



Guidance Note on the use of the Bridging Document between the CRIRSCO Template and UNFC



*Based on the CRIRSCO Template November 2019 version
and UNFC (Update 2019)*

April 2024

Summary

This document was prepared by the Ad Hoc Task Group for Revising the Committee for Mineral Reserves International Reporting Standards (CRIRSCO) Template and the United Nations Framework Classification for Resources (UNFC) Bridging Document (2024) which was established in April 2023 at the request of the Expert Group on Resource Management of the United Nations Economic Commission for Europe (UNECE) and the CRIRSCO Executive. The Task Group was charged with updating the previous version of the CRIRSCO Template-UNFC Bridging Document, which was issued in 2015, in order to take account of subsequent changes including the publication in 2019 of updated versions of both systems.

The Task Group included the following members:

- Tom Bide, Hendrik Falck and Janne Hokka of the Expert Group on Resource Management's Minerals Working Group
- Roger Dixon and Edmund Sides, members of CRIRSCO.

Following completion of several rounds of review and editing, a final draft of the updated Bridging Document was released in July 2023 for wider review by professionals with experience of working in industry and/or government who were familiar with either the CRIRSCO Template aligned reporting codes and standards and/or the UNFC classification system.

A pre-release version was prepared at the end of August 2023 with changes made to address issues raised by the reviewers.

At that time it was agreed that the version of the Bridging Document developed up to that point should be issued as two separate documents, namely:

- A shorter version to be issued by UNECE as the official CRIRSCO Template-UNFC Bridging Document in compliance with the UN's rules on parliamentary documents. This is to be developed as a Summary of the longer document which had been developed and reviewed up to this stage
- The longer document, to be renamed as the: "Guidance note on the use of the CRIRSCO Template to UNFC Bridging Document (2024 version)", and to be issued as a joint CRIRSCO-UNECE document and branded accordingly.

CONTENTS

Summary	i
I. INTRODUCTION	1
II. BACKGROUND	2
A. Expert Group on Resource Management and UNFC	2
B. CRIRSCO and the CRIRSCO Template	3
C. Comparison of the CRIRSCO Template and UNFC	4
III. OVERVIEW OF SYSTEM CONTENTS	5
A. THE CRIRSCO TEMPLATE	5
B. UNFC	7
IV. COMPETENCY AND QUALIFICATION REQUIREMENTS	10
V. MAPPING CRIRSCO TEMPLATE TO THE UNFC CATEGORIES AND SUB-CATEGORIES	12
A. Minerals Project	12
B. Generalised overall mapping	12
1. Geological Confidence (CRIRSCO Y-axis)	12
2. Modifying Factors (CRIRSCO X-axis)	13
3. Standard Mapping	13
4. Simplified representation based on the E and F axes only	15
5. Other aspects	16
C. Detailed mapping of the E axis	16
D. Detailed mapping of the F axis	19
E. Detailed mapping of the G axis	22
F. Exploration Target	23
G. Additional considerations	24
1. Exploration Results	24
2. Reference Point	24
3. Mineral Inventory	24
4. Mineral Resources	25
5. Mineral Resources – Reporting as Inclusive or Exclusive of Mineral Reserves:	25
6. Mineral Reserves	26
7. Effective Date	26
8. Historical estimates	26
9. Closed, closing or uneconomic mining operations	26
H. Step by Step Process for Mapping from the CRIRSCO Template to UNFC	27
VI. MAPPING UNFC TO THE CRIRSCO TEMPLATE	29
A. General considerations	29
B. Reporting UNFC estimates using CRIRSCO terminology	29
C. Reporting a UNFC estimate in compliance with a CRIRSCO code or standard	30
VII. References	31
VIII. Appendix I: Key features of the CRIRSCO Template and UNFC	33
IX. Appendix II: Terminology	35
A. Abbreviations and acronyms used	35
Glossaries of terms	36

LIST OF FIGURES

Figure III.1 General Relationship between Exploration Results, Mineral Resources and Mineral Reserves, as set out in the CRIRSCO Template (CRIRSCO, 2019)	6
Figure III.2 Diagrammatic representation of the UNFC classification system (from UNECE, 2019)	8
Figure V.1 Simplified representation of the E-F matrix showing UNFC project classification with mapping to CRIRSCO categories	15

LIST OF TABLES

Table III.1 UNFC Classes, Sub-Classes, Categories and Sub-Categories (from UNECE, 2021)	8
Table V.1 Standard mapping of CRIRSCO Template aligned estimates to UNFC Categories	14
Table V.2 Specification of the UNFC E axis and corresponding CRIRSCO Template considerations	17
Table V.3 UNFC sub-divisions of the E-axis Categories (to be used in conjunction with Table V.2) (based on UNECE, 2019)	18
Table V.4 Specification of the UNFC F axis and corresponding CRIRSCO Template considerations	20
Table V.5 UNFC sub-divisions of the F-axis Categories (to be used in conjunction with Table V.4) (based on UNECE, 2019)	21
Table V.6 Specification of the UNFC-G-axis and corresponding CRIRSCO Template considerations	22
Table V.7 UNFC sub-divisions of the G-axis Categories (to be used in conjunction with Table V.6) (based on UNECE, 2019)	23
Table VI.1 Simplified mapping of UNFC coded estimates to the CRIRSCO Template (only to be used for the reporting of mineral inventory data using CRIRSCO terminology)	30

PRACTICAL APPLICATION OF THE BRIDGING DOCUMENT BETWEEN THE CRIRSCO TEMPLATE and UNFC

I. INTRODUCTION

In the United Nations Framework Classification for Resources (UNFC) terminology, the purpose of a Bridging Document is to explain *“the relationship between the United Nations Framework Classification for Resources (UNFC) and another classification system, including instructions on how to classify estimates generated by the application of that system using the UNFC Numerical Codes”* (UNECE, 2019). The Committee for Mineral Reserves International Reporting Standards (CRIRSCO) has developed the CRIRSCO International Reporting Template (the “CRIRSCO Template”) which has been endorsed by UNECE (EGRM) as a UNFC Aligned System for use in classifying estimates from minerals projects. This document provides guidance on the relationship between estimates reported in compliance with reporting codes and standards based on the CRIRSCO Template and estimates classified using UNFC and is referred in the text as “the Bridging Document”.

CRIRSCO has published an agreed set of Standard Definitions which are included in the CRIRSCO Template, the most recent edition of which was issued in November 2019. The CRIRSCO Template provides a framework for the CRIRSCO Template aligned reporting codes and standards which include those currently used by fifteen different national and regional organisations around the world. The CRIRSCO Template is an advisory document only, and where a national or regional code or standard exists, the relevant code or standard will take legal precedence. The CRIRSCO Template includes standard definitions of common terms that are used in all of the CRIRSCO Template aligned reporting codes and standards. Hence the Bridging Document provides a basis for classifying estimates reported in compliance with CRIRSCO Template aligned reporting codes and standards using the UNFC classification system.

The CRIRSCO Template and the reporting codes and standards aligned with it, are independent from UNFC. The use of specific CRIRSCO codes or standards may be mandatory for reporting in some jurisdictions in order to comply with legal obligations, stock market regulations, or to meet other specific legislative requirements. The Bridging Document is not intended to supersede or replace such mandatory reporting requirements.

The use of the UNFC and CRIRSCO Template aligned systems to classify and report on mineral projects, respectively, should be seen as complementary, with the application of each system being dependent on the objectives of the project evaluation and related reporting requirements. A common objective of both the CRIRSCO Template and UNFC is to communicate information on the levels of confidence associated with the estimates of the size and quality of mineral deposits to the users of such information. The different sub-categories recognised in the CRIRSCO Template are based on the level of geological confidence associated with the estimates. Likewise the value assigned to the G axis in UNFC is used to communicate the degree of confidence in the estimate.

While there is much commonality in the principles and guidelines of the two systems, and it is noted that both systems require consideration of technical feasibility, and social and environmental aspects when assessing the viability of a project, there are differences. For example, UNFC's use of the E and F axes and the provision for E and F Sub-categories allows for a greater level of detail (granularity) when classifying projects with respect to such considerations. Unless constrained by regulation, the application of the Bridging Document shall not limit the use of the full granularity of UNFC (Update 2019).

Since their initial releases, both UNFC and the CRIRSCO Template have been updated several times. Additionally, the national reporting codes and standards aligned to the CRIRSCO Template are also updated periodically and may not necessarily be aligned with the most recent version of the CRIRSCO Template. Relevant information with respect to the use of UNFC in the minerals sector was published in the Supplementary Specifications for the Application of the United Nations Framework Classification for Resources to Minerals as adopted in 2021 (UNECE, 2021). Users of the Bridging Document should use the most recent version of guidance documents for both systems and make clear in any accompanying documents or databases, the particular versions of UNFC, the CRIRSCO Template, and the relevant CRIRSCO Template aligned national or regional reporting code or standard that has been used.

Recently the European Union (EU) and other UNECE countries have expressed interest in the application of UNFC to provide a framework for the development of harmonised transnational databases on mineral information as well as providing a means of assessing and monitoring strategic mineral projects. In particular, the provision of information on mineral projects classified in accordance with UNFC has been specified in the European Commission's Critical Raw Materials Act (CRMA, European Commission, 2024). It is envisaged that the revision of the Bridging Document will assist mineral companies that are currently using a CRIRSCO Template aligned reporting code or standard to determine the UNFC classification for their mineral project(s) to meet the proposed requirements of the CRMA.

