

# PERC, CRIRSCO, and UNFC: minerals reporting standards and classifications

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There are two internationally recognised systems for classification and reporting of reserves and resources of solid minerals: the CRIRSCO family of reporting standards and the United Nations Framework Classification (UNFC). Despite a common perception that these are in competition, they are in fact closely linked, and they address different sets of requirements. The CRIRSCO standards, which include PERC, JORC, and the Canadian CIM standard among others, were developed for public reporting by companies listed on stock exchanges to provide a consistent terminology as well as quality assurance in company estimates of mineral resources and reserves. The underlying objective is protection of the public (in this case investors) by ensuring that the reports produced use consistent terminology and core content so that they can be understood and compared, and that those who prepare public disclosure reports are competent to do so and are prepared to take personal responsibility for their own work. There are minor differences among the CRIRSCO standards as a result of differing regulatory regimes in the countries in which they are used, but all share identical core definitions and classification. The United Nations classification was developed to provide an all-inclusive system that could be used for mineral inventories and minerals policy planning by governments and companies alike. Where the two systems overlap, CRIRSCO provides the detailed specifications for the corresponding UNFC categories. This paper outlines the history and use of the two systems.

Il existe deux systèmes, avec reconnaissance internationale, concernant la classification et le compte-rendu des réserves et des ressources minières : le CRIRSCO définissant les modalités de rapport et le Système de Classification des Nations Unies (UNFC). Bien que ces deux systèmes soient perçus communément comme en compétition, ils sont en fait étroitement liés et répondent à des besoins différents. Les standards du CRIRSCO qui incluent entre autres les standards du PERC, du JORC et du canadien CIM ont été établis pour les rapports publics émis par les compagnies représentées à la Bourse, pour fournir une terminologie cohérente et aussi une assurance qualité dans l'estimation par une Compagnie des ressources et réserves minières. L'objectif sous-jacent est la protection du public (les investisseurs ici) en garantissant que les rapports émis utilisent une terminologie cohérente, un exposé de la réalité de telle manière qu'ils puissent être compris et comparés et que ceux en charge d'élaborer les rapports destinés au public soient compétents pour le faire et prêts personnellement à assumer leur responsabilité pour leur propre travail. Il existe quelques différences mineures dans les standards CRIRSCO provenant des différents systèmes de régulations pour les pays où elles sont utilisées mais tous les rapports partagent les mêmes définitions de fond et la même classification. L'UNFC a été créée pour fournir un système complet pouvant servir aussi bien pour un inventaire minier que pour un programme de politique minière définie par les gouvernements et les compagnies. Là où les deux systèmes se recouvrent, le CRIRSCO fournit des spécifications détaillées pour les catégories correspondantes de l'UNFC. Cet article décrit l'histoire et l'utilisation des deux systèmes.

Existen dos sistemas de clasificación y declaración de recursos minerales reconocidos internacionalmente: la familia de los códigos CRIRSCO y la Clasificación Marco de Naciones Unidas (UNFC). A pesar de que existe una cierta percepción de que ambas compiten entre ellas, en realidad están íntimamente relacionadas y se refieren a una serie de requisitos diferentes. Las normas CRIRSCO, que incluyen –entre otras– a las PERC, JORC y la norma canadiense CIM, se desarrollaron para la declaración pública de compañías cotizadas en las bolsas de valores, con objeto de proporcionar una terminología unificada así como el control de calidad en las estimaciones de recursos y reservas de las empresas. El objetivo de fondo es la protección del público (en este caso los inversores) asegurando que los informes emitidos tienen una terminología y contenido nuclear congruente de modo que se puedan entender y comparar y que los autores de esos informes para el público tengan la adecuada competencia y estén dispuestos a asumir la responsabilidad personal que implica su firma. Hay pequeñas diferencias entre las normas CRIRSCO como consecuencia de los diferentes regímenes regulatorios en los países en los que se utilizan, pero todas tienen las definiciones y clasificaciones fundamentales idénticas. La clasificación de Naciones Unidas se desarrolló para proporcionar un sistema global que se pudiera utilizar en inventarios minerales y en planes de planificación minera tanto por Gobiernos como por empresas. En aquellos en que los dos sistemas se solapan, CRIRSCO proporciona las especificaciones detalladas para las categorías UNFC correspondientes. En este artículo se describe la historia y el uso de los dos sistemas.

