. Countries such as Australia, South Africa, USA and Canada are major mining

centres and, together with Europe and particularly the United Kingdom, are also the main sources of mining capital. It is here that we find the origins of some of the most widely used reporting standards today.

The development of reporting standards – a brief history

From initial origins in USA, Australia took the lead in providing a Code and Guidelines for defining and classifying Mineral Reserves, Mineral Resources and Exploration Results. The JORC Code was first published in 1989 with further updates in 1992, 1993, 1996, 1999 and 2004 (Reference 1). Figure 1 illustrates how from 1999 onwards, using JORC and its successive updates as a model, there was a rapid increase in the development of new standards in other countries. So reporting standards became an international phenomenon without there being an explicit international standard.

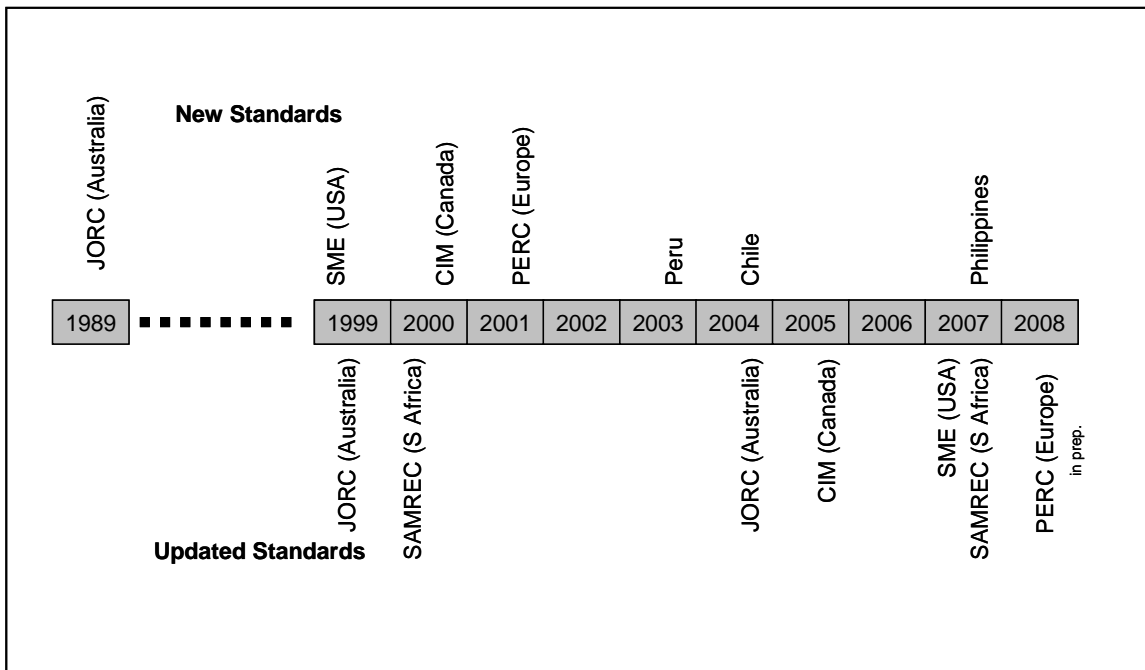


Figure 1 New and updated reporting standards 1989-2008

From 1994 on, representatives of all of the major national reporting organisations (NROs) had met at various times to examine how to converge their national standards into an internationally recognised form. The key to this was agreement on the definitions of resource and reserve categories so that national standards would be compatible with each other in this critical way. Under the auspices of the Council of Mining and Metallurgical Institutions (CMMI), the 1997 Denver Accord reached just such a ground-breaking agreement. This was followed in 1999 by an agreement between the CMMI and the United Nations Economic Commission for Europe (UNECE) that the same definitions for minerals would apply in the United Nations Framework Classification for Solid Fuels and Mineral Commodities (UNFC).