II. BACKGROUND

A. Expert Group on Resource Management and UNFC

The United Nations Economic and Social Council (ECOSOC) is one of the six principal organs of the United Nations (UN), responsible for coordinating the UN's economic and social fields. ECOSOC established five regional commissions to promote regional development, one of which is the United Nations Economic Commission for Europe (UNECE) which was established in 1947. UNECE has established several sectoral committees, including the Committee on Sustainable Energy under the auspices of which the Expert Group on Resource Management falls.

The Expert Group and the United Nations Framework Classification for Resources (UNFC) had their origins in work carried out originally by the UNECE Working Party on Coal, which subsequently led to the formation of an Ad Hoc Group of Experts on Harmonization of Fossil Energy and Mineral Resources Terminology. This in turn became the Expert Group on Resource Classification (EGRC) which was renamed as the Expert Group on Resource Management in 2018.

The UNECE Working Party on Coal initiated the first version of the United Nations Framework Classification for Solid Fuels and Mineral Commodities in 1992, on the basis of a proposal made by the German Government. The same principles had already been applied in a classification originally developed by Mr. Dietmar Kelter, Federal Institute for Geosciences and Natural Resources, Hanover, in 1991. Over a period of six years, the UN Task Force, chaired by Mr. Kelter, designed and elaborated it with the substantial contribution and support of more than fifty countries and organizations worldwide. In 1997, UNECE published the United Nations Framework Classification for Reserves and Resources of Solid Fuels and Mineral Commodities (UNFC-1997) as a unifying international system for classifying solid minerals and fuels. At its annual session in 1997, ECOSOC recommended that all UN member countries should apply the Classification to their coal and mineral sectors (ECOSOC Decision 226/1997).

In October 1998, the UNECE Task Force and an Expert Group of the Council of Mining and Metallurgical Institutions (CMMI) reached an agreement to integrate their respective definitions into

a single, universally applicable set of definitions. The joint UNECE/CMMI definitions for mineral and reserves and resources were agreed at a meeting in Geneva in November 1999 (UNECE, 2000). The use of the terms 'Mineral Resources' and 'Mineral Reserves' in UNFC was, however, subsequently discontinued.

In 2004, UNFC was revised to include petroleum (oil and natural gas) and uranium and renamed the UNFC for Fossil Energy and Mineral Resources 2004 (UNFC-2004). In 2009, a simplified United Nations Framework Classification for Fossil Energy and Mineral Reserves and Resources 2009 (UNFC-2009) was published in response to the application of UNFC being extended to cover renewable energy, injection projects for geological storage and anthropogenic resources.

In 2017 the name was changed to the United Nations Framework Classification for Resources. The most recent version of the United Nations Framework Classification for Resources (UNFC, 2019) is an update of UNFC-2009 which incorporates Specifications for its Application (ECE Energy Series 42 and ECE/ENERGY/94) and was adopted in 2019.

B. CRIRSCO and the CRIRSCO Template

The acronym CRIRSCO stems from its original organizational name, the Combined Reserves International Reporting Standards Committee. CRIRSCO is currently known as the Committee for Mineral Reserves International Reporting Standards, but the original abbreviation has been retained.

The need for international agreement on the terminology and practices used in reporting on mineral projects is linked to the international nature of the mining industry and mining finance. The mining sector requires the trust and confidence of investors and other stakeholders for its on-going financial and operational well-being. Unlike many other industries, mining is based on depleting mineral assets, the knowledge of which is imperfect with estimates being made at various levels of confidence prior to the commencement of extraction. It is essential that the minerals industry communicates the risks associated with investment effectively and transparently to earn the level of trust needed to underpin its activities. The main objective of the CRIRSCO Template aligned reporting codes and standards is to promote high standards of reporting of mineral deposit estimates (Exploration Targets, Mineral Resources and Mineral Reserves) and of exploration progress (Exploration Results) so as to provide investors, potential investors, their professional advisors and other stakeholders with reliable information on which to base their investment decisions.

CRIRSCO's formation has its origins in two high profile events which caused a significant loss of investor confidence in the minerals sector, namely the Poseidon boom and bust of 1969–1970 which refers to a speculative spike in share prices of nickel exploration companies in Australia, and the Bre-X fraud of 1997 where samples from the Busang gold project in Indonesia – which was owned by a Canadian junior mining company – were fraudulently tampered with by 'salting' the samples with gold. The Poseidon boom and bust led to the development of the Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves (JORC Code) in Australasia, and the Bre-X fraud led to the introduction of the Canadian National Instrument 43-101 legislation on Standards of Disclosure for Mineral Projects (NI 43-101) which is applicable to mineral companies listed on Canadian stock exchanges.

In parallel with the development of the JORC Code, the work of the CMMI's Expert Group, which included representatives of associations of mining professionals from Australasia, Canada, Europe, South Africa, and the USA, led to the formation of CRIRSCO in 1994, and subsequent international agreement on standard definitions for the terms used when reporting on minerals projects. Since its

formation in 1994, CRIRSCO has grown from the initial five member organisations to an association representing fifteen national reporting organisations (NROs) from around the world¹.

The first version of the CRIRSCO International Reporting Template was published in 2006 in order to provide a framework for the development of reporting codes and standards suitable for market-related disclosure and reporting to support requests for financial investment. The most recent version of the CRIRSCO Template was released in November 2019.

The members of CRIRSCO have established a governance system based on the principles of Transparency, Materiality and Competence, in which the CRIRSCO Template has a central role, gathering standard definitions and general procedures to be observed by all Competent Persons (Qualified Persons) in the exercise of reporting Exploration Targets, Exploration Results, Mineral Resources and Mineral Reserves. The governance system is self-regulated, comprising four layers of responsibilities providing training and supervision of Competent Persons, subject to codes of ethics and conduct and disciplinary procedures. Over the years, the governance system and the CRIRSCO Template have evolved to being used beyond the stock market, with the information being increasingly used by governments, state policymakers and academics for a better knowledge of the volumes and quality of national or global mineral resources.

C. Comparison of the CRIRSCO Template and UNFC

UNFC and the CRIRSCO Template were developed for different purposes but are complementary in nature. Whilst they may appear to represent alternative choices for the classification of estimates of the magnitude of mineral deposits or for stock exchange disclosures by mineral companies they were developed for fundamentally different requirements as discussed below.

The CRIRSCO Template aligned reporting codes and standards were developed specifically to support the regulation of disclosures by publicly listed mineral companies in order to protect investors by reducing the chances of market abuse occurring. A foundational requirement of CRIRSCO Template aligned reporting is to ensure that when a company is reporting on mineral exploration, mineral project development and mineral production activities they provide all the relevant information - material to the mineral property and activity being reported on - that investors, potential investors and their advisors would reasonably require and expect to find in a such a report. In addition to utilizing the system to meet legal and regulatory requirements, many unlisted mineral companies have also adopted the use of the approach to support corporate governance requirements and internal decision making.

On a broader level, UNFC is an internationally applicable scheme for the classification of energy and raw material resource projects at all stages of development which can also be applied to non-economic and non-commercial projects. UNFC reflects conditions in the economic, environmental, and social domain, including markets and government framework conditions, social and environmental considerations, technological and industrial maturity of resource projects of many types. The classification system is aligned to the requirements of the 2030 Agenda for Sustainable Development. It provides a single framework on which to build international energy and raw material studies and policies, support government resource management policies, plan industrial processes innovation and allocate capital efficiently. Historically, UNFC was designed to meet the classification needs of regional and national governments and policymakers to undertake long-term mineral resource management. It is still intended for use in creating and managing harmonized mineral

¹ Details of current CRIRSCO member organisations and links to their individual websites and codes and standards are provided on the CRIRSCO website at: <https://www.criirSCO.com/>.

inventories that can be easily compared across regions and national borders for the purpose of developing mineral policies and planning.

The CRIRSCO Template aligned reporting codes and standards focus on the detailed requirements for listed mineral companies to substantiate the material conclusions of their activities in a logical manner regarding the reporting of volumes of mineralised material on a mineral asset(s) owned by a minerals company, with the prime objective of supporting exchange regulation and avoiding market abuse. UNFC provides a logical framework for the comparison of the estimated mineral products that may be derived from an entire mineral project in terms of aggregated estimate quantities, the maturity and feasibility, the degree of technical environmental-socio-economic viability and the level of confidence in such assessments. As it has been expanded over time to cover a wider range of sectors, UNFC has moved from a focus of classifying estimates of quantities of products (e.g. amounts of mineralised material contained in a mineral deposit) to a focus on classifying projects according to their development status.

A summary of different aspects of the CRIRSCO Template aligned reporting codes and standards and the UNFC classification system is provided in Section VIII (Appendix I), in order to illustrate their complementary nature.