Mineral resources and reserves have been estimated systematically for many decades, but with expansion of the minerals industry interna-

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tionally, and with increasing involvement of capital markets in financing mining ventures, it became clear during the 1980s and 1990s that systematisation and regulation were needed. An early warning sign came in 1970-71 when a major nickel discovery by Poseidon in Western Australia sparked a wave of speculative company flotations,

many based upon unsubstantiated estimates of resources. A much more serious case was the Bre-X fraud in 1997, in which a Canadian company announced a gigantic gold discovery in Indonesia based on data from drill-hole core which had been 'enriched' before assaying with extra gold grains. In both cases - and in many other smaller scale

cases - investors were defrauded of huge sums of money.

Professional organisations of geologists and mining engineers around the world decided that it was necessary to take action to rationalise and regulate the reporting of mineral resources and reserves. The first to produce a formal regime – consisting of a simple classification and a set of professional standards regulating its use – was the ‘Joint Ore Reserves Committee’ in Australia and New Zealand - now better known as JORC. This was closely followed by similar initiatives in Canada, the USA, South Africa, and the United Kingdom. The initial UK initiatives led to pan-European co-operation through the involvement of EFG and IGI.

There was much in common among these standards: in particular the concept of the “Competent Person” (or in Canada the “Qualified Person”), and the same classification was adopted by all. Standards committees from the five countries listed above formed CRIRSCO in 1994, and agreed on an initial set of common definitions in 1997 at a meeting in Denver, USA. Initial UK representation evolved into European participation through the formation of PERC in 2006. Chile joined CRIRSCO in 2004, and Russia in 2011.

Since 1999, CRIRSCO has formally been a participant in developing the United Nations Framework Classification (UNFC) in a project led by the United Nations Economic Commission for Europe (UNECE).

There are two distinct types of public reporting of mineral resources and reserves:

- Disclosure for companies quoted on stock exchanges. Objectives: reliable, transparent information for investors and potential investors. This is the role of the CRIRSCO family of standards
- Governmental, inter-governmental, or NGO reporting of mineral resource estimates and forecasts. Objectives: a reliable mineral inventory to underpin minerals policies (especially cross border, e.g. Europe), available to exploration and mining companies to attract inward investment and exploration activity. This is the role of UNFC.

It should be noted that there is no conflict between CRIRSCO and UNFC, since the CRIRSCO classification itself provides the specifications for corresponding categories within UNFC.

**The CRIRSCO Family of Reporting Standards: PERC as an example**

In 1991, a simple code was published by the Institution of Mining and Metallurgy in London, intended to be used for reporting of mineral resources and reserves by companies with stock exchange listings. This code evolved rapidly and converged with JORC and other reporting standards. In 2001 a major revision was published, incorporating the best features of all of the other codes. This code was prepared with the active involvement and support of the European Federation of Geologists, the Geological Society of London, the Institute of Geologists of Ireland, and the Institution of Mining and Metallurgy. It was named simply “The Reporting Code”, and the intention was that it would act as a reporting standard for Europe but potentially could become a worldwide minerals reporting standard. The reason this did not happen is discussed below. However, it succeeded in its European objectives. In 2006, in light of the further development and improvement of other standards, especially the publication of JORC 2004 in Australia, there was seen to be a need for further updating, so the European committee was reconvened as PERC. PERC had an

