
WORKSHOP ON
POLYMETALLIC NODULES RESOURCE CLASSIFICATION

Jointly organized by the
International Seabed Authority, Kingston, Jamaica
&
Ministry of Earth Sciences, Government of India

BACKGROUND DOCUMENT



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Introduction:

1. In January 1994, the Preparatory Commission for the ISA and the International Tribunal for the Law of the Sea convened a meeting of its technical experts to review the state of deep seabed mining and make an assessment of the time when commercial production might be expected to commence¹. In the 20 years since, along with the establishment of the International Seabed Authority, a number of developments of a legal, structural, economic and technical nature have taken place.
2. Following the adoption of the Regulations on Prospecting and Exploration for polymetallic nodules in the Area, by the International Seabed Authority, it entered into exploration contracts, in 2001 with six entities for these resources; the Interoceanmetal joint Organization (IOM), Yuzhmorgeologiya, the government of the Republic of Korea (KORDI), China Ocean Mineral Resources research and Development Association (COMRA), Deep Ocean Mineral Resources Development Co. Ltd (DORD) and Institut Français de recherché pour l'exploitation de la mer (IFREMER). The Government of India signed an exploration contract with the Authority in 2002 and the Institute for Geosciences and Natural resources of Germany signed an exploration contract in 2006 under the same regulations. Nauru Ocean Resources Inc. entered into an exploration contract in 2011, Tonga Offshore Mining Limited (TOML) in 2012, UK Seabed Resources Ltd in 2013 and G-Tec Sea Mineral Resources NV in 2013. Pending the decision on the applications by the Cook Islands, UK Seabed Resources Ltd and Ocean Mineral Singapore Pty Ltd, the Authority has approved 13 exploration contracts for polymetallic nodules exploration.
3. Under the Regulations, an exploration contract is for fifteen years duration, and is to be executed in three phases of five years each². Six contracts will expire in 2016 and another in 2017. These are the contracts entered into by the IOM and Yuzhmorgeologiya on 28th March 2001; the Republic of Korea on 26 April 2001, the People's Republic of China on 21st May 2001, France and Japan on 19th June 2001. India's contract will expire on 24th March 2017.
4. Each contractor is required to submit an annual report to the Secretary-General covering its programme of activities in the exploration area and containing, as applicable, *inter alia*, information in sufficient detail on: the exploration work carried out during the calendar year, including maps, charts and graphs illustrating the work that has been done and the results obtained; the equipment used to carry out the work, including the results of tests conducted of

¹ Report of the Group of Technical Experts to the General Committee of the Preparatory Commission for the International Seabed Authority and for the International Tribunal for the Law of the Sea LOS/PCN/BUR/R.32 1 February 1994

² Regulations on Prospecting and Exploration for polymetallic nodules in the Area ISBA/6/A/18

proposed mining technologies, but not equipment design data, and the results obtained from environmental monitoring programmes, including observations, measurements, evaluations and analyses of environmental parameters.³

5. In addition, Annex IV, Section 11 of the regulations requires that:

11.1 The Contractor shall transfer to the Authority all data and information that are both necessary for and relevant to the effective exercise of the powers and functions of the Authority in respect of the exploration area in accordance with the provisions of this section.

11.2 Upon expiration or termination of this contract the Contractor, if it has not already done so, shall submit the following data and information to the Secretary-General:

(a) Copies of the geological, environmental, geochemical and geophysical data acquired by the Contractor in the course of carrying out the programme of activities that are necessary for and relevant to the effective exercise of the powers and functions of the Authority in respect of the exploration area;

(b) The estimation of mineable areas, when such areas have been identified, which shall include details of the grade and quantity of the proven, probable and possible polymetallic nodule reserves and the anticipated mining conditions;⁴

(c) Copies of geological, technical, financial and economic reports made by or for the Contractor that are necessary for and relevant to the effective exercise of the powers and functions of the Authority in respect of the exploration area.

(d) Information in sufficient detail on the equipment used to carry out the exploration work, including the results of tests conducted of proposed mining technologies, but not equipment design data;

(e) A statement of the quantity of polymetallic nodules recovered as samples or for the purpose of testing; and

(f) A statement on how and where samples are archived and their availability to the Authority.

11.3 The data and information referred to in section 11.2 hereof shall also be submitted to the Secretary-General if, prior to the expiration of this contract, the Contractor applies for approval of a plan of work for exploitation or if the Contractor renounces its rights in the exploration area to the extent that such data and information relates to the renounced area.

³ Annex iv, Section 10

⁴ The terminology in the regulations reflects the categorization of mineral reserves at the time the regulations were developed, but it does not reflect current international accounting and mineral assessment reporting standards that have developed and been widely accepted since that time. Over the two decades since the Authority came into being, the terminology related to "reserves" has evolved and coalesced around industry-standard definitions that have been incorporated into international accounting standards for the extractive industries and in national mineral assessment and reporting standards maintained by professional societies that are being adopted into international accounting standards.

6. Annex IV, Section 9 of the Regulations on “Book Records”, states that :

“The Contractor shall keep a complete and proper set of books, accounts and financial records, consistent with internationally accepted accounting principles. Such books, accounts and financial records shall include information which will fully disclose the actual and direct expenditures for exploration and such other information as will facilitate an effective audit of such expenditures.”

7. Together therefore, sections 9 and 11, mandate the application of internationally accepted standards and practices applicable to the assessment and reporting of mineral resources of the seabed beyond national jurisdiction. No standards or guidelines were provided to contractors to perform resource assessments and to report on the relevant work that were doing in this regard during exploration. No standards or guidelines exist for undertaking such work for deep seabed minerals. The results of the work undertaken so far by contractors reflect this reality. If this situation is not addressed, upon the expiration of exploration contracts for polymetallic nodules, the data and information made available to the Authority with regard to, *inter alia*, mineable areas will not show whether or not they are financial assets. Applicable standards have been developed for land-based mining. Utilizing these standards, company reports of mineral resources and reserves are not simply a repackaging of the findings of a mineral exploration program. They examine the exploration results through lenses of technology selection and design, commodity markets, estimates of construction, infrastructure and operating costs, legal, regulatory, environmental and social factors. The assessment of mineral resources and reserves provides a comprehensive assessment of the economic viability of a mining operation. It also marks the start of the transition of a mining operation from exploration to exploitation. These standards need to be developed for deep seabed polymetallic nodules of the Area so that the transition from exploration to exploitation within the framework of the international minerals industry can occur.

8. This paper reviews the evolution and current status of the standards that have been established for land-based mineral development. It also provides a summary of the work that has been completed and reported to the Authority with regard to resource assessment of the polymetallic nodules in contract areas for exploration. Since the effective dates of exploration contracts varies among contractors, progress in resource assessment show considerable variation. The paper provides a background for the necessary standardization that has to take place for polymetallic nodules to be commercialized, utilizing the considerable work that has been undertaken by professional organizations within the minerals industry.

Standards applicable to land-based mining

9. For land-based mining, the formalization of international standards for mineral assessment and reporting has been driven by investors and stockholders and implemented by national resource management and financial securities agencies, but the details of the standards for determining reserves and resources and the professional standards for assessment and categorizing mineral deposits have been driven by international standards established by professional organizations in the fields of accounting and mineral economics.