III. OVERVIEW OF SYSTEM CONTENTS

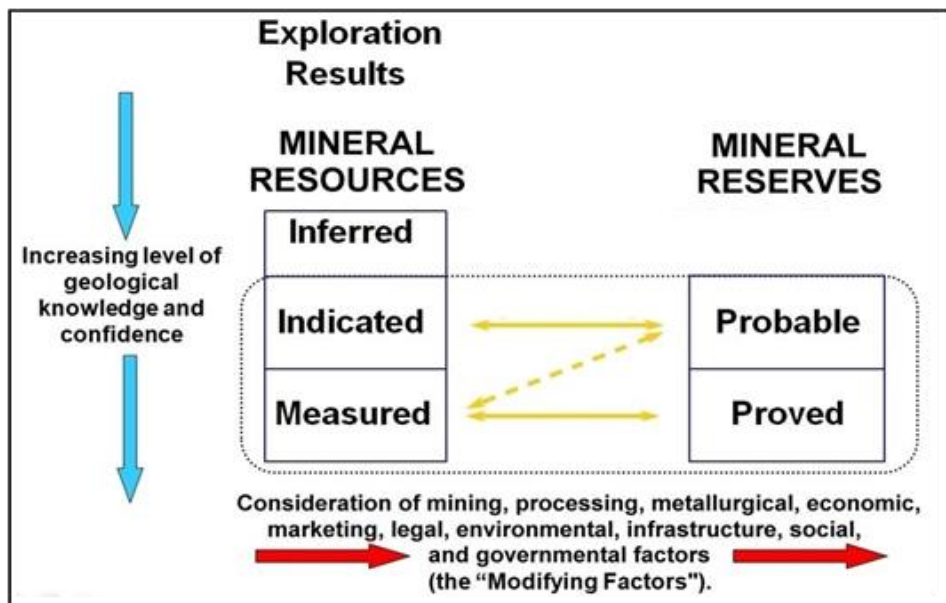
A. THE CRIRSCO TEMPLATE

The term 'CRIRSCO Template' as used in this document refers to the 2019 version of the CRIRSCO International Reporting Template for the public reporting of Exploration Targets, Exploration Results, Mineral Resources and Mineral Reserves (CRIRSCO, 2019). The CRIRSCO Template is the international standard for the reporting of Exploration Targets, Exploration Results, Mineral Resources, and Mineral Reserves and represents current international leading practices for the preparation of Public Reports by Mineral Companies. The CRIRSCO Template provides a consolidated version of national and regional codes or standards that reflect compatible international components. The CRIRSCO Template is also intended to assist countries or regions that do not have a reporting code, or whose code is outdated, to produce a new code consistent with internationally accepted practice.

The CRIRSCO Template establishes and maintains consistent standards for **Public Reports** to inform investors, potential investors, their advisors and other stakeholders about exploration progress, and estimates of **Mineral Resources** and **Mineral Reserves** for exploration, development and operating mineral projects. It does not allow for disclosure of estimates of quantities of non-economic mineralisation which may be relevant for national mineral inventories or other purposes, such as internal use in strategic planning. Consequently, a full application of a UNFC classification for solid minerals can extend beyond the classes explicitly defined in the CRIRSCO Template and may include estimates which are considered too speculative for investing purposes and cannot be publicly disclosed in **Public Reports** based on the CRIRSCO system.

The relationship between some of the key terms used in the CRIRSCO Template is shown in diagrammatic form in Figure III.1.

Figure III.1
General Relationship between Exploration Results, Mineral Resources and Mineral Reserves, as set out in the CRIRSCO Template (CRIRSCO, 2019)



The CRIRSCO Template includes sixteen Standard Definitions which are used in the individual national or regional reporting codes and standards to provide a consistent terminology at an international level. In addition to the nine terms shown in Figure III.1, the CRIRSCO Standard Definitions include the terms *Mineral, Public Reports, Competent Person, Exploration Target* and three types of technical study, namely: *Scoping Study, Pre-Feasibility Study, and Feasibility Study*.

Modifying Factors are considerations which are taken into account when converting *Mineral Resources* to *Mineral Reserves* and, as indicated in Figure III.1, they include mining, processing, metallurgical, infrastructure, economic, marketing, legal, environmental, social, and governmental factors. Preliminary consideration of the **Modifying Factors** is necessary in order to confirm that mineralisation included in a *Mineral Resource* estimate has reasonable prospects for eventual economic extraction (often abbreviated as RPEEE) based on reasonable and justifiable assumptions with respect to the relevant **Modifying Factors**.

CRIRSCO Template aligned reports are required to provide details of the data and assumptions used to assess the prospects for eventual economic extraction of a mineral project and to highlight any material uncertainties and risks that have been identified.

The CRIRSCO Template is applicable to all mineral deposit types of solid minerals, including anthropogenic deposits such as stockpiles, dumps, and tailings storage facilities. The principles of the CRIRSCO Template are applicable to metalliferous minerals, coal, diamonds and other gemstones, industrial minerals, cement feed materials and construction raw materials, dimension stone, ornamental and decorative stone, other mineral raw materials, oil shales, oil sands and other energy minerals extracted by mining.

It should be noted that companies that report in compliance with a CRIRSCO Template aligned code or standard all generate additional internal estimates of sub-economic mineralisation. Such estimates are not covered by the CRIRSCO Template. However, there are cases where CRIRSCO Template compliant reports have been prepared where estimates of mineralised material have been found to be sub-economic, such as in a completed but failed Feasibility Study. Where the results of

such studies are available, such-sub-economic estimates would provide valid data that could be classified according to the UNFC classification system.

B. UNFC

UNFC is a resource project-based and principles-based classification system for defining the environmental-socio-economic viability and technical feasibility of projects to develop resources. It was originally developed for use on mineral resource projects but has since been expanded to cover other resource projects based on solar, wind, geothermal, hydro-marine, bioenergy, injection for storage, hydrocarbons, nuclear fuels and water sources of feedstock from which products can be developed. UNFC provides a consistent framework to describe the level of confidence in estimates of the future quantities to be produced by such projects. The most recent version of UNFC was published in 2019 (UNECE, 2019) and has been used as the basis of this version of the Bridging Document.

Given the wide range of sectors in which UNFC is applied, sector-specific guidance has been developed for several sectors where there are well established methodologies and systems for project assessment and the estimation of future production potential. In this context, users of the CRIRSCO Template to UNFC Bridging Document should refer to the “Supplementary Specifications for the Application of the United Nations Framework Classification for Resources to Minerals” (UNECE, 2021) for additional information on the application of UNFC in the minerals sector.

In UNFC, the products of a resource project are classified using a numerical coding system based on three fundamental criteria, namely:

- **Environmental-socio-economic viability (E)** which indicates the degree of favourability of environmental-socio-economic conditions in establishing the viability of the project, including consideration of market prices and relevant legal, regulatory, social, environmental and contractual conditions
- **Technical feasibility (F)** which indicates the maturity of technology, studies, and commitments necessary to implement the project. This allows coding of projects ranging from early conceptual studies through to fully developed projects that are producing and reflects standard value chain management principles
- **Degree of confidence in the estimate (G)** indicates the degree of confidence in the estimate of the quantities of products from the project.

Categories (e.g. E1, E2, E3) and, in some cases, sub-categories (e.g. E1.1) are defined for each of these three criteria. Sub-categories are currently defined for the E1, E3, F1, F2, F3, F4 and G4 categories. Using combinations of the Sub-categories for each Category, a high level of detail (granularity) is provided by UNFC for the management of project portfolios by companies and government organisations.

A UNFC Class is uniquely defined by selecting from each of the three criteria a particular combination of a Category or a Sub-category (or groups of Categories/Sub-categories). Since the codes are always quoted in the same sequence (i.e. E; F; G), the letters may be dropped and just the numbers retained (e.g. 111 or 334). The numerical code defining a Class is then identical in all languages using Hindu-Arabic numerals.

A three-dimensional representation of the UNFC Categories and Classes is shown in Figure III.2, and a summary of the main UNFC Classes, Sub-Classes, Categories and Sub-Categories is provided in Table III.1.

Figure III.2
Diagrammatic representation of the UNFC classification system (from UNECE, 2019)

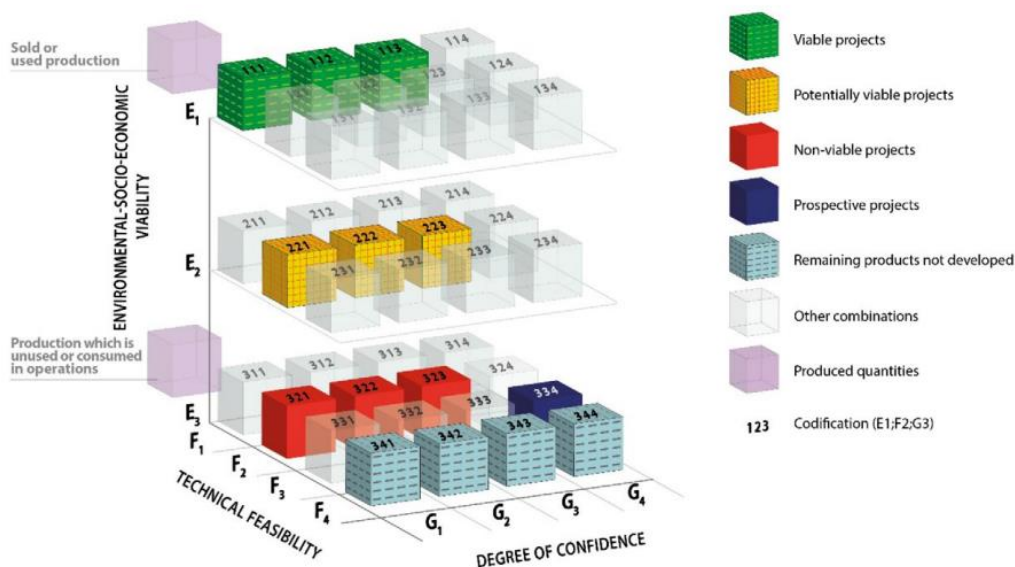


Table III.1
UNFC Classes, Sub-Classes, Categories and Sub-Categories (from UNECE, 2021)

UNFC Classes Defined by Categories and Sub-categories						
Produced	Sold or used production					
	Production which is unused or consumed in operations					
Total Products	Class	Sub-class	Categories			
			E	F	G	
	Known Sources	Viable Projects	On Production	1	1.1	1, 2, (3) ^b
			Approved for Development	1	1.2	1, 2, (3) ^b
			Justified for Development	1	1.3	1, 2, (3) ^b
		Potentially Viable Projects	Development Pending	2 ^a	2.1	1, 2, 3
			Development on Hold	2	2.2	1, 2, 3
		Non-Viable Projects	Development Unclassified	3.2	2.2	1, 2, 3
	Development not Viable		3.3	2.3	1, 2, 3	
	Potential Sources	Remaining products not developed from identified projects		3.3	4	1, 2, 3
Prospective Projects		[No Sub-classes defined]	3.2	3	4	
Remaining products not developed from prospective projects		3.3	4	4		

NOTES:

^a Development Pending Projects may satisfy the requirements for E1.