In July 2006 CRIRSCO¹, the successor to the CMMI Working Group, published the first version of its International Reporting Template for Exploration Results, Mineral Resources and Mineral Reserves (Reference 2) modelled on the standards that existed in all its member countries. CRIRSCO currently represents NROs in Australia, Canada, Chile, South Africa, USA, UK and Western Europe. The Template sets out to provide a model for countries that do not have a national standard or that want to modify their existing systems to make them internationally compatible. The Template is not binding, nor

¹ Committee for Mineral Reserves International Reporting Standards

does it replace the national standards that contribute to it. Instead it provides a generic international standard stripped of legal or regulatory components that apply only within individual countries.

It is important to note that for a long time the JORC Code was the only reporting standard commonly in use in the mining industry although it specifically applied only to Australasia. Because of its regional association, including formal links to the Australian Securities Exchange, there was an understandable reluctance to adopt it internationally, particularly amongst companies not listed in Australia or New Zealand.

The flood of new standards that started in the late 1990s and continues today is due to the desire to see JORC style standards developed elsewhere and in many countries (including Australia) new or updated standards have been developed on a regular basis. What is important about this is that the JORC Code is no longer a lone standard; in fact the rolling production of new standards has invigorated the development process as each new standard builds on the last in a quest for reporting best practice. CRIRSCO has a crucial role to play in this development and it is now widely accepted that all new national standards are peer-reviewed internationally before release, and changes to the Template can be made on a continuous basis where it is felt that these benefit the international mining and investment communities.

All of the standards mentioned above include a similar set of terms, organised as shown in Figure 2.

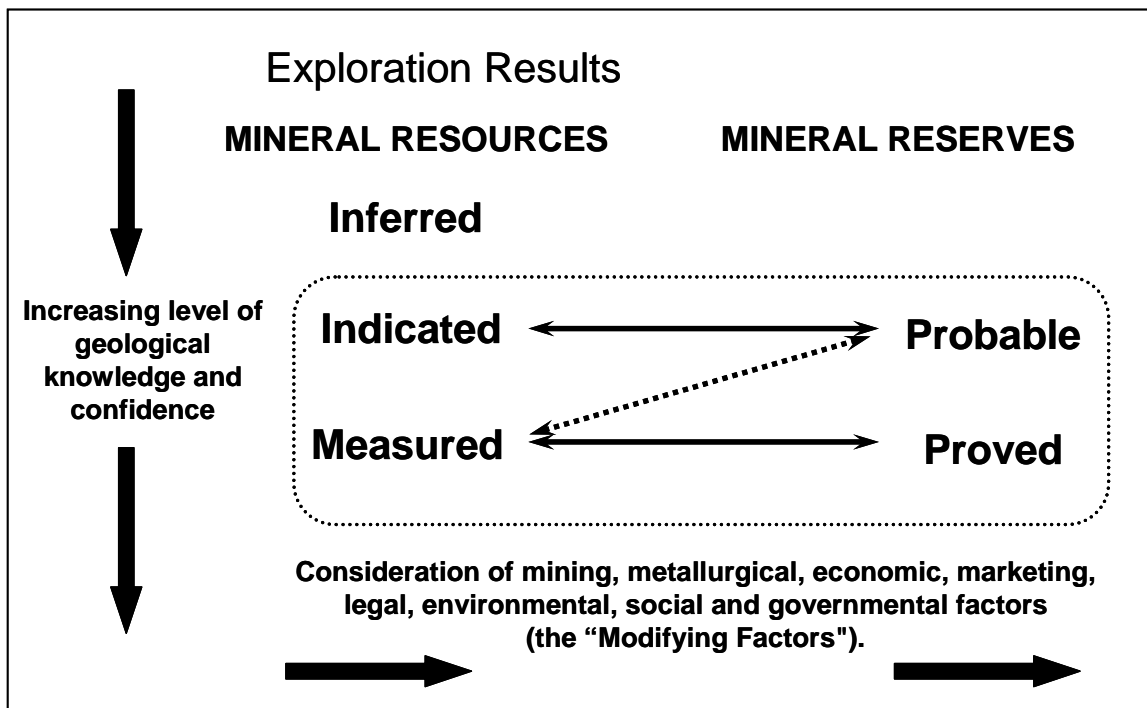


Figure 2 'CRIRSCO style' classification system

Exploration Results are pre-cursors to Mineral Resources; often points of data such as drill hole intercepts or geochemical sampling that are insufficient to estimate a volume, tonnage or grade of mineralisation.