International Mineral Assessment Standards Organizations

10. Professional societies have made significant contributions in clarifying reporting standards, identifying and sharing best practices, and recognizing experts competent to oversee exploration and assessment activities. Both the Authority and the seabed mining industry can benefit from applying practices developed for land-based mineral deposits, and they will also benefit from the development of standards and approval of their use by the same organizations that establish standards for land-based extractive industries.
11. There are four bodies that will be closely involved in establishing international mineral assessment and reporting standards that will apply to activities in the Area:
 - International Accounting Standards Board (IASB)
 - International Marine Minerals Society (IMMSOC)
 - Society of Petroleum Engineers Oil and Gas Resources Committee (SPE OGRC)
 - UN ECE Framework Classification

The International Accounting Standards Board

12. The specific reference to “internationally accepted financial principles” in the regulations for exploration and in contracts with the Authority is directly related to the work of the International Accounting Standards Board. In the years following the Authority’s adoption of exploration regulations in 2000, there have been significant advances in the adoption of international financial standards. Significant work has been undertaken on standards for the extractive industries that will be applicable to financial information, including the estimation of mineral resources and reserves in the contract areas.

International Standards for Mineral Assessment and Reporting

13. The IFRS Foundation is an independent non-profit organization whose goals are to develop a single, globally-accepted and enforceable set of standards governing financial reporting standards, promote the use of those standards, give attention to emerging economies and small

to medium-sized entities, and promote and facilitate adoption through convergence with national standards. IFRS promotes the development and adoption of financial reporting standards through the work of its International Accounting Standards Board (IASB). The IFRS and the ISAB were founded in 2001; a year after the Authority adopted its rules and regulations for prospecting and exploration for polymetallic nodules.

14. Since the establishment of the IFRS Foundation and its International Accounting Standards Board, application of the standards developed by the IASB have either been required or permitted by 124 countries including 103 members of the Authority and 15 of the 20 current and prospective states sponsoring exploration contracts (the five outstanding state sponsors are small island states of which only Cuba has a significant land based minerals industry). As such, the work of the IASB will be the primary source for internationally accepted accounting standards for contractors with the Authority.

15. In August of 2009 the IASB released a working draft of a discussion paper titled "Extractive Industries." In early 2010 the Discussion Paper was published and distributed for public comment. In addressing the accounting issues related to mineral reserves and resources, the Discussion Paper reached beyond ISAB's expertise to identify two professional mineral assessment and reporting organizations to establish the basis for definitions of reserves and resources. For international standards applicable for mineral assessment and reporting, the Discussion Paper turned to the "International Reporting Template for the Public Reporting of Exploration Results, Mineral Resources and Mineral Reserves" prepared by the **Committee for Mineral Reserves International Reporting Standards (CRIRSCO)**.

16. The discussion paper went beyond the definition of mineral reserves and resources to discuss financial and legal issues in determining the conditions under which a mineralization may be claimed as a financial asset. This includes the existence of legal rights, including exploration and exploitation rights that are necessary to the exploitation of the mineral deposit. Committee for Mineral Reserves International Reporting Standards (CRIRSCO) was established in 1994, the same year in which the Authority was established. The current membership of CRIRSCO comprises seven national professional organizations from North and South America, Europe, Australia, Africa and Asia (see Table 1).

Table 1 — CRIRSCO Membership

Nation/Region Represented	CRIRSCO Member Organization
Australia	Australasian Joint Ore Reserves Committee (JORC)
Canada	Canadian Institute of Mining, Metallurgy and Petroleum (CIM)
Chile	Chilean Institute of Mining Engineers (IMEC)
Europe	Pan-European Reserves & Resources Reporting Committee (PERC)
Russia	National Association for Subsoil Examination (NAEN)
South Africa	South African Mineral Codes (SAMCODES)
United States	Society for Mining, Metallurgy and Exploration Inc (SME)

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17. CRIRSCO's mission statement is:
The mining industry is a vital contributor to national and global economies; never more so than at present with soaring demand for the commodities that it produces. It is a truly international business that depends on the trust and confidence of investors and other stakeholders for its financial and operational well-being. Unlike many other industries, it is based on depleting mineral assets, the knowledge of which is imperfect prior to the commencement of extraction. It is therefore essential that the industry communicates the risks associated with investment effectively and transparently in order to earn the level of trust necessary to underpin its activities. The aim of CRIRSCO (Committee for Mineral Reserves International Reporting Standards) is to contribute to earnings and maintaining that trust by promoting high standards of reporting of mineral deposit estimates (Mineral Resources and Mineral Reserves) and of exploration progress (Exploration Results).
18. CRIRSCO works by consensus. Its recommendations are implemented and enforced at the national level by government agencies, particularly by securities agencies and stock market managers that oversee informational materials published by firms seeking funds through sales of stocks.
19. Membership in CRIRSCO is open to National Reporting Organizations (NROs) that meet the following criteria to be accepted for CRIRSCO Membership:
- Produce and be responsible for maintaining a reporting standard that is compatible with the Template and which is recognized as the standard for Public Reporting, or has the wide support of professional bodies, in the country/region;
 - Agree to conduct international consultation with NROs represented on CRIRSCO before making amendments to its National or Regional reporting standard;
 - Include credible, self-regulating, professional bodies that provide disciplinary systems and codes of ethics that govern the behaviour of Competent Persons or equivalents as defined in the Template; and
 - Commit to engaging in CRIRSCO activities.

Society of Petroleum Engineers Oil and Gas Resources Committee (SPE OGRC)

20. Beginning from the same basic roots as the CRIRSCO taxonomy, the Society of Petroleum Engineers "Oil and Gas Resources Committee" (SPE OGRC) developed a contemporary taxonomy that reflects differences between how the hard mineral and energy sectors have historically approached the identification and assessment of resources and reserves as potential financial assets of an exploration or development company. The SPE OGRC taxonomy includes a wider

range of sub-economic or speculative resources in the taxonomy so it is related to, but not directly comparable with, the mineral taxonomy developed by CRIRSCO.

Consultation continues between CRIRSCO and SPE to improve the correlation between categories in the two taxonomies. Until that time, both systems will inform the application of internationally accepted accounting standards with regard to their target resources.

UN ECE Framework Classification (UNFC)

21. The UN Economic Commission for Europe began work on a comprehensive Framework Classification for mineral and energy resources in the 1990s, preparing its “Framework Classification for Reserves and Resources of Solid Fuels and Mineral Commodities” in 1997. Continuation of this work led in 2009 to the release of “United Nations Framework Classification for Fossil Energy and Mineral Reserves and Resources 2009.” Consultations between CRIRSCO and the UNECE led to the incorporation of the CRIRSCO definitions of reserves and resources into the UNFC.
22. The UNFC taxonomy is more complex than either the CRIRSCO or SPE-OGRC taxonomies. One source of complexity is the separation of technical feasibility from economic matters, resulting in a three dimensional system that provides resource managers with greater illumination on the potential for development through policy actions affecting economic factors (including legal and regulatory issues) and technology development. The complexity of the UNFC and its lack of wide acceptance in internationally accepted accounting standards let the ISAB to recommend the use of the CRIRSCO and SPE-OGRC systems, However, the UNFC may be more suitable than these two systems in broad resource management applications, including tracking and projecting changes in development potential across different minerals, technologies and legal and economic conditions.