^b In minerals projects, the parallel categorisation of G3 together with E1 and F1 Categories usually is not realised due to the lack of direct evidence. A Viable Project must have sufficient material in the G1 and G2 categories to confirm the project’s viability and material in the G3 category is regarded as additional material of interest for further investigation.

Details of the specifications for the E, F and G axes Categories and Sub-categories are provided in the Tables included in Section V.

A UNFC Project may have quantities of products that fall into several Classes including ones that are not reported in other reporting systems. The most common products include those Products that will be sold or used, but there can also be Products that will be consumed by the Project or not used (e.g., fuel and mine tailings) and quantities of products that may not leave the Project (e.g., unrecoverable quantities remaining in situ such as pillars in an underground mine). A Project may produce multiple Products, each of which is defined by estimates of the quantities crossing a reference point which may be the input to, or output from, a processing plant or smelter. Each of the products may be classified through sub-Projects and all of them may not necessarily have the same classification categories.

According to UNFC, a mining project produces mineral products from a source with defined frame conditions, which provide the basis for environmental-socio-economic evaluation and decision-making. A Project provides estimates of resource quantities with different levels of confidence. For a minerals project the product quantities are expressed as estimates of tonnage, volumes, grade, or quality. When reporting quantities, tonnage and grade or quality information is preferred. A Project is comprised of a defined activity or set of activities, which form the basis for estimating the technical viability on the one hand (F-axis issues), and environmental-socio-economic viability on the other (E-axis issues), but are also subjected to geological and estimation uncertainties (G-axis issues).

For a minerals project, Product types can include metallic minerals, non-metallic minerals, industrial minerals including aggregates, coal, diamond etc. The products are recovered from geological occurrences in the earth's crust and from extractive industry residues such as tailings, stockpiles, and waste rocks. For reporting of corporate or national quantities, the estimated quantities of individual Projects may need to be aggregated.

It should be noted that in the minerals sector, UNFC can be applied in two slightly different ways, namely:

- **Classification of estimates of a specified volume on an individual minerals project.** In this context, UNFC provides a framework for reporting estimates in a standardised manner so as to facilitate the incorporation of such estimates into mineral inventory databases held by companies, government bodies or other interested parties. The sub-division of estimates for individual deposits into confidence categories is important for the assessment of the overall level of confidence in aggregated resource and reserve totals. This application is more closely aligned with the CRIRSCO-type approaches and was used as the main basis for the initial version of UNFC as published in 1997 (UNECE, 1997)
- **Classification of minerals projects.** In this context, UNFC provides a framework for comparing raw materials projects across the spectrum from exploration to extraction, processing, and recycling. Significant emphasis is placed on the overall socio-environmental acceptability of the project as well as its stage of technical development. This type of approach is similar to the approach used in the petroleum sector where the Petroleum Resource Management System (PRMS) was developed for managing portfolios of projects at different stages of development (SPE, 2018). This more project focused approach is emphasised in the latest version of UNFC (UNECE, 2019).

As noted above, the emphasis of UNFC has evolved over time from a volume-focused approach to a project-focused approach and this can cause confusion when interpreting the instructions and guidance contained in it. Users of this Bridging Document are advised to keep in mind the purpose for which a UNFC classification is being prepared in order to facilitate its application. In all cases the principle that the UNFC Classes, as defined by a specific 3-digit code, are unique and non-overlapping should be taken into account. The reporting of multiple estimates for the same volume is not allowed so as to avoid double-counting of materials in mineral inventories. UNFC allows for the reporting of

aggregated estimates from different classes, provided that the classes that have been aggregated and the methodology used are disclosed.

IV. COMPETENCY AND QUALIFICATION REQUIREMENTS

Decisions makers such as investors, financial institutions, government departments and company managers need to base their decisions on reliable information. When using information generated by either of the CRIRSCO and UNFC systems, key considerations that need to be accounted for are the identity, qualification and experience of the individual(s) who are responsible for the collection and assessment of data; the models and assumptions used as the basis for estimates of mineral product quantities; and the classification of such estimates. To address such concerns both systems have developed specific rules and guidance as discussed below.

CRIRSCO-aligned reporting

The principle of Competency has been embedded in the CRIRSCO Template aligned systems since their initial development. The CRIRSCO Template includes requirements which are designed to ensure proper accountability in minerals reporting with the individuals involved and therefore the companies being accountable for the information provided to investors.

All of the CRIRSCO Template aligned systems are required to include a definition of a **Competent Person (CP)**. This can be modified from the definition provided in the CRIRSCO Template to allow for reference to the specific relevant national or regional reporting organisation but the primary elements are common to all of the CRIRSCO Template aligned reporting codes and standards.

The definition of a Competent Person includes two separate elements, as illustrated below:

1. **Qualification requirement:** *A Competent Person is a minerals industry professional, who is a [National Reporting Organisation (NRO) to insert appropriate membership class and name of Professional Organisation (PO)] or other Recognised Professional Organisations (RPOs) with enforceable disciplinary processes including the powers to suspend or expel a member;*
2. **Experience requirement:** *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. (CRIRSCO, 2019).*

To comply with the requirements of the CRIRSCO Template, a person who prepares information to be used as the basis for a **Public Report** assumes responsibility for such information and is identified as the CP who provided the information on which the report is based and their name and qualifications must be provided in the report. Thus the CP must be prepared to be held accountable if it is determined that they provided false or misleading information or failed to disclose identified uncertainties and risks which could have a material effect on reported estimates and forecast project outcomes.

When a **Public Report** is released by a minerals company the CRIRSCO Template requires that the CP, and the professional organisation of which they are a member, be named and that the CP confirms that they have consented to the release of the report and that it accurately reflects the original information which they provided to the company. Users of **Public Reports** who consider that they have been misled or misinformed can complain about the CP to their professional organisation so that the organisation's complaint procedures can be initiated and disciplinary action taken if considered necessary.

UNFC classification

As UNFC applies to a much wider range of industry sectors, the situation is slightly different as a wider diversity of people may be involved in preparing UNFC classifications. Government organisations may be both the producers and the users of such information. Much of the information may be intended for internal strategic planning purposes rather than for public release.

Nevertheless, UNECE has recognised that given the important nature of the information contained in a UNFC classification of product estimates for a project, such work should be performed by suitably qualified and experienced personnel. The Competency Working Group of the UNECE's Expert Group on Resource Management prepared a Guidance Note on Competency Requirements for the Estimation, Classification and Management of Resources (UNECE, 2022) which was presented to the thirteenth session of the Expert Group on Resource Management in April 2022 and subsequently updated in October 2022.

The guidance note is written in a 'resource neutral' manner (i.e. non-sector specific) and includes, amongst others, the following definitions:

- **Professional Organisation:** *a self-regulatory professional association or statutory body (e.g., government authority) that admits individuals on the basis of their academic qualifications, experience, and ethical fitness; requires compliance with the professional standards of competence and ethics established by the organisation; requires or encourages continuing professional development; and has and applies disciplinary powers, including the power to suspend or expel individuals*
- **Qualified Assessment:** *a formal report pertaining to the estimated quantities and/or value of resources made by a Qualified Expert, that should include, but not be limited to, sources and adequacy and reliability of the underlying data, assumptions made and limitations, the qualifications and experience of the author(s) or those responsible for signoff*
- **Qualified Expert:** *an independent person with education, training, and relevant professional experience in a discipline pertinent to a resource, acting in compliance with the professional standards of competence and ethics established by his/her Professional Organization. This person is responsible for the standards and methodologies used for collecting, analysing, and verifying information used in a Qualified Assessment. (UNECE, 2022).*

UNECE's guidance note on competency requirements clearly parallels the rules and requirements developed under the CRIRSCO framework. The UNECE guidelines have been adapted to align with other resource sectors. Clause 9 of the guidance note recommends that in the process of making estimates and values for a resource, the work of the Qualified Expert "should be done in accordance with any relevant national or international reporting standard, where such standard exists for the resources sector in question".

For the application of the Bridging Document the following approaches are recommended:

- To map estimates from CRIRSCO to UNFC, based on information contained in a report prepared by a CRIRSCO CP, it should be assumed that the requirements of the Qualified Expert are equivalent to those needed for CRIRSCO compliance, subject to the following considerations being satisfied:
 - That the CP has familiarised themselves with UNFC and the CRIRSCO Template to UNFC Bridging Document and is satisfied that they have sufficient experience to carry out the mapping; and
 - That the independence and objectivity requirements are satisfied. In this instance 'independence' should be interpreted as meaning that the CP does not have a potential

conflict of interest in relation to the purposes for which the UNFC classification is being prepared.