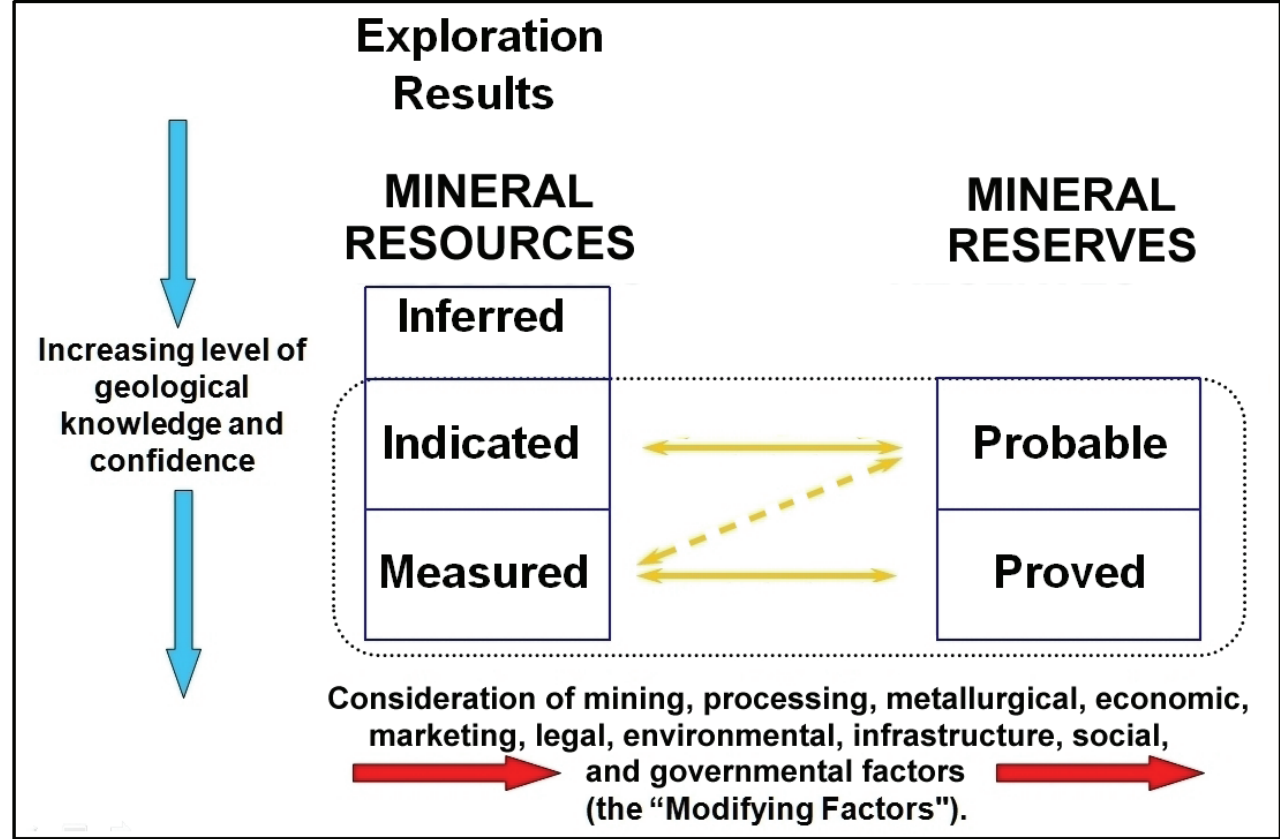


Figure 1: The CRIRSCO standard classification now used by all reporting standards that are aligned with CRIRSCO.

additional role in assisting the integration of Russia into the CRIRSCO family by first developing a method for conversion from the Russian State (GKZ) classification to the CRIRSCO classification, followed by development of a Russian national reporting standard. The PERC Code was issued in 2008, and an update has been published in 2013.

PERC is now recognised by the European Securities and Markets Authority for use on all European stock exchanges, as well as by the Canadian regulators for use within the Canadian reporting system (National Instrument 43-101). Other regulators – such as in Australia and South Africa – mandate the use of only their own national standards, although these still recognise Competent Persons who are accredited in accordance with other CRIRSCO Codes and Standards and by overseas professional organisations elsewhere.

### The role of CRIRSCO

CRIRSCO, which was formed in 1994 under the auspices of the Council of Mining and Metallurgical Institutes (CMMI), was established as a grouping of representatives of organisations that are responsible for developing mineral reporting codes and guidelines in Australasia (JORC), Canada (CIM), Chile (National Committee, from 2004), Europe (PERC), Russia (NAEN/OERN, from 2011), South Africa (SAMREC) and the USA (SME). 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 15<sup>th</sup> CMMI Congress at Sun City, South Africa in 1994. The mineral definitions working group (later called CRIRSCO) was formed after a meeting at that Congress, and was made up of representatives from the countries listed above (except for Chile and Russia, 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 initial participants reached agreement (the Denver Accord) for the definitions of the two major categories, Mineral Resources and Mineral Reserves, and their respective sub-categories of Measured, Indicated and Inferred Mineral Resources, and Proved and Probable Mineral Reserves. This classification is shown

in *Figure 1*.