Evolution of Reporting Standards for Exploration Results

Development of the Taxonomy for Exploration Results

23. The importance of publicly reported exploration data has grown radically over the past century. The starting point is illustrated by the recommendation of Herbert Hoover, mining engineer and future president of the United States, that ore in place be divided into three classifications: proved, probable and prospective.
24. Hoover’s classifications depended on the division of ore deposits into blocks of uniform characteristics. The classification was intended to replace an older evaluation of “ore in sight” that had been subject to abuse in mineral assessment and reporting. In Hoover’s three-part classification, assessment of deposits depended on the uniformity of such blocks and the assurance through sampling and testing of the characteristics of each block. This classification of

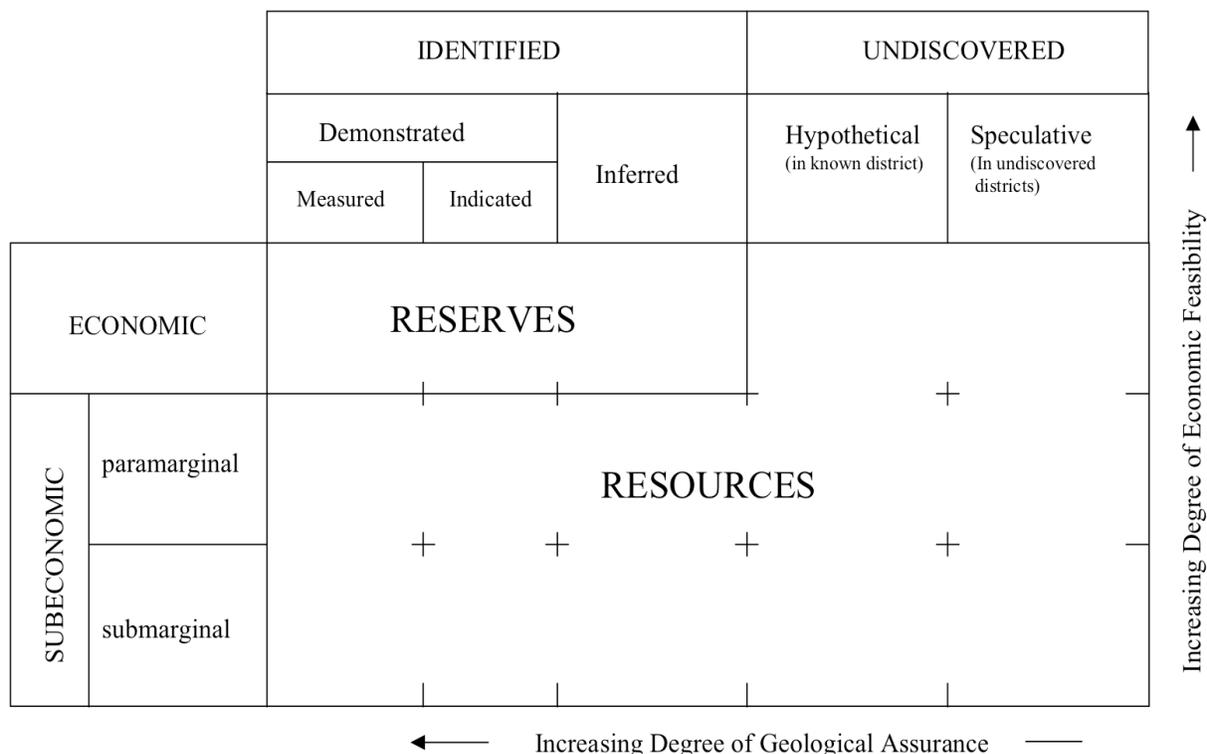
degree of geological assurance of economically mineable ore provided the foundation upon which modern systems of exploration and assessment of ore deposits are based.

25. Hoover's classification, which reflected the consensus of professionals in mining engineering in the early 20th century, responded to the needs of two categories of stakeholders: mine developers and investors in mining developments⁵. Over the next several decades, and particularly after the lessons learned during and after World War II in critical and strategic materials supply, national resource managers and planners became a third stakeholder in the assessment and measurement of mineral deposits. Improvements in geologic understandings, resource modelling and remote measurement led to a broadening of the inputs affecting the evaluation of the economic viability of potential deposits.
26. As mineral development projects grew in size and expense, as new independent companies focused on discovery and exploration of prospective deposits grew in number, and as the cost of development expanded beyond the scope of individual company resources, it became increasingly more important for developers to assess with increasing assurance the real potential of a deposit for commercial development. Similarly, it became more important for the resource owner, either private or public, to understand the potential value of a deposit in order to set rates for its sale or lease.
27. In the 1970's, a new structure for assessing mineral resources was developed. One of the early new taxonomies was prepared by the US Geological Survey.⁶ Known as the "McKelvey Box," for the head of the USGS, Dr. Vincent McKelvey, the taxonomy arrays mineral deposits in two dimensions based on assurance of the geological nature of a deposit on the horizontal axis and potential for commercial development on the vertical axis (see Figure 1). The "McKelvey Box" served as the starting point for the more detailed taxonomies of today.

⁵ Herbert Hoover, *Principles of Mining*, (New York, NY: McGraw-Hill Book Company, 1909) page 19. Accessed On-line at <http://www.gutenberg.org/files/26697/26697-h/26697-h.htm#page_19> on July 8, 2013.

⁶ USGS, "Principles of the mineral resource classification system for the U.S. Geological Survey," *USGS Bulletin 1450-A*, Washington, DC, 1976.

Figure 1 — USGS Taxonomy of Mineral Resources and Reserved: The “McKelvey Box”



In Figure 1:

Reserves are the part of a mineral resource which could be economically extracted or produced at the time of determination. The term reserves need not signify that extraction facilities are in place and operative.

Demonstrated Reserves are determined by measurement with “*Measured Reserves*” determined by detailed sampling and “*Indicated Reserves*” computed from more widely spaced sampling.

Inferred Reserves are estimated based on assumed continuity of more widely spaced samples in which estimates between samples may be based on factors other than direct sampling.

“Reserves” in the McKelvey Box corresponds roughly to Hoover’s three ore classifications (proven, probable, and possible). What is added are levels of economic viability below current economic conditions and mineral deposits that have yet to be found. Identification of deposits in this broader characterization provides a basis for policy making with regard to future exploration and the development of exploitation technology.

28. The 1990s saw major advances in mineral resource taxonomy and reporting standards. These were prepared to address the needs of three different audiences: the mining industry, the finance and investment sector, and resource owners, managers and planners.

Reporting standards

29. Mineral information and public reports, including measured data, inferred information and theoretical assessments, is of interest to three distinct clients, with each category of clients having its own needs and interests:
- *Developers*, for determining whether and how to develop a site, the development, selection and improvement of technology, and the development of operational plans for exploitation and exploitation operations;
 - *Investors, lenders and insurers*, for evaluating the economic prospects for development and for estimating the value of investments and the value of the site as collateral for loans;
 - *Owners and managers* of resources who must consider not only issues of development, but the management of the resource to ensure the greatest value to all stakeholders, not just for the value of exploitation, but for protection of other values of the area under consideration, and the maximization of value over time.(category of the International Seabed Authority)
30. While all three sets of stakeholders have interests in the raw data, information and observations of the minerals and the surrounding environment, they have differing needs for level of detail and type of analysis. In many countries, reporting standards for exploration results and mineral resource assessment and reporting are governed by laws under which the dissemination of mineral information to potential investors and to stockholders is regulated. As the mineral industry is international, mineral exploration experts sought to bring order to differing national standards.
31. In order to minimize confusion and incompatibility among national reporting standards regarding mineral resources, professional organizations in key mineral producing nations joined together to help bring national reporting standards into compatibility. Established in 1994 as the “Mineral Definitions Working Group” under the auspices of the Council of Mining and Metallurgical Institutes (CMMI), the body became the Committee for Mineral Reserves International Reporting Standards (CRIRSCO) in 2002.
32. In 2007, CRIRSCO became a task force of the International Council on Mining and Minerals (CIMM) and in 2009 became a “Strategic Partner” of the Council. The Council provides administrative and financial support for CRIRSCO but is not involved in the substantive work of the body.

Professional Societies in Standard Setting for Mineral Assessment and Reporting

33. CRIRSCO's focus is on the public reporting of mineral resource and reserve information. Public reports include:
- Reports prepared for investors or potential investors
 - Annual Reports
 - Quarterly Reports
 - Information Memoranda
 - Websites
 - Public Presentations
 - Stock Exchange Information Systems
34. Information in some or all of these categories of reports may be regulated by national authorities, particularly those that regulate investment markets and stock exchanges. Publication of data in nations with different standards would undermine efforts to make reliable information available to potential investors.
35. CRIRSCO identifies three principles that guide the work of the organization and its members: transparency, materiality, and competence.
- *Transparency* - to inform with a clear and fair description of the mineral assets.
 - *Materiality* - to inform with concrete and concise information.
 - *Competence* - to inform with knowledge, expertise, and judgment.
36. Underlying these three principles is the essential requirement that the reporting system earns and maintain the public trust.