- To report on the procedures used to map a CRIRSCO estimate to UNFC, based on a CRIRSCO estimate contained in a Competent Person's Report (CPR) or equivalent document, a separate detailed report is generally not required. Provided that the same Competent Person has prepared, or directed the preparation of, the mapping of the CRIRSCO estimates to UNFC, and is prepared to take responsibility for this, then the procedure used and the results of the CRIRSCO to UNFC mapping could be presented in a separate sub-section or appendix which is added to the relevant CPR or equivalent document. Alternatively these details could be provided in a separate standalone document signed off by the Competent Person.

V. MAPPING CRIRSCO TEMPLATE TO THE UNFC CATEGORIES AND SUB-CATEGORIES

A. Minerals Project

In the supplementary specifications for the application of UNFC to minerals (UNECE, 2021), a minerals project is defined as follows:

A minerals project is a defined development or operation which provides the basis for environmental, social, economic, and technical evaluation and decision making. A minerals project produces mineral products from a mineral source with defined frame conditions, which provide the basis for environmental-socio-economic evaluation and decision-making.

A minerals project comprises a defined activity or set of activities, which provide the basis for estimating environmental-socio-economic viability including costs and potential revenues associated with its implementation.

The CRIRSCO Template is designed to guide mineral companies in the reporting of Exploration Targets, Exploration Results, Mineral Resources, and Mineral Reserves for the purposes of informing investors, potential investors, their advisors, and other stakeholders. As such, CRIRSCO Template-compliant reporting will sometimes cover all of a company's mineral assets (e.g., in a company's annual report) and on other occasions it may relate to a specific mineral property owned by the company corresponding with a mining operation or a project still under development (e.g., when reporting the results of Technical Studies on a property such as a Scoping Study, Pre-Feasibility Study or Feasibility Study). Although the term 'project' is mentioned frequently in the CRIRSCO Template the term is not specifically defined in it.

B. Generalised overall mapping

1. Geological Confidence (CRIRSCO Y-axis)

In the CRIRSCO Template terminology a **Mineral Resource** is a concentration or occurrence of solid material of economic interest in or on the Earth's crust in such form, grade or quality and quantity that there are reasonable prospects for eventual economic extraction. The location, quantity, grade or quality, continuity and other geological characteristics of a Mineral Resource are known, estimated or interpreted from specific geological evidence and knowledge, including sampling. Mineral Resources are subdivided, in order of increasing geological confidence into Inferred, Indicated and Measured categories (CRIRSCO, 2019).

In the CRIRSCO Template, as illustrated in Figure III.1, Mineral Resources are subdivided, in order of increasing geological confidence into Inferred, Indicated and Measured categories. These categories

correspond with the G3 (low level of confidence), G2 (moderate level of confidence) and G1 (high level of confidence) Categories in UNFC, respectively.

Although there is broad level of correlation between the CRIRSCO Template Y-axis (level of geological confidence) and the UNFC G axis this is tempered by the need to consider the confidence level of the Modifying Factors. In the case where one or more of the Modifying Factors has a lower confidence than the level of geological confidence then the value assigned to the UNFC G axis should be assigned a lower confidence Category in order to reflect the lower level of confidence in the estimate.

2. Modifying Factors (CRIRSCO X-axis)

As defined in the CRIRSCO Template, **Modifying Factors** are considerations used to convert Mineral Resources to Mineral Reserves. These include, but are not restricted to, mining, processing, metallurgical, infrastructure, economic, marketing, legal, environmental, social, and governmental factors. Mineral Reserves can only be estimated using the Indicated and Measured Mineral Resource categories which are defined as those portions 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 either:

- mine planning and evaluation of the economic viability of the deposit (Indicated Mineral Resource), or
- detailed mine planning and final evaluation of the economic viability of the deposit (Measured Mineral Resource).

The CRIRSCO Template does not provide specific guidance on the levels of confidence required for Indicated and Measured Mineral Resource estimates, however, widely accepted practice is that Indicated Mineral Resources should allow forecasting of annual production increments within acceptable tolerance limits and that Measured Mineral Resources should allow forecasting of quarterly or monthly production increments within similar tolerance limits.²

Given that the Modifying Factors used in the CRIRSCO Template include both technological and socio-economic elements, when mapping CRIRSCO estimates to UNFC, it will normally be assumed that the numeric values assigned to the E and F codes will be identical.

3. Standard Mapping

The standard mapping for estimates obtained from CRIRSCO Template aligned reports for different study types is provided in Table V.1.

The following important points should be considered when using Table V.1:

- Mineral Reserves are based on estimates derived from a life of mine plan (as developed for an operating mine, or as the outcome of a Pre-Feasibility or Feasibility Study), which includes the design of extraction volumes and preparation of an annual production schedule and should only comprise the economically mineable portions of Measured and Indicated Mineral Resources. The results of the accompanying studies should demonstrate that, at the time of reporting, the extraction of such material is reasonably justified. Whilst Inferred Mineral Resources may be included in a Life of Mine Plan, such material cannot be reported as Mineral Reserves, and the economic viability of reported Mineral Reserves must be established without the inclusion of such material (see Clause 8.22 in CRIRSCO, 2019).

² For instance, Parker and Dohm (2014) proposed tolerance limits of $\pm 15\%$ at a 90% confidence level.

- In order to avoid double counting estimates of mineralised material from the same minerals project which are assigned to different classes, UNFC requires that such estimates should be non-overlapping. To adhere to this requirement when mapping estimates obtained from CRIRSCO Template aligned reports on Life of Mine Plans (for operating mines), Feasibility Studies or Pre-Feasibility Studies which include estimates of both Mineral Reserves and Mineral Resources, users must only use estimates for Mineral Resources reported as exclusive of Mineral Reserves when mapping such estimates to UNFC
- In situations where both Mineral Reserves and Mineral Resources have been reported for a project, and where the Mineral Resources have only been reported as inclusive of Mineral Reserves, then these Mineral Resource estimates should not be mapped to UNFC as it would result in double counting of product quantities for that particular project.

Table V.1
Standard mapping of CRIRSCO Template aligned estimates to UNFC Categories

CRIRSCO Template		Corresponding UNFC Category ^c	UNFC Class	
Public Report and Study Types ^a	Standard Definitions			
Feasibility Study or Life of Mine Plan ^b (for an operating mine)	Mineral Reserves — Proved	E1 F1	G1 G2	Viable Projects
	— Probable			
Pre-feasibility Study ^d	Mineral Reserves — Proved	E2 F2	G1 G2	Potentially Viable Projects
	— Probable			
Feasibility Study, Life of Mine Plan ^b (for an operating mine) or Pre-feasibility Study ^e	Mineral Resources (exclusive of Mineral Reserves) — Measured	E2 F2	G1	
	— Indicated		G2	
	— Inferred		G3	
Scoping Study report or other Public Report on a Mineral Resource estimate ^f	Mineral Resources — Measured	E2 F2	G1	
	— Indicated		G2	
	— Inferred		G3	
Public Report on exploration stage projects	Exploration Target	E3 F3	G4	Prospective Projects
	Exploration Results	Estimates not published		
Not applicable ^g	Estimates obtained from historical reports ^h		Non-viable Projects	

^a The use of a Life of Mine Plan on operating mines, as indicated below, only applies in cases where no material changes to the current operation are envisaged.

^b In cases where a Life of Mine Plan includes a proportion of Inferred Mineral Resources, and the estimated quantities of such material have been reported separately, then such material should be coded as E2F2G3.

^c These are the Categories which would normally be used for a study when the mapping is based on a current (or recently published) study. Where there have been material changes since the effective date of a report, or the study is otherwise no longer considered current, the assumptions used in the study should be reviewed in order to determine whether the results obtained are still valid and whether the E and F axis values need to be altered. For instance, where an operating mine has ceased operation, where mining licences have expired or been revoked, or where there have been material changes in costs of prices the mapping of Mineral Reserves from a Feasibility Study or Life of Mine Plan would be downrated from E1 to E2 and from F1 to F2.

^d Estimates included in a Life of Mine Plan which is potentially viable under current conditions.

^e Estimates of material not included in the Life of Mine Plan which could be economically extracted using reasonably assumed future conditions.

^f Estimates which are considered to have ‘reasonable prospects for eventual economic extraction’ under reasonably assumed future conditions.

^g CRIRSCO Template aligned reporting does not allow the Public Reporting of estimates on non-economic mineralisation.

^h Historical estimates will generally be downrated to E3 and F3, with the original G Categories being retained.

The mapping indicated in Table V.1 can provide an initial indication of the appropriate classification for a mineral product estimate that has been published in compliance with one of the CRIRSCO Template aligned Codes and Standards. Users should refer to the text below and subsequent sections of this document for detailed guidance on assigning the codes for the individual E, F and G axes of UNFC.

As indicated in Table III.1 the CRIRSCO Mineral Resource and Mineral Reserve confidence categories have a direct mapping to the G1 (high confidence), G2 (moderate confidence) and G3 (low confidence) UNFC values. The E and F Categories provided in Table III.1 specify minimum confidence categories for the UNFC Classes. For example, a Potentially Viable Project must be at least E2F2 but it could also be E1F2 or E2F1.

Step by step guidance on the mapping of estimates obtained from CRIRSCO Template aligned reports to UNFC is provided in sub-section H.

4. Simplified representation based on the E and F axes only

An alternative simplified representation of the mapping of CRIRSCO Mineral Reserves, Mineral Resources and Exploration Targets to the UNFC E and F axes and project categories is provided in Figure V.1. The Sub-categories of the UNFC E axis are described in sub-section C below.