Mineral Resources are in situ estimates of tonnes and grade of mineralisation with 'realistic prospects of eventual economic extraction'. In other words they are not just mineralised rock; they can be shown by preliminary technical and economic analysis to be likely to be mineable, treatable and saleable.

Mineral Reserves are a sub-set of Mineral Resources and are derived by the application of the 'modifying factors' shown in Figure 2. In essence this means that the geological estimate of the resource

is converted into reserves by technical and economic work we commonly call pre-feasibility and feasibility studies. Reserves are different from resources. Studies must address all of the modifying factors in order to demonstrate that at the time of reporting, extraction could reasonably be justified.

The purpose of all of the CRIRSCO style standards is explicit; they are for the public reporting of Exploration Results, Mineral Resources and Mineral Reserves. They are therefore firmly targeted at investors in the mining industry including financial institutions who have an interest in determining the future health and prospects of mining companies. The fact that many of the standards are linked to regulatory bodies whose role is to protect such investors is a further indication of the priorities that these standards set out to achieve. While there is no explicit intention for the standards to be applicable to other users, there is nothing that stops them from being used for other purposes, such as government reporting. In fact it would be hugely beneficial if governments adopted the same terminology as the mining industry when describing Mineral Reserves and Mineral Resources.

Other Classifications

Mention has already been made of the United Nations Framework Classification (UNFC) which was first published for minerals in 1997 and later re-named and revised for petroleum and solid minerals in 2004 (Reference 3). This classification is not intended solely for public reporting but is intended to classify mineralisation of possible strategic interest to governments and in its current form it poses difficulties in application for all stakeholders.

Since 1998 CRIRSCO has been engaged with the UNECE to try to improve the UNFC for wider use and in 2006 at the request of the International Accounting Standards Board (IASB) a Convergence team was set up to examine possible ways of bringing solid minerals and petroleum definitions and guidelines closer together. The Convergence team comprises representatives of CRIRSCO, on the solid minerals side, and the Society of Petroleum Engineers (SPE) representing Petroleum. In 2007, the SPE (and others) published the Petroleum Resource Management System (PRMS) (Reference 4) which reflected the work of the Convergence team. While complete convergence between the two industries is unlikely in the medium term and understandable as they have existed largely independently for the last three decades, the Convergence team developed a strong mutual understanding of each others systems, resulting in the development of a joint mapping report (Reference 5) in 2007. This report is now under consideration by the IASB as the basis for defining, recognising and measuring resource and reserve assets for the purposes of International Financial Reporting Standards.

The similarities (and remaining differences) between the PRMS and the Template are illustrated in Figure 3. While differences are largely restricted to classes of mineralisation that are not publicly reported (Sub Marginal Contingent and Prospective Resources in petroleum terminology), there is a high degree of convergence between Reserves and Resources as defined by the Template. What is currently under discussion is how CRIRSCO countries wish to address those categories of mineralisation (for example here given the name Discovered Not Economic) that are present in the PRMS but not required under CRIRSCO.