The CRIRSCO Taxonomy of Mineral Resources and Reserves

37. The CRIRSCO taxonomy of mineral resources (see Figure 2) has its roots in the "McKelvey Box" but it has both a different orientation and increased specificity. In orientation, geological assurance increases toward the lower edge of the diagram and economic prospects increase as one moves toward the right. In specificity, the taxonomy addresses a specified "exploration target" so it excludes hypothetical and speculative resources and minerals from consideration. The taxonomy focuses on known mineral deposits that show serious indication of potential economic value.

38. Progress of mineral classification from Inferred Resources to Proved Reserves is based on exploration of the site, giving increasingly detailed geologic understanding of the site, and research and development to understand and improve the “modifying factors” that affect the economic outlook for commercial development. Modifying factors include mining, processing, metallurgical, economic, marketing, legal, environmental, social, infrastructure and governmental considerations. Details of the resource and reserve categories are provided below in Table 1.

Figure 2 — CRIRSCO Taxonomy for Mineral Reserves and Resources

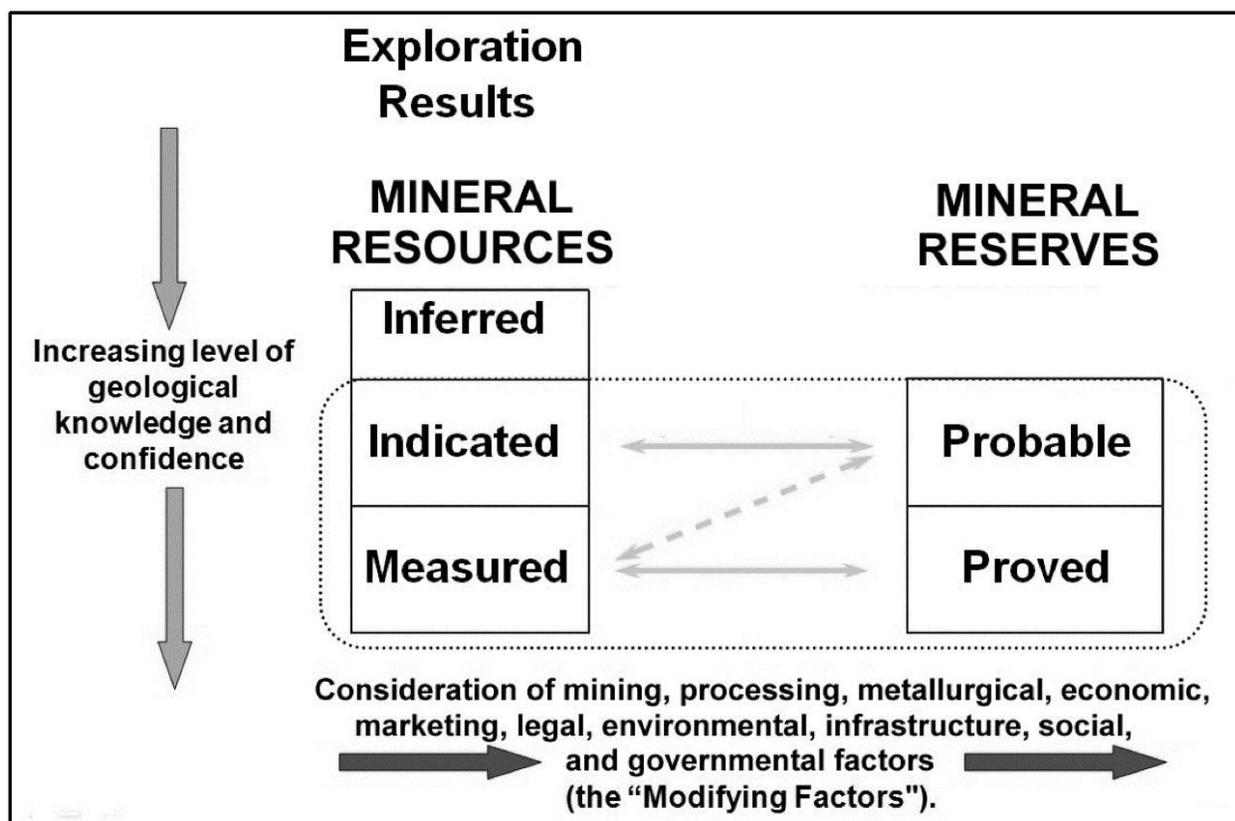


Table 2: — Industry Standard Definitions of Resource and Reserve Categories⁷

Mineral Resource

A Mineral Resource is a concentration or occurrence of solid material of economic interest in or on the Earth's crust in such form, grade or quality and quantity that there are reasonable prospects for eventual economic extraction. The location, quantity, grade or quality, continuity and other geological characteristics of a Mineral Resource are known, estimated or interpreted from specific geological evidence and knowledge, including sampling.

Inferred Mineral Resource

An Inferred Mineral Resource is that part of a Mineral Resource for which quantity and grade or quality are estimated on the basis of limited geological evidence and sampling. Geological evidence is sufficient to imply but not verify geological and grade or quality continuity. An Inferred Resource has a lower level of confidence than that applying to an Indicated Mineral Resource and must not be converted to a Mineral Reserve. It is reasonably expected that the majority of Inferred Mineral Resources could be upgraded to Indicated Mineral Resources with continued exploration.

Indicated Mineral Resource

An Indicated Mineral Resource is that part of a Mineral Resource for which quantity, grade or quality, densities, shape and physical characteristics are estimated with sufficient confidence to allow the application of Modifying Factors in sufficient detail to support mine planning and evaluation of the economic viability of the deposit. Geological evidence is derived from adequately detailed and reliable exploration, sampling and testing and is sufficient to assume geological and grade or quality continuity between points of observation. An Indicated Mineral Resource has a lower level of confidence than that applying to a Measured Mineral Resource and may only be converted to a Probable Mineral Reserve.

Measured Mineral Resource

A Measured Mineral Resource is that part of a Mineral Resource for which quantity, grade or quality, densities, shape, and physical characteristics are estimated with confidence sufficient to allow the application of Modifying Factors to support detailed mine planning and final evaluation of the economic viability of the deposit. Geological evidence is derived from detailed and reliable exploration, sampling and testing and is sufficient to confirm geological and grade or quality continuity between points of observation. A Measured Mineral Resource has a higher level of confidence than that applying to either an Indicated Mineral Resource or an Inferred Mineral Resource. It may be converted to a Proved Mineral Reserve or to a Probable Mineral Reserve.

⁷ Source: CRIRSCO Standard Definitions, October, 2012:

<http://www.criresco.com/news_items/CRIRSCO_standard_definitions_oct2012.pdf>

Mineral Reserve

A Mineral Reserve is the economically mineable part of a Measured and/or Indicated Mineral Resource. It includes diluting materials and allowances for losses, which may occur when the material is mined or extracted and is defined by studies at Pre-Feasibility or Feasibility level as appropriate that include application of Modifying Factors. Such studies demonstrate that, at the time of reporting, extraction could reasonably be justified. The reference point at which Reserves are defined, usually the point where the ore is delivered to the processing plant, must be stated.

Probable Mineral Reserve

A Probable Mineral Reserve is the economically mineable part of an Indicated, and in some circumstances, a Measured Mineral Resource. The confidence in the Modifying Factors applying to a Probable Mineral Reserve is lower than that applying to a Proved Mineral Reserve.