Figure V.1
Simplified representation of the E-F matrix showing UNFC project classification with mapping to CRIRSCO categories

	F1	F2	F3	F4
E1				
E2				
E3.1				
E3.2				
E3.3				

LEGEND	UNFC	CRIRSCO
	Viable Projects	Mineral Reserves (based on a Feasibility Study or the Life of Mine Plan for an operating mine)
	Potentially Viable Projects	Mineral Reserves (based on a Pre-Feasibility study) or Mineral Resources (reported as exclusive of Mineral Reserves)
	Non-Viable Projects	Estimates cannot be publicly reported
	Prospective Projects	Exploration Targets (estimates must be reported as range of tonnages and a range of grades or quality)
	Not normally used	Estimates cannot be publicly reported

5. Other aspects

It should be noted that estimates for non-viable projects (as defined under UNFC) cannot be publicly reported in CRIRSCO Template aligned codes and standards. Estimates for prospective projects can only be reported as Exploration Targets.

All three of the CRIRSCO study types (Scoping, Pre-Feasibility and Feasibility) involve an assessment of the overall viability of a project, and as such they will correspond with a minimum of E2 and F2 (the project's environmental-socio-economic viability and/or technical feasibility has yet to be confirmed). The results of a CRIRSCO Template defined Scoping Study cannot be used as the basis for the estimation of Mineral Reserves, nor can such estimates be assigned to the E1 Category or the F1 Category.

The existence of an operating mine, or the completion of a positive Feasibility Study, is required in order to meet the requirements for viable projects (E1 and F1 where the project's environmental-socio-economic viability and technical feasibility have both been confirmed). Completion of a positive Pre-Feasibility Study allows Mineral Reserves to be reported, but this does not necessarily imply that the project is viable, merely that a potential development scenario has been defined which warrants further study at a Feasibility Study level in order to allow a final decision on project development and financing to be made. Whilst the engineering studies used to support the reporting of Mineral Reserves may be sufficient for assignments on the F axis, assignments on the E axis also need to account for the results of environmental and social impact studies, which are typically carried out concurrently to support project design work and applications for both mining licences and associated environmental permits. Following their separate assessment, the results of environmental and social assessment studies should be combined with the results of the economic assessment to define the appropriate Category for the UNFC E axis.

The CRIRSCO Template does not provide for further sub-division of the Categories shown in Figure III.1, but focuses instead on the different study types and the progression from Exploration Results to Mineral Resources to Mineral Reserves during the development of a specific project. There is a broad correspondence between the three study types defined in the CRIRSCO Template and the E and F axes and this is examined in more detail in later sections.

In the mapping of CRIRSCO-based estimates to UNFC, the Sub-category coding for the E and F axes should be determined by checking the documentation supporting the CRIRSCO estimates against the tables provided in Sections C and D below, respectively.

C. Detailed mapping of the E-axis

Mineral Resources are in situ estimates of mineralization which are used as the basis for the estimation of Mineral Reserves (i.e., they do not include any adjustments for mining dilution or losses). Nevertheless, when estimating Mineral Resources a preliminary judgement must be made on the Modifying Factors in order to confirm that the mineralisation included in the Mineral Resource estimate has reasonable prospects for eventual economic extraction. Portions of a mineral deposit with insufficient information to use as the basis for an estimate, or that do not have reasonable prospects for eventual economic extraction, must not be included in a Mineral Resource.

Technical Studies carried out to support the reporting of Mineral Reserves are required to include consideration of all the Modifying Factors in order to demonstrate that, at the time of reporting, the extraction of the estimated material is considered justified based on reasonably assumed conditions.

As illustrated in Table V.2, in CRIRSCO Template aligned reporting the results of an assessment of the prospects for economic extraction, including consideration of the Modifying Factors, can broadly be

considered to be similar to the assessment used for assigning a value on the E axis (Environmental-Socio-Economic Viability) under UNFC.

Table V.2

Specification of the UNFC E axis and corresponding CRIRSCO Template considerations

UNFC E axis: Environmental-Socio-Economic Viability (based on UNECE, 2021)			CRIRSCO Template considerations
Category	Definition	Supporting explanation	Prospects for eventual economic extraction / consideration of the Modifying Factors
E1	Development and operation are confirmed to be environmentally-socially economically viable.	Development and operation are environmentally-socially-economically viable on the basis of current conditions and realistic assumptions of future conditions. All necessary conditions have been met (including relevant permitting and contracts) or there are reasonable expectations that all necessary conditions will be met within a reasonable timeframe and there are no impediments to the delivery of the product to the user or market. Environmental-socio-economic viability is not affected by short-term adverse conditions provided that longer-term forecasts remain positive.	The reported estimates have confirmed prospects for economic extraction under currently realistic assumptions. This may be demonstrated by the results of a Feasibility Study or the Life of Mine Plan for an operating mine (where no material changes are envisaged) which include consideration of the design measures and costs associated with the social and environmental aspects of the project. The results of such studies should demonstrate that any necessary social and environmental requirements for the project could be met without affecting the overall economic viability of the project and that the project would yield a positive financial return on the capital investment (in the case of a development project) or a positive financial return on ongoing operating and sustaining capital costs (for a project that is currently in operation).
E2	Development and operation are expected to become environmentally, socially, and economically viable in the foreseeable future.	Development and operation are not yet confirmed to be environmentally-socially-economically viable but, on the basis of realistic assumptions of future conditions, there are reasonable prospects for environmental-socio-economic viability in the foreseeable future.	The reported estimates have reasonable prospects for eventual economic extraction based on a preliminary judgement with respect to reasonably assumed Modifying Factors (including ESG aspects). This should be based on the results of studies carried out at Pre-Feasibility or Scoping study levels. Such studies should identify any social and environmental requirements that would need to be met in order for the project to proceed and provide a reasonable expectation that these requirements could be satisfied.
E3	Development and operation are not expected to become environmentally, socially, nor economically viable in the foreseeable future or evaluation is at too early a stage to determine environmental-socioeconomic viability.	On the basis of realistic assumptions of future conditions, it is currently considered that there are not reasonable prospects for environmental-socio-economic viability in the foreseeable future; or the environmental-socio-economic viability cannot yet be determined due to insufficient information. Also included are estimates associated with projects that are forecast to be developed, but which will be unused or consumed in operations.	The reported estimates do not have reasonable prospects for eventual economic extraction based on an initial consideration of reasonably assumed Modifying Factors (including ESG aspects). This may be due to identified obstacles to project development (such as permitting restrictions, technical issues, environmental issues, etc.) or the lack of sufficient information to complete a reliable assessment.

Social and environmental aspects of a project are considered to be included in the Modifying Factors as defined in the CRIRSCO Template; and such aspects are mentioned several times in the guidance accompanying several of its clauses. Section 13 of the CRIRSCO Template specifically addresses the topic of Sustainability. Section 5.5 of the CRIRSCO Template ‘Checklist of assessment and reporting criteria’ (Table 1 in CRIRSCO, 2019) covers environmental and social aspects.

In order to determine the E-axis coding, users should check the commentary on these aspects which is included in supporting documentation accompanying the CRIRSCO-based estimate. Technical Reports prepared for Pre-Feasibility and Feasibility stage projects will normally include, or be accompanied by, environmental and social impact assessment (ESIA) studies. Technical studies at Scoping, Pre-Feasibility or Feasibility Study level should also include the results of financial modelling (at associated levels of confidence) that demonstrate the potential economic viability of a project.

The CRIRSCO Template ‘Guideline for Technical Studies’ (Table 2 in CRIRSCO, 2019) provides guidance on the approach which should be taken to assessing selected social, environmental, and economic aspects during the different study stages of a project. The details provided in accompanying Technical Reports should be considered when assigning the UNFC E-axis value.

Once the main coding for the E axis has been determined using Table V.2, users should refer to Table V.3 to determine the appropriate E-axis Sub-category to assign.

Table V.3
UNFC sub-divisions of the E-axis Categories (to be used in conjunction with Table V.2) (based on UNECE, 2019)

Category Definition	Category	Sub-category	Sub-Category Definition
Development and operation are confirmed to be environmentally-socially economically viable.	E1	E1.1	Development is environmentally-socially-economically viable on the basis of current conditions and realistic assumptions of future conditions.
		E1.2	Development is not environmentally-socially-economically viable on the basis of current conditions and realistic assumptions of future conditions, but is made viable through government subsidies and/or other considerations.
Development and operation are expected to become environmentally-socially-economically viable in the foreseeable future.	E2		No sub-categories defined.
Development and operation are not expected to become environmentally-socially-economically viable in the foreseeable future or evaluation is at too early a stage to determine environmental-socio-economic viability.	E3	E3.1	Estimate of product that is forecast to be developed, but which will be unused or consumed in operations.
		E3.2	Environmental-socio-economic viability cannot yet be determined due to insufficient information.
		E3.3	On the basis of realistic assumptions of future conditions, it is currently considered that there are not reasonable prospects for environmental-socio-economic viability in the foreseeable future.

D. Detailed mapping of the F axis

As illustrated in Table V.4, the CRIRSCO Study types correspond in broad terms as equivalents to the F-axis (Technical Feasibility and Maturity) of UNFC.

These three study types, namely: Scoping Study, Pre-Feasibility Study and Feasibility Study are typically completed in a sequential fashion during the development of a mineral project, and are defined as follows:

- **A Scoping Study**³ 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
- **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 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 (CRIRSCO, 2019).