In 1999, agreement was reached with the United Nations Economic Commission for Europe (UNECE), which had since 1992 been developing an International Framework Classification for Mineral Reserves and Resources (UNFC), to incorporate into the UNFC the CMMI-CRIRSCO resource / reserve definitions for those categories that were common to both systems. This agreement gave true international status to the CMMI-CRIRSCO definitions.

Following these agreements, an updated version of the JORC Code was released in Australia in 1999 (and more recently, in 2004), followed by similar codes and guidelines in South Africa, USA, Canada, UK / Ireland / Western Europe, Chile and Peru. The JORC Code (Joint Ore Reserves Committee 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 codes and guidelines.

In 2002 CMMI was disbanded. CRIRSCO is now a partner of, and partly funded by, ICMM, the International Council on Mining and Metals, which is a worldwide consortium of minerals companies and mining industry associations whose purpose is promoting high environmental and ethical standards in the industry.

The similarity of the various national reporting codes and guidelines enabled CRIRSCO to develop an International Minerals Reporting Code Template in 2006, which is available on the CRIRSCO web site. This can act as a “core code and guidelines” for any country wishing to adopt its own CRIRSCO-style reporting standard, after including provisions for country-specific requirements such as those of a legal and investment regulatory nature.

CRIRSCO serves as an international advisory body without legal authority, relying on its constituent members to ensure regulatory and disciplinary oversight at a national level.

All CRIRSCO standards follow the same set of principles and use the same classification.

CRIRSCO's scope includes all solid minerals (metals, gemstones, bulk commodities, aggregates, industrial minerals, energy minerals such as coal and uranium) and its overall aim is promoting international best practice in the public reporting of mineral exploration results, mineral resources and mineral reserves by achieving international consensus on reporting standards, and by encouraging consistent and high quality

reporting through maintenance of Competent Person standards (see below).

The core of the various standards is practically identical (and becoming ever more closely aligned), but inclusion of national regulatory requirements provides small but important differences – which is why CRIRSCO cannot offer a single worldwide standard. However, for the geoscientist a report prepared under one national standard can readily be referenced to the requirements of another, since they all use an identical classification (*Figure 1*) and an identical set of core definitions. *Table 1* summarises the current CRIRSCO member standard-setting organisations and their professional organisation sponsors.

### The United Nations Framework Classification

The United Nations Framework Classification (UNFC) has a very different purpose from the codes and standards which are aligned with CRIRSCO. Its development was begun in the 1990s by UNECE and proceeds under a global mandate from the UN Economic and Social Council. The UNFC classification is more complex and more extensive than CRIRSCO's; it covers oil and gas resources as well as solid minerals, and its principal objective is to provide a method of standardisation for regulatory and statistical purposes, both governmental and intergovernmental. It may also be useful to larger minerals groups with many sites for their internal planning and management of their mineral inventory.

Key definitions and terminology used for reporting solid mineral reserves and resources (and exploration results) within these two classification systems have been aligned through extensive co-operative efforts between CRIRSCO and UNECE since 1999. A parallel collaboration has taken place between SPE (the Society of Petroleum Engineers) and UNECE for oil and gas, with the PRMS (Petroleum Resources Management System) classification.

UNFC is a generic classification framework for solid minerals and oil and gas. It is an important tool for global and governmental communication. It should be emphasised that it is not a public reporting standard; there are no underlying principles as there are in a reporting standard, and it has no recognition by market regulators. It is a classification and carries no concept of any certification of Competency. In other words, it does not define a Competent Person who takes personal responsibility



Table 1: National Minerals Reporting Standards and their Sponsor Organisations.

The following countries are currently represented on CRIRSCO. Member organisations include all bodies that have a direct influence on the form and content of national reporting standards although they may be more or less active in the affairs of the national committee.