Proved Mineral Reserve

A Proved Mineral Reserve is the economically mineable part of a Measured Mineral Resource. A Proved Mineral Reserve implies a high degree of confidence in the Modifying Factors.

CRIRSCO has developed and refined a template for the assessment and reporting of mineral deposit information. The template addresses not only the classification of mineral deposits; it establishes a methodology for applying the classifications. The most important elements of the template are the concept of the “Competent Person” and the “Modifying Factors” that are applied to exploration results by the Competent Person(s) to properly categorize the mineralization.

Role of the “Competent Person” in Mineral Classification

40. Classification of minerals into the specified taxonomy is a task that requires trusted professional judgement. This judgement is incorporated in the taxonomy by the specification that public reports be prepared under the direction of a “Competent Person” (equivalent terms in different national systems are “Qualified Person” and “Competent Qualified Person”).⁸ While it is up to each country to define the qualifications, experience, and responsibilities of this person, CRIRSCO provides a standard definition for this role:

A “Competent Person” is a minerals industry professional who is a member at an appropriate classification of an organization specified by the national authority with enforceable disciplinary processes including the powers to suspend or expel a member.

Such a 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.

⁸ Alternative terms in national regulation include “Qualified person” and “Competent Qualified Person.”

41. The “Competent Person” is responsible for directing or overseeing the conduct of exploration and research related to the determination of mineral resources and reserves and may be assisted by other “Competent Persons” in areas that contribute to the assessment. The Competent Person is the critical element of the mineral reporting system. The quality and accuracy of public reports depends upon the work of the Competent Person so CRIRSCO has prepared a Code of Conduct for the Competent Person. The Code is contained in the International Reporting Template. A copy of the Code of Conduct is provided as Appendix 1 of this background paper. Breaches of the code are responded to by the national professional organization of which he or she is a member.

Transforming Geological Information into Mineral Resource and Reserve Assessments

42. Where exploration results address the issue of geological assuredness of mineral endowment, it is the “modifying factors” that determine the economic potential of a specific mineralization.
43. Modifying factors include:
- Commodity Prices
 - Mineral Excavation Technology
 - Metallurgy of Mineral Recovery
 - Transportation
 - Capital and Operating Expenses of Operation
 - Infrastructure
 - Fees, Royalties and Taxes
 - Assurance of Legal Title and Right to Mine
 - Environmental Regulation and Costs of Compliance
 - Social Factors
 - Training Projects
44. Other than cases of straight-forward expansion of a known exploitation project, the evaluation of modifying factors will draw upon site and industry specific studies and upon the judgement of the “Competent Person.” In such cases, the “Competent Person” is required to layout and justify the bases of the assumptions used in his or her evaluation. The overall evaluation and the information and expertise upon which it is based may be presented in a series of increasingly detailed and rigorous assessments that begin with “**scoping studies**” and extend through “**pre-feasibility**” and “**feasibility studies**” (see Table 3 for definitions of these studies).
45. The Canadian Institute of Mining, Metallurgy and Petroleum (CIM, a member organization of CRIRSCO) has prepared an extensive set of best practice guidelines for estimation of mineral resources and mineral reserves. The guidelines include 35 pages of generally applicable recommended best practices, and are supplemented by additional commodity specific recommended practices.

Table 3: Categories of Reports Used in Defining “Modifying Factors” and Evaluating Mineral Resources⁹

<p>Scoping Study</p> <p>A Scoping Study is an order of magnitude technical and economic study of the potential viability of Mineral Resources that includes appropriate assessments of realistically assumed Modifying Factors together with any other relevant operational factors that are necessary to demonstrate at the time of reporting that progress to a Pre-Feasibility Study can be reasonably justified.</p>
<p>Pre-Feasibility Study</p> <p>A Pre-Feasibility Study is a comprehensive study of a range of options for the technical and economic viability of a mineral project that has advanced to a stage where a preferred mining method, in the case of underground mining, or the pit configuration, in the case of an open pit, is established and an effective method of mineral processing is determined. It includes a financial analysis based on reasonable assumptions on the Modifying Factors and the evaluation of any other relevant factors which are sufficient for a Competent Person, acting reasonably, to determine if all or part of the Mineral Resource may be converted to a Mineral Reserve at the time of reporting. A Pre-Feasibility Study is at a lower confidence level than a Feasibility Study.</p>
<p>Feasibility Study</p> <p>A Feasibility Study is a comprehensive technical and economic study of the selected development option for a mineral project that includes appropriately detailed assessments of applicable Modifying Factors together with any other relevant operational factors and detailed financial analysis that are necessary to demonstrate at the time of reporting that extraction is reasonably justified (economically mineable). The results of the study may reasonably serve as the basis for a final decision by a proponent or financial institution to proceed with, or finance, the development of the project. The confidence level of the study will be higher than that of a Pre-Feasibility Study.</p>

Best Practices in Mineral Resource and Reserve Assessment and Reporting

46. The “Competent Person” is also able to draw upon best practices, guidelines and standards established within the profession and within specialized fields related to the “modifying factors.” Evaluation of mineral resources may draw upon professional standards and guidelines and upon best practices developed for specific categories of minerals and mineralization.
47. The best practice guidelines laid out by CIM provide guidance in nine categories¹⁰:

⁹ Source: CRIRSCO, *Standard Definitions*, October 2012:
<http://www.crirSCO.com/news_items/CRIRSCO_standard_definitions_oct2012.pdf>

(a) Qualified (Competent) Person

48. A mineral resource/mineral reserve assessment will be directed by a “Qualified/Competent Person,” but may require that such person be assisted by individuals qualified/competent in subspecialties of the assessment.

(b) Definitions

49. Strict adherence to the formal definitions of resource and reserve categories and levels of studies (“pre-feasibility, “feasibility”) as defined in law and professional best practices must be maintained.

(c) The Resource Database

50. The Resource Database has three components: primary data (observed and measured); interpreted data; and data related to “modifying factors” that include engineering, economic, mining, metallurgical, legal and social data related to the determination of commercial viability.

(d) Geological Interpretation & Modelling

51. Models and interpretations of data must be clearly presented and based on primary data. Models must be selected for their appropriateness to the specific mineralization.

(e) Mineral Resource Estimation

52. Available data must be assessed to determine its adequacy or to identify gaps that must be filled to achieve the appropriate level of confidence. Data must be archived and made available for future reference.

(f) Quantifying Elements to convert a Mineral Resource to a Mineral Reserve

53. Details of references on modifying factors must be met or exceed criteria for preliminary feasibility studies before a mineral resource may be advanced to a mineral reserve.

(g) Mineral Reserve Estimation

54. A Mineral Reserve estimate must be based on a collection of information whose results are based at least on the level of a Preliminary Feasibility Study. The Qualified/Competent Person

¹⁰ CIM Best Practice Guidelines <<http://web.cim.org/UserFiles/File/Estimation-Mineral-Resources-Mineral-Reserves-11-23-2003.pdf>>

must understand the significance of each discipline's contribution to the overall reliability of the assessment. Documentation of the evaluation process must be maintained throughout the life of the mine.

(h) Reporting

55. A comprehensive technical report signed by the Qualified/Competent Person(s) should be prepared on completion of a particular phase or stage of work. Public reports of mineral resources and mineral reserves should be based on reports approved by the Competent/Qualified Person(s).

(i) Reconciliation of Mineral Reserves

56. Mineral production during exploitation could be monitored and reconciled with mineral resources and mineral reserve estimates. This provides a cross-check on the estimation process and reconciliation of estimates with actual performance.