In addition, the CRIRSCO Template also refers to a Life of Mine Plan (LoMP) which is defined as follows:

- *A design and financial/economic study of an existing operation in which appropriate assessments have been made of existing geological, mining, metallurgical, economic, marketing, legal, environmental, social, governmental, engineering, operational and all other Modifying Factors, which are considered in sufficient detail (to Pre-Feasibility level) to demonstrate that continued extraction is reasonably justified (CRIRSCO, 2019).*

A Life of Mine Plan (LoMP) of at least Pre-Feasibility level can be used to support the reporting of Mineral Reserve estimates in an operating mine where there is no significant capital expenditure required.

³ Sometimes referred to, and regarded as equivalent to, a Preliminary Economic Assessment (PEA)

Table V.4

Specification of the UNFC F axis and corresponding CRIRSCO Template considerations

UNFC F axis: Technical Feasibility and Maturity (based on UNECE, 2021)			CRIRSCO Template considerations
Category	Definition	Supporting explanation	Technical study type
F1	Technical feasibility of a development project has been confirmed.	Development or operation is currently taking place or, sufficiently detailed studies have been completed to demonstrate the technical feasibility of development and operation. A commitment to develop should have been or will be forthcoming from all parties associated with the project, including governments.	Feasibility Study or Operating Mine (Life of Mine Plan with no material changes to the operation). For CRIRSCO Template aligned reporting it is expected that the results of such studies should meet the requirements given for E1 in Table V.2.
F2	Technical feasibility of a development project is subject to further evaluation.	Preliminary studies of a defined project provide sufficient evidence of the potential for development and that further study is warranted. Further data acquisition and/or studies may be required to confirm the feasibility of development.	Pre-Feasibility Study or Scoping Study Report, or a Public Report on a Mineral Resource Estimate. For CRIRSCO Template aligned reporting it is expected that the results of such studies should meet the requirements given for E2 in Table V.2.
F3	Technical feasibility of a development project cannot be evaluated due to limited data.	Very preliminary studies of a project, indicate the need for further data acquisition or study in order to evaluate the potential feasibility of development.	A Public Report on Exploration Results which includes an estimate(s) of an Exploration Target(s).
F4	No development project has been identified.	Remaining quantities of product not developed by any project. These are quantities which, if produced, could be bought, sold or used.	A Public Report on an exploration opportunity which includes historical estimate(s) and/or estimates of Exploration Target(s).

Once the main coding for the F axis has been determined using Table V.4, users should refer to Table V.5 to determine the appropriate F-axis Sub-category to assign.

Table V.5

UNFC sub-divisions of the F-axis Categories (to be used in conjunction with Table V.4) (based on UNECE, 2019)

Category Definition	Category	Sub-category	Sub-Category Definition
Technical feasibility of a development project has been confirmed.	F1	F1.1	Production is currently taking place.
		F1.2	Capital funds have been committed and implementation of the development is underway.
		F1.3	Studies have been completed to demonstrate the technical feasibility of development and operation. There shall be a reasonable expectation that all necessary approvals and contracts for the project to proceed to development will be forthcoming.
Technical feasibility of a development project is subject to further evaluation.	F2	F2.1	Project activities are ongoing to justify development in the foreseeable future.
		F2.2	Project activities are on hold and/or where justification as a development may be subject to significant delay.
		F2.3	There are no plans to develop or to acquire additional data at the current time due to limited potential.
Technical feasibility of a development project cannot be evaluated due to limited data.	F3	F3.1	Site-specific studies have identified a potential development with sufficient confidence to warrant further testing.
		F3.2	Local studies indicate the potential for development in a specific area but requires more data acquisition and/or evaluation in order to have sufficient confidence to warrant further testing.
		F3.3	At the earliest stage of studies, where favourable conditions for the potential development in an area may be inferred from regional studies.
No development project has been identified.	F4	F4.1	The technology necessary is under active development, following successful pilot studies, but has yet to be demonstrated to be technically feasible for this project.
		F4.2	The technology necessary is being researched, but no successful pilot studies have yet been completed.
		F4.3	The technology is not currently under research or development.

E. Detailed mapping of the G axis

The vertical axis of Figure III.1 (taken from the CRIRSCO Template) reflects the underlying level of geological knowledge and confidence and as such corresponds directly to the G axis (degree of confidence in the estimate) of UNFC. Where geological studies have been carried out and an estimate of the quantity of mineralization is possible (volume, tonnes, grade, quality, etc.), then classification takes place on the vertical axis of Figure III.1 on the basis of the level of detail of the studies and the degree of confidence in the geological interpretation and resource estimate. As illustrated in Table V.6, the confidence categories used for classifying estimates of CRIRSCO Mineral Resources and Mineral Reserves correspond broadly with the criteria used to assign values on the UNFC G axis.

Table V.6

Specification of the UNFC-G-axis and corresponding CRIRSCO Template considerations.

UNFC G axis: Degree of Confidence (based on UNECE, 2021)			CRIRSCO considerations
Category	Definition	Supporting explanation	Resource/Reserve confidence categories
G1	Product quantity associated with a project that can be estimated with a high level of confidence.		Corresponds with a Measured Resource or Proved Reserve category of confidence.
G2	Product quantity associated with a project that can be estimated with a moderate level of confidence.	Product quantity estimates may be categorized discretely as G1, G2 and/or G3 (along with the appropriate E and F Categories), based on the degree of confidence in the estimates (high, moderate, and low confidence, respectively) based on direct evidence.	Corresponds with an Indicated Resource or Probable Reserve category of confidence.
G3	Product quantity associated with a project that can be estimated with a low level of confidence.		Corresponds with an Inferred Resource category of confidence.
G4	Product quantity associated with a Prospective Project, estimated primarily on indirect evidence.	A Prospective Project is one where the existence of a developable product is based primarily on indirect evidence and has not yet been confirmed. Further data acquisition and evaluation would be required for confirmation. Where a single estimate is provided, it should be the expected outcome but, where possible, a full range of uncertainty should be calculated for the prospective project. In addition, it is recommended that the chance of success (probability) that the prospective project will progress to a Viable Project is assessed and documented.	Corresponds with the CRIRSCO Exploration Target which is a statement or estimate of exploration potential for a mineral deposit where there has been insufficient exploration to estimate Mineral Resources. Exploration Targets must be expressed as a range of quantity and quality.

NOTE:

For the G1, G2, G3 Categories, UNFC provides the additional guidance reproduced below.

“Alternatively, product quantity estimates may be categorized as a range of uncertainty as reflected by either (i) three specific deterministic scenarios (low, best, and high cases) or (ii) a probabilistic analysis from which three outcomes (P90, P50 and P10) are selected. In both methodologies (the “scenario” and “probabilistic” approaches), the estimates are then classified on the G axis as G1, G1+G2 and G1+G2+G3 respectively.

In all cases, the product quantity estimates are those associated with a project.

Additional Comments:

The G-axis Categories are intended to reflect all significant uncertainties (e.g., source uncertainty, geologic uncertainty, facility efficiency uncertainty, etc.) impacting the estimate forecast for the project. Uncertainties include variability, intermittency and the efficiency of the development and operation (where relevant). Typically, the various uncertainties will combine to provide a full range of outcomes. In such cases, categorization should reflect three scenarios or outcomes that are equivalent to G1, G1+G2 and G1+G2+G3.” (UNECE, 2019).

This type of approach is not used in the solid minerals sector where different approaches to probabilistic estimates are used.

Sub-categories of the G axis are only provided for the G4 Category, as shown in Table V.7.

Table V.7

**UNFC sub-divisions of the G-axis Categories (to be used in conjunction with Table V.6)
(based on UNECE, 2019)**

Category	Category	Sub-category	Sub-Category Definition
Product quantity associated with a Prospective Project, estimated primarily on indirect evidence.	G4	G4.1	Low estimate of the quantities.
		G4.2	Incremental amount to G4.1 such that G4.1+G4.2 equates to a best estimate of the quantities.
		G4.3	Incremental amount to G4.1+G4.2 such that G4.1+G4.2+G4.3 equates to a high estimate of the quantities.

F. Exploration Target

An **Exploration Target** is a statement or estimate of the exploration potential of a mineral deposit in a defined geological setting where the statement or estimate, quoted as a range of tonnes and a range of grade or quality, relates to mineralisation for which there has been insufficient exploration to estimate Mineral Resources (CRIRSCO, 2019).

An Exploration Target is normally mapped to 334 in UNFC. The confidence level associated with estimates of Exploration Targets is considered to be less than the confidence level for estimates of an Inferred Mineral Resource and hence Exploration Targets are mapped to the G4 confidence category. In cases where Exploration Targets are based on brownfield projects for which historical data and estimates exist, other aspects might need to be considered (see Section G).

When converting an estimate of an Exploration Target to UNFC, it is recommended that the following procedure is used.

For an Exploration Target expressed as:

- Estimated tonnage ranging from T_{min} to T_{max}
- Estimate grade ranging from G_{min} to G_{max} (expressed as a percentage, grammes per tonne or parts per million).⁴

The following estimates of contained product quantities can be obtained:

- Minimum estimated contained product quantity: $Q_{min} = T_{min} * G_{min}$
- Maximum estimated contained product quantity: $Q_{max} = T_{max} * G_{max}$
- Average estimated contained product quantity: $Q_{av} = 0.5 * (Q_{min} + Q_{max})$.

The following UNFC classification would then be reported

- UNFC Category: E3F3G4
- Estimated product quantity: Q_{av} .