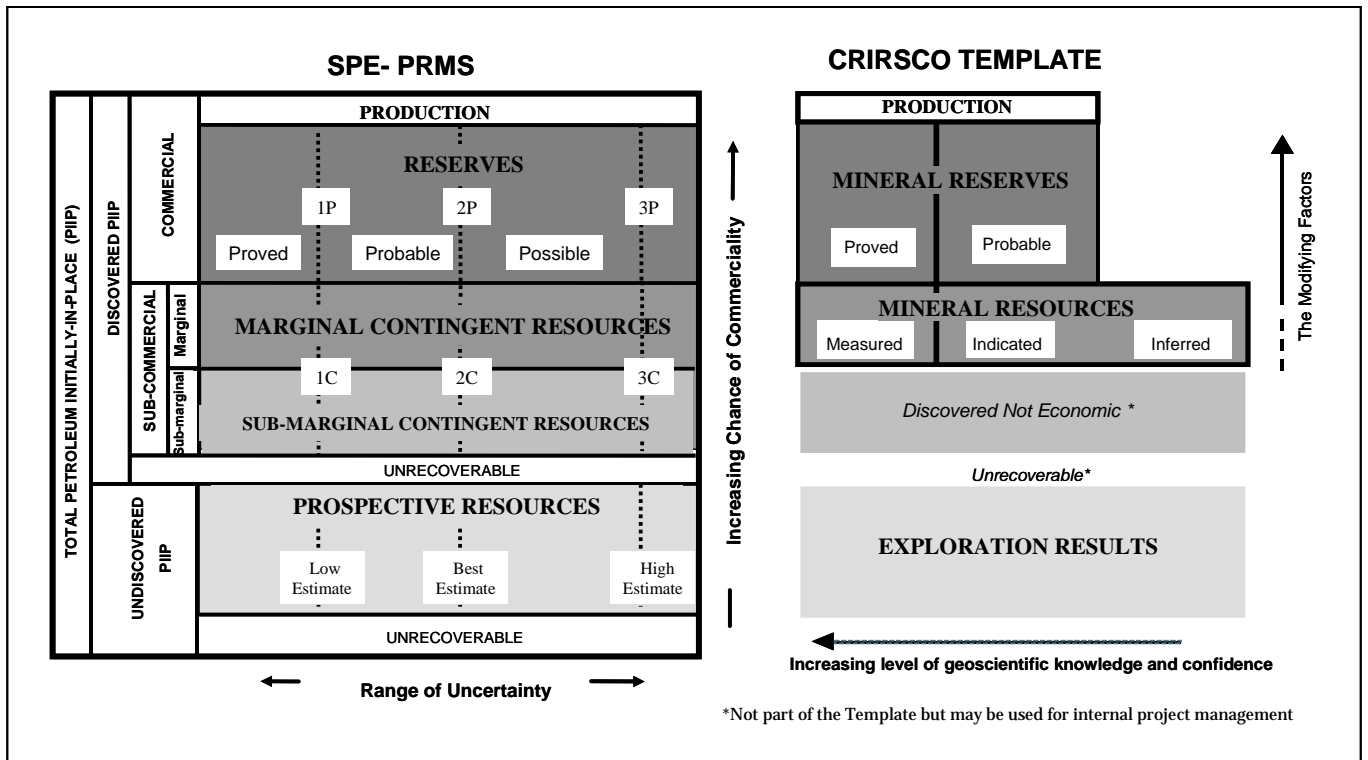


Figure 3 Comparison between PRMS and Template

The most significant development in the mining industry in recent years has been the emergence of Russia and China as major producers and consumers of minerals. With both inwards and outwards flow of commodities and capital to and from these countries increasing almost exponentially, it would clearly be highly beneficial if their mineral reporting standards could be harmonised with those of the traditional Western mining countries represented by CRIRSCO. The most recent minerals classifications published in Russia and China are illustrated in Figure 4 below.

At first glance the systems seem to be significantly different from the CRIRSCO system shown in Figure 2. The separation between resources and reserves is less apparent. For example in Russia the classes A, B, C1 and C2 can refer to either resources ('off balance') or, if economic studies have been completed, to reserves (on balance). In China 'Basic Reserves' are referred to and given a 'b' postscript to indicate that they are the in situ figures from which reserves can be derived. In the Template these would be Mineral Resources. In turn, the Russian and Chinese systems do not appear to be compatible with each other, and in Russia, the classifications of solid minerals and petroleum are not fully aligned with each other.

CRIRSCO takes the view that it should be possible to 'map' the Russian and Chinese systems to the Template and has established two committees for this purpose. Each has representatives from CRIRSCO and the relevant organisations in Russia and China and includes speakers of both languages. The purpose of these sub-committees is not to force the systems into a single version but to examine and understand the underlying principles so that there can be a clear mutual understanding of what is meant by the terms in each. In the same way that the CRIRSCO Template was mapped to the PRMS, it is hoped to map the Chinese and Russian (and other) systems to the Template. Good progress has been made to date.