International Reporting Template

57. The "International Reporting Template" was developed as a guideline for national implementation of mineral reporting systems. It was initially prepared based on the experiences of experts from Australia, Canada, South Africa, Chile, the UK and Europe and the United States and released in 2005. As a common standard, the International Reporting Template has resulted in revisions of national standards to bring them in compliance with the new international standards.
58. An outline of the contents of the International Reporting Template is provided below. The template includes sections that are specific to five categories of minerals:
- (1) mineralized fill, low grade mineralization, stockpiles, dumps and tailings,
 - (2) Coal,
 - (3) Diamonds and other gemstones,
 - (4) Industrial minerals, and
 - (5) Unconventional energy resources.
59. The International Reporting Template is a check list of assessment and reporting criteria for exploration results, mineral resources and mineral reserves. Having been developed from experience in land-based mineral develop, the template includes some specific examples of

techniques for general land based mineral assessment and some techniques specific for one category of minerals (gemstones). It provides general guidance that could be applied to deep seabed minerals, but does not address issues specific to polymetallic nodules.

60. The Template includes in its appendices recommended rules of conduct and guidelines for “Competent Persons” engaged in preparation of reports on exploration results, mineral resources or mineral reserves. A copy of the Code of Conduct is provided as Appendix 2 of this report.
61. CRIRSCO drew upon the national reporting codes to produce a template for developing national codes consistent with the practice of CRIRSCO members. The International Reporting Template (IRT) draws from the codes adopted by the professional organizations representing Australasia, Chile, UK and Western Europe, Canada, South Africa, and the United States.⁷The highly annotated template is intended to serve as a guide that is based on successful national reporting codes and standard that have already been developed and tested. The template includes extensive annotation and guidance. It also includes sections directed at specific categories of mineralization.¹¹
62. The main sections of the International Reporting Template are as follows:
 - Introduction
 - Scope
 - Competence and Responsibility
 - Reporting Terminology
 - Reporting General
 - Reporting of Exploration Results
 - Reporting of Mineral Resources
 - Reporting of Mineral Reserves
 - Technical Studies
 - Reporting of Mineralized Fill, Pillars, Low Grade Mineralization, Stockpiles, Dumps and Tailings
 - Reporting of Coal Exploration Results, Resources and Reserves
 - Reporting of Diamond and Other Gemstone Exploration Results, Mineral Resources and Mineral Reserves
 - Reporting of Industrial Minerals Exploration Results, Mineral Resources and Mineral Reserves
 - Reporting of Unconventional Energy resources

¹¹ The November 2013 edition of the International Reporting Template may be downloaded from the CRIRSCO site at
<http://www.criresco.com/templates/criresco_international_reporting_template_2013.pdf>

The Template also includes an illustrative checklist of general and mineral-specific practices.

- Sampling Techniques and Data
- Reporting of Exploration Results
- Estimation and Reporting of Mineral Resources
- Estimation and Reporting of Mineral Reserves
- Estimation and Reporting of Diamonds and Other Gemstones

63. While illustrative of the information required to construct /evaluate mineral deposits, the checklist does not address deep seabed minerals. The Template is designed as a starting point for national governments and is open to extension through the specification of mineral and commodity-specific guidelines and best practices.

(f) The Resource Database¹²

64. A Resource Database is established by the collection, verification, recording, storing and processing of the data and forms the foundation necessary for the estimation of mineral resources and mineral reserves. The establishment of a QA/QC program of all data is essential during this process. Components of the Resource Database typically will include geological data (e.g. lithology, mineralization, alteration, and structure), survey data, geophysical data, geochemical data, assay data, rock quality and bulk density information and activity dates. As stated in the CIM Standards and as noted above, a Mineral Resource must have reasonable prospects of economic extraction. Consequently, preliminary data and information concerning a number of factors (e.g. mining, metallurgy, economics and social and environmental sensitivity) will be collected and assessed during the estimation of a Mineral Resource.

General comments (land-based deposits)

- A database consists of two types of data, primary data and interpreted data. Primary data are parameters amenable to direct physical measurement. Examples include assays, survey data, and geological observations. Interpreted data sets are derivations or interpretations of primary information. Examples are geological projections and block models.
- Bulk density is an important parameter that should be measured and recorded at appropriate intervals, and in an appropriate manner, for the deposit. The choice of methods for determining the bulk density of a particular deposit will depend on the physical characteristics of the mineralization and the available sampling medium.

¹² May 30, 2003 - Adopted by CIM Council on November 23, 2003

- The QP should be diligent in ensuring that the final database fairly represents the primary information. Data verification is an essential part of finalising the resource database.
- The Resource Database provides a permanent record of all the data collected from the work carried out, the date of the work, observations and comments from the results obtained. It should be readily available for future reference. The database provides all of the information necessary to enable current and future geological interpretations and modelling.
- Although most databases are generally maintained in an electronically-stored digital format, hand-printed tables with well-organized information may also form a database. It is recommended that data be stored digitally, using a documented, standard format and a reliable medium that allows for easy and complete future retrieval of the data.

Primary Data Visualization

- It is essential that the systematic recording of geological observations from mapping and drill hole logging be entered into an organized database.
- Data collection and display must foster a good geological understanding of a deposit as a prerequisite for the Mineral Resource estimation process
- The important primary data must be identified and accurately presented in three dimensions, typically on a set of plans and sections. Examples are lithology, structural measurements, assays, etc.
- Where local mine coordinates are used on geological maps and sections, a mechanism for conversion to universal coordinates must be provided. Maps and sections must include appropriate coordinates, elevation, scale, date, author(s) and appropriate directional information.
- Data positioning information should be relative to a common property co-ordinate system and should include the methodology and accuracy used to obtain that information. Accurate location of data points is essential. If data points are referred to a particular map or grid, those reference data should be included, the map properly identified and the coordinate system clearly stated.
- If primary data have been intentionally omitted from the presentation, they should be identified with an explanatory note for their exclusion.

Interpreted Data Visualization

- The geological interpretation including mineralization and its controls (e.g. structure, alteration, and lithology) is essential for MRMR estimation. The primary data (i.e. from outcrops, trenches and drill holes) should be clearly identifiable and be distinct from the interpreted data so that it may be utilised in subsequent interpretations and Mineral Resource estimates.
- The relevant geophysical/geochemical/topographic data used to support the interpretation of faults or boundaries must be included or referenced appropriately.
- Since the mineralising episode(s) and related features of the geology are critical aspects in the mineral resource/mineral reserve estimations, they must be clearly represented. Examples are controlling features, style(s) and age(s) of mineralization, boundaries of the mineralization, and zonation of the mineralization.

Polymetallic Nodules of the Area

65. Mineable areas are neither defined in the Regulations nor in the Convention. The term is first used in the United States "Deep Seabed Hard Mineral Resources Act" of 1978. In this regard, the Act states that: "The applicant must submit with the application a resource assessment to provide a basis for assessing the area applied for. This assessment must include a discussion of mineable and unmineable areas, taking into account nodule grade, nodule concentration, and other factors such as seafloor topography. These areas may be delineated graphically. The resources in the area must be described in relation to the applicant's production requirements, operating period, and recovery efficiency in order to justify the area applied for"¹³
66. Mineable areas comprise three crucial factors; the grade of nodules, the abundance (concentration) of nodules and seafloor characteristics.¹⁴ Thus mineable areas will be defined by each contractor as having a combination of grade and abundance above respective cut-off levels and acceptable seafloor characteristics (slope, number and size of obstacles and sediment shear strength are the factors upon which the collector system would be designed and its recovery efficiency determined). Mine sites within the exploration area will have to contain a sufficient number of mineable areas capable of supporting an economic mining venture, including its operating period. Grade and abundance are geological factors; seafloor characteristics will determine the design of the collector system and the latter's recovery efficiency.
67. Within two to three years from now, seven Contractors for polymetallic nodules exploration in the Area are coming to the end of their contracts. For this reason, to order to ascertain the work done by the contractors in complying with the Regulations and to provide clarification of

¹³ H.R.2759 (96TH) : Deep Seabed Hard Mineral Resources Act (Public law 96-283)

¹⁴ Analysis of exploration and mining technology for manganese nodules – (Seabed minerals series;v.2) United Nations. Ocean Economics and Technology Branch, 1984

the terms contained in paragraph 1(b) of Section 11 (paragraph 2 above), the present workshop for Contractors, mineral classification experts, scientists, engineers and members of the Authority's Legal and Technical Commission has in part been organised.