<b>South Africa</b>	
National Committee	South African Mineral Resource Committee (SAMREC)
Member organisations	South African Institute of Mining & Metallurgy (SAIMM) South African Council for Natural Scientific Professions (SACNASP) Geological Society of South Africa (GSSA) Geostatistical Association of South Africa (GASA) South African Council for Professional Land Surveyors and Technical Surveyors (PLATO) Association of Law Societies of South Africa General Council of the BAR of South Africa Department of Minerals and Energy Johannesburg Stock Exchange (JSE) Council for Geoscience South African Council of Banks Chamber of Mines of South Africa (CoM)
<b>Australia</b>	
National Committee	Joint Ore Reserves Committee
Member organisations	Australasian Institute of Mining & Metallurgy (AusIMM) Australian Institute of Geoscientists (AIG) Minerals Council of Australia (MCA) Australian Stock Exchange (ASX)
<b>Europe</b>	
National Committee	Pan-European Reserves Committee (PERC)
Member organisations	European Federation of Geologists (EFG) The Geological Society of London (GSL) Institute of Materials, Minerals and Mining (IoM3) Institute of Geologists of Ireland (IGI)
<b>Canada</b>	
National Committee	Canadian Institute of Mining, Metallurgy and Petroleum (CIM)
Member organisations	CIM
<b>Chile</b>	
National Committee	National Committee for the Certification of Competency in Mineral Resources and Reserves
Member organisations	Mining Council (Consejo Minero) SONAMI (small + medium sized mining companies) Institute of Mining Engineers of Chile Association of Geologists Association of Engineers
<b>Russia</b>	
National Committee	NAEN
Member organisations	NAEN / OERN Association of Experts of Russia on Mineral Resources
<b>United States of America</b>	
National Committee	Society for Mining, Metallurgy and Exploration (SME)
Member organisations	Society for Mining, Metallurgy and Exploration (SME)

for estimates, nor does it provide mandatory requirements or guidance as to the way in which reports are to be written. Another difference from CRIRSCO is that the UNFC includes the categories “Undiscovered” and “Uneconomic” material, which cannot and must not be included in a CRIRSCO-com-

pliant report. The UNFC provides a neutral framework for mapping from/to complete reporting systems (such as CRIRSCO and PRMS).

The CRIRSCO classification is two dimensional, with axes for geological knowledge and for modifying factors;

UNFC is three dimensional (**Figure 2**) with axes for geological knowledge, project feasibility, and socio-economic viability. In other words, the ‘modifying factors’ axis of CRIRSCO has been separated into two axes representing technical feasibility and non-technical factors.

Where the categories in the two classifications correspond, CRIRSCO resource categories are mapped to corresponding UNFC categories (i.e., there is common terminology). The CRIRSCO Template is the set of commodity-specific definitions in UNFC for all solid minerals for these categories.

On 26 April 2013, the UNECE Expert Group on Resource Classification (EGRC) reached consensus on:

- specifications for UNFC 2009. CRIRSCO and SPE (and its PRMS partners) were thanked for their ongoing support and cooperation in providing the solid minerals- and petroleum-specific specifications, respectively, for UNFC-2009;
- A Technical Advisory Group to be established (to develop governance guidelines and provide detailed technical advice);
- UNFC-2009 to be applied also to nuclear fuel and renewable energy resources.

Consensus was reached under a global mandate with broad representation from both UNECE and non-UNECE member states.

### The Competent Person

What makes a CRIRSCO-aligned reporting standard much more than simply a classification is the requirement that any report be prepared and signed by a Competent Person. By signing the report, the Competent Person takes personal responsibility for its contents (whether they are employed to produce the report as an individual or as an employee of a company). This is what allows the use of a simple classification rather than a highly complex prescriptive system which would need to take account of all possible deposit types and geological settings – the Competent Person is expected to use their professional skill, judgement and experience rather than following a prescriptive set of rules.

It is the Competent Person’s qualifications and, even more, their relevant experience, which give the user of a report the assurance of its veracity and reliability. CRIRSCO standards provide a simple definition of who can be accepted as a Competent Person