| Geological Assurance Classification and Type Degree of Economic Viability | Total Identified Mineral resources | | | Undiscovered Resources |
|---|------------------------------------|------------------------------------|-----------------|------------------------|
| | Measured | Indicated | Inferred | Reconnaissance |
| Economic | Proved Extractable Reserve (111) | | | |
| | Basic Reserve (111b) | | | |
| | Probable Extractable Reserve (121) | Probable Extractable Reserve (122) | | |
| | Basic Reserve (121b) | Basic Reserve (122b) | | |
| Marginal Economic | Basic Reserve (2M11) | | | |
| | Basic reserve (2M21) | | | |
| Sub-marginal Economic | Resources (2S11) | | | |
| | Resources (2S21) | | | |
| Intrinsic Economic | Resources (331) | Resources (332) | Resources (333) | Resources (334)? |

Notes: Of the codes (111-334) used in the table above, the first digital number indicates the degree of economic viability: 1=economic, 2M=marginal economic, 2S=sub-marginal economic, 3=intrinsic economic, 7=economic interest undefined; the second digital number indicates phases of feasibility assessment: 1=feasibility study, 2=pre-feasibility study, 3=geological study; the third digital number indicates geological assurance: 1=measured, 2=indicated, 3=inferred, 4=reconnaissance, b=before the deduction of extractable quantities lost in the process of designing and mining.

Figure 4a Chinese Reserves and Resource Classification 1999

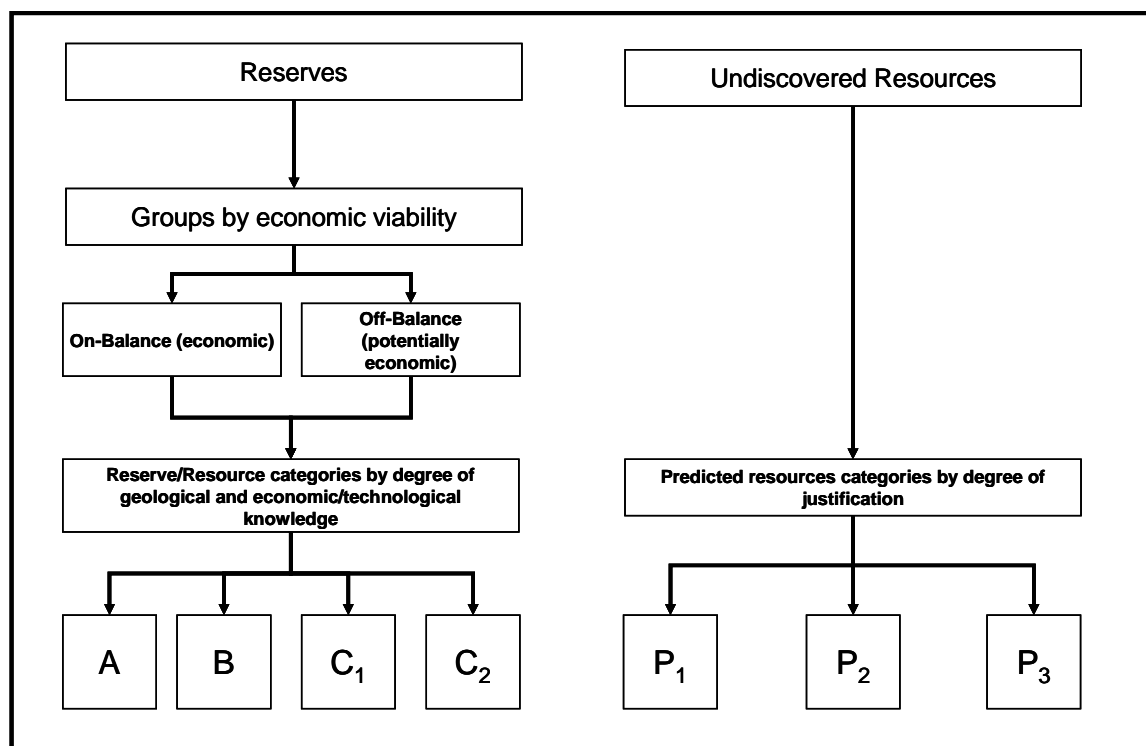


Figure 4b Russian Federation Classification System (2006)

Outlook

The pace of change in the world of minerals reporting has accelerated rapidly in the last few years as shown in Figure 1. In many ways this is due to the interest now being shown by securities regulators, organisations like the International Accounting Standards Board, corporate governance compliance auditors and NGO's with an interest in the sustainability of reserve developments and the benefits that flow from mining. All of this activity has also grabbed the attention of senior management in the mining industry who are now regarding their major assets in quite a new light.