68. The information and data that have been submitted to the Authority in relation to the process by which mineable areas have been identified by the contractors, including the criteria that have been utilized to identify such areas or the proposed technologies to collect nodules is presented below. Indeed, no information has been provided to the Authority with regard to the size and duration of possible economic mining ventures. This information would indicate the number of mineable areas in a given exploration area that would support the mining venture. Similarly, no information has been provided to the Authority with regard to proposed collectors for mining nodules, the results of tests of these technologies and their recovery efficiencies. In the absence of the requisite resource classification data, the Authority is challenged in its efforts to establish a suitable fiscal regime for polymetallic nodule mining in the Area.

The Resource Assessment work reported by the Contractors to the Authority

IOM

69. Using the UNFC classification system, IOM has classified the polymetallic nodules deposits in its exploration area as Inferred. Its resource assessment work was accomplished using geo-statistical methods, such as Krigging and the geological blocks methods of interpolation. The contractor had identified 15 ore nodule fields of different sizes with > 10 kg/m² wet nodules, for future development. Allocation of ore nodule fields and assessment of resources was carried out on data from 516 sampling stations distributed within an area of 63,075 km². Part of the criteria used by IOM to identify mineable areas was by excluding areas containing slopes with more than 7° gradient and outcrops with more than 3 meters amplitude. IOM reported that the relative error of nodule resource assessment varied from 13 to 68 per cent [mean 35%] for estimating grid practice at the present stage, whereas the assessment accuracy of average metal was less than 10 per cent.
70. The monetary value of products of mining and processing the commercial ore within the contoured prognostic nodule resources of the IOM exploration area was calculated for different indices of ore-bearing (1.0, 0.7, 0.6, 0.5), dilution (5, 10 and 15%), and losses during mining and transportation (20, 30 and 40%). IOM calculated that the supply of commercial ore for a future mining enterprise processing 3 million tonnes dry nodules per year, as the worst-case scenario of geological and mining conditions should be sufficient to meet required terms of an exploitation license. The Inferred nodule resources estimate that could be economically viable to be mined at the favourable market condition provided a sound basis for future mining activities.
71. IOM continues the selection and delineation of additional ore nodule sites within ore fields and development of more detailed nodule technology, processing technology and environment.

YUZHMOREGEOLOGIYA – RUSSIAN FEDERATION

72. Yuzhmorgeologiya, in its 2010 annual report, described a total of 32 ore deposits (industrial ore) with development potential in the Area. In its 2011 report, Yuzhmorgeologiya describes 38 ore deposits as being the most prospective, ranging in area from 11 to 310 km², length 6-67 km and width 1.0 to 7.5 km. The Contractor has used a sampling grid of 6 to 3km with the distance between stations ranging from 2 to 4 km.
73. Yuzhmorgeologiya plans to continue the demarcation of the deposits and assessment of the resource content (resource computation) of the nodules which could be developed in the future and for identification of sites favourable for development in the area demarcated as containing nodule deposits.

THE GOVERNMENT OF THE REPUBLIC OF KOREA (KORDI)

74. KOREA, in its 2011-15 programmes of activities has indicated that it will outline priority mining areas and carry out a benthic impact experiment in its exploration area in preparation for commercial production. It proposes to use high precision acoustic surveys for assessment of resource potential in the priority mining area; and pre-pilot mining test at 1000 m depth in the East Sea of Korea. However, KORDI provides limited information on its resource assessment and classification work.

CHINA OCEAN MINERAL RESOURCES RESEARCH AND DEVELOPMENT ASSOCIATION (COMRA)

75. COMRA reports that it has set up a data and information management system for mathematical and geological models for evaluating and predicting the mineral resources for economic prospecting. It has used sampling grids of 5.3'x5.3' or 9.8km x 9.8km in selected areas and carried out a resource assessment.
76. The contractor has made an economic analysis of commercial deep sea mining on varieties of production, consumption and market conditions of metals produced from the categories of minerals to be derived from the Area based on the results of general, technical and economic evaluation. It concludes that due to uncertainty of technology, operating costs and environmental protection costs, as well as competition with land based mineral resources, the commercial development prospects for mining polymetallic nodules is not certain in the short term.

DEEP OCEAN RESOURCES DEVELOPMENT CO. LTD (DORD)

77. DORD has used the land based Code of the Australian Joint Reserve Committee (JORC, 2004) to classify the mineral resources in its exploration area as Inferred. DORD collected a significant amount of data on occurrence, density and know-how of exploration during 1975 to 1996. A

review and economic appraisal work was conducted in 2010 with respect to the value of ore deposits using the Discounted Cash Flow (DCF) method. DORD reports that though the technological developments for low cost mining and smelting are necessary, because of the stable supply of minerals from land, the advancement of Research and Development related to deep-sea mineral resources has been sluggish. Therefore, it has taken old methods and cost estimates into consideration. The contractor has assumed that the project would be economically viable.

INSTITUT FRANÇAIS DE RECHERCHE POUR L'EXPLOITATION DE LA MER (IFREMER)

78. IFREMER has compiled and geo-referenced all the data that it collected during 1975 to 1988. In 2012, it undertook a major integrative overview on environment work carried out in its licence blocks and plans biological work with Germany for the period 2011-16 in the Area. No developments on resources and resource classification have been reported by the contractor.

MINISTRY OF EARTH SCIENCES, GOVERNMENT OF INDIA

81. The contractor has identified a first generation mine-site, an area of 7858 km², in its exploration area and has divided the mine site into 42 blocks of 0.125° x 0.125° for detailed exploration and comprehensive resource evaluation.¹⁵
82. The MOES of India plans to identify a test mining site (a block of 12.5km x 12.5km) within the contractor's First Generation Mine-site to carry out a preliminary techno-economic evaluation of the mining complex including processing and recovery of additional metals and value added products. Based on the existing resource evaluation with further refinement relating to block-wise estimation variances and the available sampling grids, the contractor plans to attempt classification of the resources in the Area into measured, indicated and inferred categories, during 2014-15.

BGR, GERMANY

83. Based on conceptual studies and modelling of limited available data, BGR has identified 'a highly prospective area of approximately 2000 km² with a high density of mineable nodule areas of economic interest, which would be sufficient for 7-12 years of mining'. The Contractor reports the coefficient of variation for the main metal content (Mn, Cu, Ni, Mo, V) is a factor 3 lower than the coefficient of variation for nodule abundance (approximately 10% versus 30%). The nodule abundance being the controlling factor for resource estimation, the contractor projected to improve the quantity and quality of nodule abundance data.

¹⁵ The term "first generation mine site" is to be defined.

84. BGR reports that it has prepared an internal report with the Aker Wirth Company regarding a study on the “Technical development and economic feasibility of mining polymetallic nodules from the deep-sea”. This covered :
- (a) An evaluation of existing deep-sea mining techniques;
 - (b) an assessment of these techniques regarding environmental issues, safety, capital expenditure, operating costs, and profitability;
 - (c) a survey of related technological sectors regarding their transferability and based on the results of these studies, and
 - (d) The development of a detailed conceptual design for a nodule mining and lifting system, including computer simulations of important sub-systems and components and basic concepts for a production platform and a nodule ore transport system to a land-based metallurgical processing plant.
85. In its 2013 Annual Report, BGR reported its resource calculations for the entire PA1 as “indicated mineral resource” according to the CIM Definitions Standards for mineral resources and mineral reserves (2010).