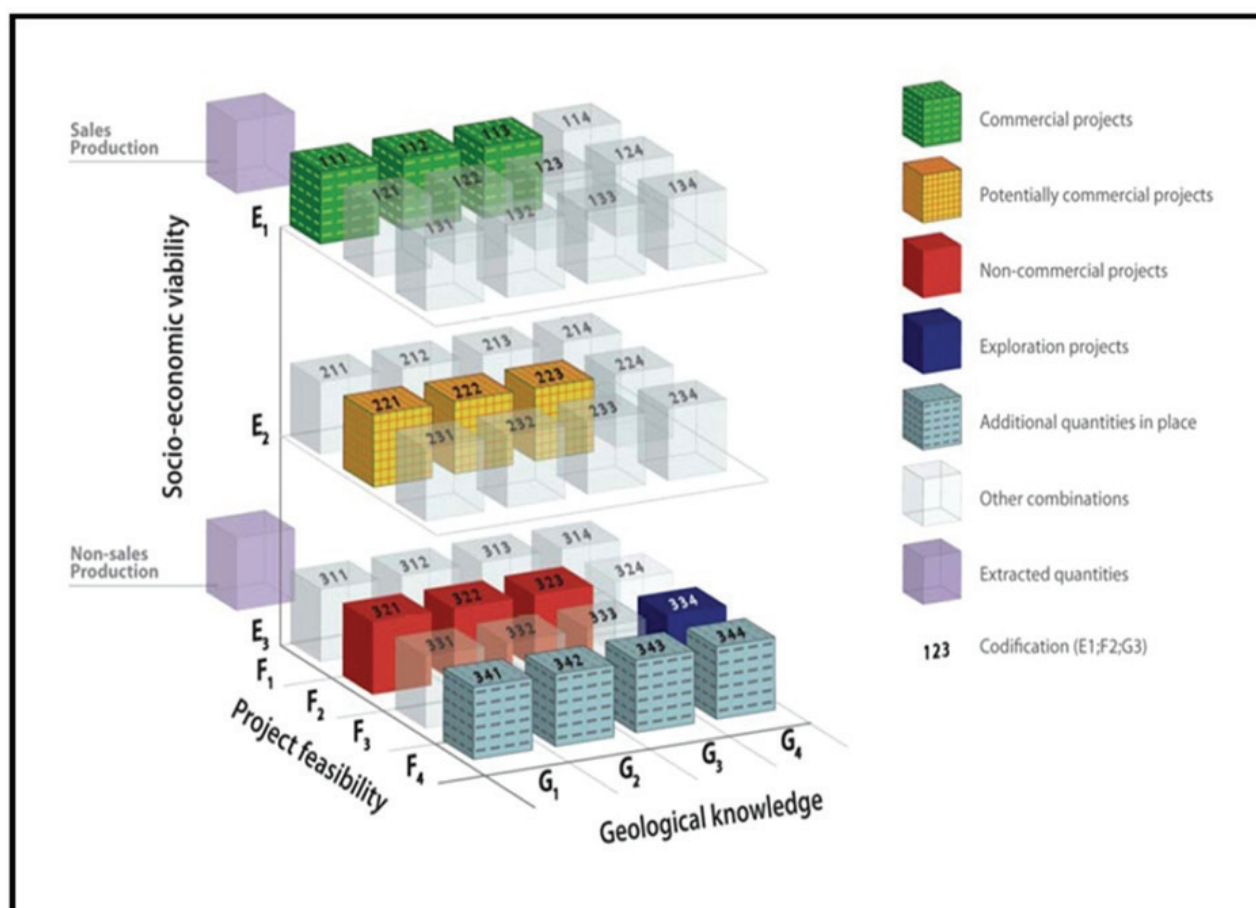


Figure 2: The United Nations Framework Classification.

– this is the definition from the PERC Standard 2013:

**A Competent Person is a minerals industry professional, defined as a corporate member, registrant or licensee of a recognised professional body (including mutually recognised international professional organisations) with enforceable disciplinary processes including the powers to suspend or expel a member.**

**A Competent Person must have a minimum of five years relevant experience in the style of mineralisation or type of deposit under consideration and in the activity which that person is undertaking. Acceptable professional bodies and classes of membership under the Standard, which meet these requirements, within Europe or elsewhere (an 'RPO') are listed in Appendix 5 or in updated lists which may be published from time to time.**

This definition of 'Competent Person' is subject to any additional restrictions or conditions which may be required by the appropriate stock exchange or regulatory authority.

Membership of the recognised professional body – a list of which is included in an Appendix to the Standard – will carry with it the requirement to have tertiary-level qualifications such as a university degree, as well as some years of experience in the minerals industry.