Those responsible for setting and maintaining reporting standards now need to move more quickly and respond to the needs of their stakeholders more regularly than has been the case in the past. Now more than ever, with new countries entering the field, it is incumbent on everyone to work together, as CRIRSCO is doing with the UN, Russia and China, to ensure that terminology is standardised, definitions are clearly understood and the principles of resource and reserve classification are applied consistently and globally. This does not mean that every standard has to be the same, but it does mean that there needs to be a mutual understanding of each others' standards to enable their international application. Also it is important that those outside the industry but with a strong interest in it, such as banks and investors, should understand and be able to cope with different standards under the same international umbrella.

Public awareness of mining has increased because of high profile mergers and acquisitions, the consumer demand from China, India and others and consequently higher commodity prices. With increased awareness comes concern about where future supplies of metals and minerals will come from, can supplies be maintained and increased? What damage will this cause to the environment or to communities affected by mining? Not only are mining companies having to get better at estimating and reporting their mineral assets, they need also to explain how these assets will be mined and what the impacts of the mining will be, both positive and negative, so that the needs of all stakeholders can be taken into account when mines are proposed.

CRIRSCO has recognised the need for improved and broader reporting through its alliance with the International Council on Mining and Metals (www.icmm.com) a body that represents 16 of the world's largest mining companies with a further 28 association members including industry bodies, commodity institutes and chambers of commerce. The ICMM has among its objectives a commitment to the 'highest level of public reporting: in accordance with the Global Reporting Initiative (GRI) 2002 Sustainability Reporting Guidelines and Mining and Metals Sector Supplement'. In addition, the 10 guiding principles established by the ICMM include provisions for implementing and maintaining ethical business practices and sound systems of corporate governance, risk management strategies based on valid data and sound science and effective and transparent engagement, communication and independently verified reporting arrangements with its stakeholders. CRIRSCO supports these basic principles, which all contribute to more open and reliable resource and reserve reporting.

Emerging Issues

As noted above, various classifications extend beyond what CRIRSCO would describe as materials with reasonable prospects for eventual economic extraction (Mineral Resources). In the petroleum industry it is common to assess upside potential statistically on the basis of the likelihood of discovery and recovery. While the uncertainties of speculating on what is still to be discovered might seem to outweigh the benefits of this approach, nevertheless many in the

mining industry and in governments are interested in what might happen as well as what they are reasonably confident will happen. An issue for the international minerals community to address is the need for such an approach; in effect one that classifies all mineralised material whether discovered or undiscovered, recoverable or unrecoverable, economic or uneconomic.

Minerals company managements like to know what the potential of their company is or when their exploration portfolios might be getting weak. Half formed resource estimates that may be currently uneconomic or under-explored but which might one day turn into the mines of the future are potential assets that should be nurtured. There is no harm, and possibly a lot of good, in this far sighted approach provided the figures, if reported externally, are clearly labelled to prevent any misunderstandings on what they represent. Such 'mineral inventories' or 'additional mineralisation' extending beyond Inferred Resources are now the topic of debate in the industry. Should there be a standard classification for mineral inventories or should it be left to companies to assess the prospects of such mineralisation on their own internal criteria?

Regulators have to keep up: many reporting rules that involve reserves and resources are several decades old. During that time, exploration tools, estimation methods and valuation techniques have changed radically, yet the regulations that govern what we are allowed to tell stakeholders have stayed the same. CRIRSCO is pleased to see that one of the most conservative institutions, the American Securities and Exchange Commission (SEC), has recognised that its rules are well out of date and may need to change. Unfortunately so far they are only considering changes to oil and gas reporting regulations, but CRIRSCO has made representations to the SEC to encourage them to similarly update minerals reporting rules.