TOML-TONGA

86. Tonga Offshore Mining Limited (TOML), TONGA signed its contract with the ISA in 2012. However, in its first annual report, it has classified the deep sea polymetallic nodule resources as Inferred deposits. This classification follows the Canadian Securities Exchange Standards and is in accordance with the JORC standards (NI43-101 or JORC standards). The resources have been classified based on conceptual costing and revenue modelling and relative metal price assumptions, conceptual production cost per tonne at each stage of the production chain, based almost entirely on proven technology. The resource modelling reviewed the historical data available for the CCZ.

NORI

87. Based on the interpretation of geological and geophysical data collected during 2012, NORI has generated a nodule distribution model including correlation with the seafloor topography and sediment characteristics, which was used for its resource estimate and geological model. This model also incorporated historical data. The Inferred mineral resource estimates were prepared in accordance with the CIM ‘Estimation of Mineral Resources and Mineral Reserves Best Practice Guidelines’ and the Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves (JORC Code, 2012).

88. The remaining polymetallic nodule contractors are yet to report on their resource assessment work, as well as the classification of the resources.

Comments on reported work

89. With the limited amount of information and data on the polymetallic nodule resources in exploration areas, in particular for contracts that expire between 2016 and 2017, there is an urgent need to inform and educate all stakeholders (including staff of the Authority, members of Authority, commissions and committees, sponsoring states and contractors) in the international standards for mineral assessment and reporting through discussions with experts in the establishment and application of such standards. There is also an urgent need to work with the Committee on Mineral Reserve Information Reporting Standards (CRIRSCO) in order to apply the CRIRSCO standards to mineral reserve and mineral resource reporting by all contractors and, through the CRIRSCO standards, maximize consistency with national reporting standards.
90. Of the seven contracts that expire by 2017, only one contractor has provided criteria to define mineable areas, the number of such areas that have been identified in its exploration area and a classification of these resources. Another contractor has provided information on “ore deposits” in its exploration area without reference to the criteria used to define “ore deposits”. A third contractor refers to a first generation mine site without a definition of the term. Two others indicate that they have undertaken resource assessment work but provide no data or reports on the work. Only one contractor has indicated the classification system that it has used.
91. As can be gleaned from the above, the comparability of assessments across deposits and development sites is not possible. This will require clear standards, and these standards must reflect the nature of the resource and the technology and economics of their exploitation.
92. In order for such comparability to be possible, there is a need to review the work being undertaken by contractors in this regard, agreement on the utilization of applicable land-based standards and their utilization in the short term for polymetallic nodules, establishment of a continuing relationship with organizations such as CRIRSCO to refine standards, and a determination of the additional work to be performed by contractors and the time required to fulfill. Consideration must also be given to elaborate on the best practices for the “Resource Database” identified in the CIM Best Practices in regard to the ‘end of contract’ regulation applicable to exploration contractors regarding transfer of exploration and resource data from the contractor to the Authority at the end of the exploration contract.

Objectives of the workshop

- (I) Ascertain the work being undertaken by contractors for polymetallic nodule exploration in the Area with a view to the standardization of the exploration and resource data required in Section 11 of the standard clauses of Exploration contracts;
- (II) Review of current practice in land-based mineral development on national reporting standards for exploration results and resource classification;
- (III) Identification of special aspects of polymetallic nodule deposits that should be addressed in resource reporting standards;
- (IV) Identification of any issues arising from differences in national reporting standards to which the Authority should respond;
- (V) Assist contractors to identify and implement best practices in polymetallic nodule resource evaluation;
- (VI) Identification of the work to be completed by contractors to fulfil item (i);
- (VII) Determine the time required to fulfil item (v), and
- (VIII) Provide guidance to the ISA regarding relations with mineral information standards organizations, including potential cooperation with CRIRSCO's work;

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Appendix 2: Recommended Rules of Conduct Applicable to “Competent Persons”¹⁶

The following recommended Rules of Conduct apply to Competent Persons engaged in the practice of preparing or contributing to public reports that include statements of Mineral Exploration Results, Mineral Resources or Mineral Reserves. These Rules are in addition to the Professional Codes of Ethics that may apply due to the Competent Person’s membership of a recognized professional body. In the event of a conflict, the rules of the Competent Person’s recognized professional body will prevail. The Rules of Conduct are listed under various areas of responsibility, highlighted in bold text.

The Public and Society

Competent Persons must discharge their duties with fidelity to the public, and at all times in their professional or employed capacities carry out their work with integrity and professional responsibility.

In particular:

- Recognize at all times, that the responsibility of Competent Persons towards the Public overrides all other specific responsibilities including responsibility to professional, sectional, or private interests or to other Competent Persons.
- Ensure that public comments on geological, engineering and metallurgical and related matters are made with care and accuracy, without unsubstantiated, exaggerated, or premature statements; they should be made clearly and concisely.
- Base documentation underpinning Public Reports on Mineral Resources and Mineral Reserves on sound and relevant estimation techniques, adequately validated data and unbiased judgement.
- Note that when required to do so, Competent Persons should give evidence, express opinions or make statements in an objective and truthful manner on the basis of adequate knowledge and understanding.
- Recognize that where required to do so, Competent Persons should be prepared to disclose details of qualifications, professional affiliations and relevant experience in all public reports.

The Profession, Employers and Clients

Competent Persons must uphold the honour, integrity, reputation and dignity of their profession and maintain the highest level of conduct in all professional matters. In particular they should:

- Act with due skill, care and diligence at all times in conducting their activities.
- Perform work only in their area of competence.
- Never knowingly mislead or deceive others, falsify or fabricate data.

¹⁶ CRIRSCO, International Reporting Template, November, 2013. Accessed at <http://www.criresco.com/templates/criresco_international_reporting_template_2013.pdf> on February 23, 2014.

- Respect and safeguard confidential information.
- Acknowledge and avoid wherever possible both real and perceived conflicts of interest.

International Standards for Mineral Assessment and Reporting

- Distinguish between fact and opinion so that it is clearly evident what is interpretation of fact and what is professional judgement. Competent Persons may give a considered professional opinion based on facts, experience, interpretation, extrapolation or a combination of these.
- Ensure the scientific and technological contributions are thorough, accurate and unbiased in design, implementation and presentation.
- Ensure that sound and relevant estimation techniques, adequately validated data and unbiased judgement are applied to the documentation upon which public reports on Mineral Resources and Reserves are based.
- Comply with all laws and regulations relating to the mineral industries and rules, regulations and practices as established and promulgated by the relevant regulatory authorities.
- Use their best endeavours to ensure that their employer or client complies with the rules and regulations and practices of the relevant regulatory authorities.

Professional Bodies, Colleagues and Associates

Competent Persons must at all times conform to the rules of the professional bodies to which they belong and respect and acknowledge the contributions of colleagues and other experts in enabling them to conduct their work.

They should:

- Accept responsibility for their own errors.
- Demonstrate a willingness to be judged by their professional peers.
- Agree to be bound by the disciplinary code of the professional body to which they are affiliated.
- Encourage others to accept the same responsibilities, to join a recognized professional body and to be bound by these Recommended Rules of Conduct.

The Environment, Health and Safety

In performing their work, Competent Persons should strive to protect the natural environment and ensure that the consequences of their work do not adversely affect the safety, health and welfare of themselves, colleagues and members of the Public.

- Ensure that consideration of the modifying factors used to determine Mineral Reserves fully recognizes the need to provide a safe working environment.

- Ensure that Mineral Reserve estimates acknowledge the likely environmental impact of development and ensure that appropriate allowances are made for mitigation and remediation.