The associated guidelines in the Standard add some further explanation:

*It is expected that the Competent Person will usually be a geoscientist for reporting Exploration Results or Mineral Resources, but for reporting Reserves may be qualified in other fields such as mining engineering or mineral processing.*

*The Competent Person may of course have relevant qualifications or experience in more than one field or type of work.*

*The key qualifier in the definition of a Competent Person is the word 'relevant'. Determination of what constitutes relevant experience can be a difficult area and common sense has to be exercised. For example, in estimating Mineral Resources for vein gold mineralisation, experience in a high-nugget, vein-type mineralisation*

*such as tin, uranium etc. will probably be relevant whereas experience in (say) massive base metal deposits may not be. As a second example, to qualify as a Competent Person in the estimation of Mineral Reserves for alluvial gold deposits, considerable (probably at least five years) experience in the evaluation and economic extraction of this type of mineralisation would be needed. This is due to the characteristics of gold in alluvial systems, the particle sizing of the host sediment, and the low grades involved. Experience with placer deposits containing minerals other than gold may not necessarily provide appropriate relevant experience. Similarly, sulphidic nickel deposits form a type of their own with nickel being distributed between silicate and sulphide minerals, only the latter being economically extractable. Experience with other types of sulphide deposits may not have given sufficient background in evaluating nickel deposits.*

The definitions (in **bold** type) are identical in all CRIRSCO standards, and although the text of guidelines (in *italics*) can vary, all carry the same message. A CRIRSCO reporting standard requires a suitably experienced

rienced person to take personal professional responsibility for the content of any report.

Central to the accreditation process is the concept of peer review and the role of the professional organisation. The European Federation of Geologists is accepted by all of the CRIRSCO standards as a recognised professional organisation, and the European Geologist qualification establishes a person as potentially a Competent Person. To be able to act as a Competent Person in the context of a particular mineral deposit, of course they must also satisfy the second criterion, that of relevant experience. This is normally done by personal affirmation within the report, always subject to challenge, and therefore the Competent Person must be able to substantiate this experience by reference to previous projects. Breach of these conditions will always be a breach of the Code of Ethics or Code of Conduct of the Competent Person's professional organisation. Such breaches can and do lead to disciplinary action by professional organisations against any of their members who represent themselves as Competent Persons when, in fact, their experience, qualifications or the quality of their work falls short of the standards required.

## Conclusions

A question that commonly arises is whether CRIRSCO or UNFC is better, and if CRIRSCO is to be used, which Standard

should the user adopt?

If preparing a report for a company listed on a stock exchange, the choice is made by the stock exchange regulator: usually one of the CRIRSCO-aligned standards is mandatory. In the European Union, for example, the choice is among a specified list of all the recognised CRIRSCO-aligned standards.

In other situations, there is not a question of "competition" or "choice" between the CRIRSCO reporting standards and the UN Framework Classification. Effectively UNFC provides a big umbrella within which consistent and comparable public reporting can be carried out at a range of scales and for a range of purposes, and national mineral inventories can be developed and maintained. Its complexity can, however, be challenging. If users find it easier to follow the CRIRSCO classification, they can do so in full confidence that this is also compliant with UNFC with the 'added value' of the Competent Person concept.

Decisions on disclosure and quality assurance are independent from decisions on classification.

- CRIRSCO addresses both disclosure/QA and classification.
- UNFC-2009 requires preparers and users to agree on disclosure/QA issues.

UNFC provides a method for governments and NGOs to incorporate published industry data (using the CRIRSCO classification) into databases, mineral invento-

ries, etc. It also provides a mechanism for companies to use a standardised internal classification beyond the publicly reported CRIRSCO categories if they wish to do so, although if they are quoted companies they are normally forbidden by stock exchange regulators to publish such internal classifications.

CRIRSCO standards require all publicly declared resources to have reasonable prospects for eventual economic extraction. Reports must not include any inventory of all mineralisation regardless of economics, or of any supposed mineralisation that is not supported by adequate geological evidence.

Short and medium term planning should use resources and reserves reported under CRIRSCO standards as a solid and reliable basis for financial modelling. Longer term planning can simply migrate to UNFC, with the inclusion of prospective estimates of mineral potential, but these cannot be reported publicly.

## References

The following web sites carry further information:

PERC – <http://www.percstandard.eu>

EFG – <http://www.eurogeologists.eu>

CRIRSCO – <http://www.crirSCO.com>

UNFC-2009 – <http://www.unece.org/energy/se/reserves.html>



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