The issue of developing international reporting standards will be with us for a while. In the author's opinion it is highly unlikely that a single, truly international standard will emerge for many years. What is important now however is that more countries than ever with an interest in such international standards are talking to each other. With dialogue comes understanding and with understanding comes the hope that eventually there will emerge a unified minerals reporting standard. The current approach of bi- and multi-lateral mapping of standards to each other is the first step in this process and has already produced positive results in the CRIRSCO-SPE convergence exercise.

Language is and will remain a barrier to effective international standards, for it is not just the words that are used but the understanding of these words that is critical, particularly where principles-based reporting is concerned. The UNFC aims to remove the language barrier by simplifying definitions and applying numerical codes to mineral classes. CRIRSCO supports this to the extent that it provides a high level umbrella that avoids the details, and pit-falls, of language, and is currently participating in a Task Force to revise the UNFC with this in mind. However, as soon as more detail is required, the numerical approach, with many sub-divisions, risks becoming overly complex and understanding is lost. The Task Force must aim to achieve the right balance between understanding, ease of use and robustness of application.

The differences in perspective between industry and government have become clear in recent years as more discussion has taken place. Government systems, particularly those in the Former Soviet Union, for example, were never designed for international use or for commercial market application and there is an understandable difficulty in wholeheartedly embracing this purpose now. However, CRIRSCO firmly believes that there are fewer obstacles to this than might be imagined and that existing systems, perhaps with some additions and more guidance, are capable of handling all of the classes of mineralisation that all users need to see reported.

One aspect of existing Western standards that is unique to the minerals sector and, so far, to the CRIRSCO family of standards, is that of the Competent Person. All of the western standards are based on principles that are designed to apply across commodities and throughout the development process of a mine from exploration through to production. To make such a system work requires skilled and experienced people that can apply the mechanical parts of estimation while thinking clearly about the logic and the uncertainties in the process. Competent Persons must have a minimum of 5 years experience relevant to the style of mineralisation and type of deposit under consideration and be members of professional bodies which enforceable rules of conduct. This system strengthens the standards, but is not universal. Even in more prescriptive based systems there is no such requirement, although governments may be quite explicit about what is required for a deposit to reach a resource or reserve status. There are interesting indications now that governments are prepared to move away from the old rules based systems and embrace the concept of the Competent Person. The Russian Society of Subsoil Use Experts has been formed as an equivalent to a Western professional body, and is now a member of the European Federation of Geologists with the aim of being able to provide internationally recognised Competent Persons.

Finally

Where would we be if we didn't have standards? Reporting standards provide recognisable benchmarks inside the industry and are recognised by others outside the industry. Standards gain strength and credibility when they are mutually compatible. They reduce confusion, increase understanding, hopefully keep things as simple as possible and are applicable under all circumstances.

Yes, there are issues of compatibility between systems, but these are getting less as we examine them more. Keeping up to date with developments and revising national and international standards is a time consuming task often left to dedicated volunteers, but their success over the years is clear to see if we simply look back to the prevailing situation 20, 10 or even 5 years ago.

Acknowledgements

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2. Committee for Mineral Reserves International Reporting Standards (CRIRSCO), 2006. International Reporting Template for the Public Reporting of Explorations Results, Mineral Resources and Mineral Reserves. [online] Available from: <<http://www.criusco.com>>

- 3 UNECE, (2004), United Nations Framework Classification for Fossil Energy and Mineral Resources ENERGY/WP.1/R.77, UNECE Committee on Sustainable Energy.
- 4 "Petroleum Resource Management System (PRMS)", 2007, Society of Petroleum Engineers (SPE) website: <http://www.spe.org/spe-app/spe/industry/reserves/prms.htm>
- 5 Mapping of Petroleum and Minerals Reserves and Resources Classification Systems Available at: http://www.criusco.com/080314_mapping_document.pdf

Links to international and national reporting standards:

- CRIRSCO www.criusco.com
- JORC (Australasia) www.jorc.org
- IOM³ (UK) www.iom3.org
- CIM (Canada) www.cim.org
- SAIMM (South Africa) www.saimm.co.za
- SME (USA) www.smenet.org
- Chile www.minmineria.cl
- Peru www.bvl.com.pe
- Philippines www.geolsocphil.org/