⁴ It may not be possible to handle qualities expressed using other types of measurement using this approach.

In cases where publicly reported Exploration Targets are based on historical estimates or non-CRIRSCO compliant estimates (e.g. reported under the Former Soviet Union reporting systems or other standards) the use of alternative UNFC coding may be justified.

G. Additional considerations

1. Exploration Results

Exploration Results include data and information generated by exploration programmes, but which are not part of a formal declaration of Mineral Resources and Mineral Reserves. Exploration Results emanate from the early stages of exploration when the quantity of data available is generally not sufficient to allow any reasonable estimates of tonnage and grade or quality to be made. Consequently, they do not have an equivalent in UNFC.

Apart from estimates of Exploration Targets, as discussed in the previous section, reports on Exploration Results should not include estimates of product quantities and, hence, they cannot be assigned a UNFC classification code. Spatially located information contained in such reports may be of interest to capture in government databases of mineral occurrences or drillhole data.

2. Reference Point

When assigning UNFC codes to CRIRSCO Template aligned estimates, one important aspect that needs to be considered is the reference point of the estimate. UNFC specifies the reference point as a “defined location within a development at which the reported estimate or measurement is made” and requires that it “shall be disclosed in conjunction with the classification”. The reference point “may be the sales, transfer or use point from the development or it may be an intermediate stage, in which case the reported quantities account for losses prior to but not subsequent to the delivery point.” Consequently, when preparing mineral information databases using UNFC classifications, it is important that details of the reference point are captured together with the estimates and their associated UNFC categories.

Under CRIRSCO Template aligned reporting, estimates of Mineral Resources are typically reported as estimates of in situ volumes of material, which may sometimes include a certain amount of internal dilution which is unlikely to be separated during extraction. Hence the corresponding reference point would be ‘in situ’ or ‘in place’. Estimates of Mineral Reserves are defined with respect to a specified reference point, “usually the point where the ore is delivered to the processing plant”, which must be stated in the accompanying report. In all situations where the Mineral Reserves reference point is not the point of delivery to the processing plant, such as for estimates of the amounts of a saleable product that can be delivered to customers, this must be explained in an accompanying clarifying statement so as to ensure that the reader is fully informed as to what is being reported. The reference point(s) as specified in the relevant CRIRSCO Template aligned reports should be recorded together with the UNFC classification(s) obtained during the mapping exercise.

3. Mineral Inventory

Where adequate geological studies have been carried out but a preliminary judgement on all the Modifying Factors indicates that a project is not viable in the foreseeable future (i.e., it does not have “reasonable prospects for eventual economic extraction”), the mineralization is classified as

“inventory” and is not converted to a Mineral Resource.⁵ “Inventory” is not a defined term in the CRIRSCO Template, and such quantities may not be disclosed in a Public Report (as defined in the CRIRSCO Template), but for other purposes would generally be classified as follows in UNFC:

- E3F2 (Sub-categories E3.3, F2.3) where the quantities are technically recoverable but are not expected to become environmentally-socially-economically viable in the foreseeable future,
- E3F2 (Sub-categories E3.2, F2.2) where the quantities are technically recoverable but where economically viability cannot yet be determined due to insufficient information, or
- E3F4 (Sub-category E3.3) where no technically viable development project or mining operation can be identified.

Classifications of “inventory” should be reviewed periodically to determine whether the classifications should be altered to take account of changes in environmental, social or economic criteria and assumptions.

4. Mineral Resources

In UNFC, a Mineral Resource estimate will generally be classified as 221, 222 or 223. Optionally, it may be sub-classified on the F-axis into F2.1 or F2.2 (see Table V.5). In some cases, a Mineral Resource estimate could correspond to 121, 122 or 123, where there is no doubt regarding environmental-socio-economic viability, or 211, 212 or 213 (Sub-category F1.3) where there is no doubt concerning technical feasibility but there are doubts about the environmental-socio-economic viability. (Note that these combinations do not change the UNFC Class, which would remain as a Potentially Viable Project, as shown in Figure III.2.)

5. Mineral Resources – Reporting as Inclusive or Exclusive of Mineral Reserves:

It should be noted that in UNFC, estimates in classes such as 221 are always exclusive of other classes, such as 111, so as to avoid double-counting of quantities (tonnages or volumes). Where classes are aggregated, this must be documented explicitly (e.g., 111 + 221).⁶

The CRIRSCO Template allows for both Mineral Resources and Mineral Reserves to be reported for a project at the same time. Such reports must include a statement which clearly indicates whether the Mineral Resources are inclusive of, or exclusive of (i.e. additional to), the Mineral Reserves. In order to prevent aggregation of estimates based on fundamentally different assumptions, and possible double accounting in situations where Mineral Resources are reported as inclusive of Mineral Reserves, the CRIRSCO Template specifies that Mineral Reserve estimates must not be added to Mineral Resource estimates to report a single combined figure. When assigning UNFC codes to such estimates, only the estimates for Mineral Resources reported exclusive of Mineral Reserves should be used in order to avoid double counting of the estimated volumes.

⁵ For more discussion regarding what constitute “reasonable prospects for eventual economic extraction” in the context of different solid mineral commodities, refer to the discussion on Mineral Resources in the CRIRSCO Template.

⁶ Under the CRIRSCO rules, for Public Reporting, aggregation of Mineral Resources and Mineral Reserves is not permitted. Reporting of aggregated total Mineral Resources or total Mineral Reserves is only permitted provided that the estimates for the individual confidence categories are also reported at the same time.

6. Mineral Reserves

Mineral Reserves are generally quoted as the product of mining activities which are delivered to a process plant (specified as tonnages or volumes with average grades or quality values). For some commodities (e.g., coal) Mineral Reserves are quoted as saleable product (specified as a tonnage and average quality values). UNFC is based on classifying the products of resource projects and, as such, in cases where further processing is required to produce a saleable product, the recovery or yield factors should be provided. In such cases estimates of run of mine Mineral Reserves deliverable to a processing plant, must be adjusted by the appropriate mineral processing, metallurgical recovery and moisture adjustment factors to estimate the mineral product quantities for the 'point of sale' reference point.

Provided that all the Modifying Factors are satisfied, Indicated Resources can be converted to Probable Reserves. Similarly, Measured Resources are usually converted to Proved Reserves, but may be converted to Probable Reserves if the confidence in any of the Modifying Factors is less than the geological confidence. Inferred Resources must not be converted to a Mineral Reserve (see Figure III.1).

7. Effective Date

Both UNFC and the CRIRSCO Template have a requirement for the Effective Date to be stated when any estimate of quantities is published. When applying the Bridging document, it would normally be expected that the Effective Date of both estimates would be the same. Should this not be the case, then an assessment would need to be carried out in order to determine whether any new information (e.g., changes in costs and prices, changes in permitting status) has become available subsequent to the original Effective Date which could have significantly changed the estimate as at the Effective Date. Should this have occurred then the likely effect that such new information would have on the previously reported estimate must be included in the report.

8. Historical estimates

The term historical (or historic) estimate is not used in the CRIRSCO Template, however, where the term is used in the context of stock exchange reporting it is generally taken to refer to estimates of Mineral Resources or Mineral Reserves that were made by a previous owner or operator of a mineral property and which have not yet been verified by the present owner or operator in accordance with the requirements of the CRIRSCO Template. The term can also be used to refer to estimates in historical reports about a mineral project which is currently not being actively explored.

Any such information relating to an historical estimate must be expressed so that it cannot be misrepresented or misconstrued as a current estimate of a Mineral Resource or Mineral Reserve. To comply with the CRIRSCO Template requirements, historical estimates should not be included in economic studies that are used in a Public Report on a current project.

When applying the Bridging Document, the unverified historical estimates will generally be downrated to E3 and F3, with the original G Categories being retained (see Table V.1).

9. Closed, closing or uneconomic mining operations

In situations where a mining operation is nearing the end of its planned life or has been put on prolonged care and maintenance due to adverse economic or operating circumstances, the mapping of published Mineral Resources and Mineral Reserves may need to be revised accordingly.

Where a planned mine closure is underway, a company will be mining out the remaining Mineral Reserves and not converting any additional Mineral Resources into Mineral Reserves. Once the mine closes and enters a closure monitoring phase, such material would no longer satisfy the requirements for RPEEE and would represent non-viable quantities which should be classified as E3.3; F2.3; G1, G2 or G3. During the period where a mine is transitioning to closure, or is on prolonged care and maintenance, the project would be classified as E3.2; F2.2. Subsequently, if it is decided to investigate a closed mine with a new development concept, the project might be classified as F2.1 or F3.1.

H. Step by Step Process for Mapping from the CRIRSCO Template to UNFC

When using this Bridging Document to obtain a UNFC classification to accompany a report on a mineral project which has been assessed and reported on in compliance with a CRIRSCO Template aligned code or standard, it is recommended that the following procedures are used.

In all cases where estimates of Exploration Targets, Mineral Resources or Mineral Reserves have been mapped to UNFC, the following information should be determined and included in the documentation accompanying the UNFC coded estimates:

- The name and date of the CRIRSCO Template aligned code or standard under which the original estimate was reported
- The name and credentials of the Qualified Expert who prepared the UNFC classification report
- The version of the Bridging Document which was used as a reference when determining the UNFC coding
- The version of UNFC which was used
- The effective date for the estimate (see additional comments below)
- The product that was estimated and the reference point used when the estimate was made
- Details of the Public Report(s) from which the CRIRSCO-based estimates have been obtained, and the name of the Competent Person(s) who prepared such Public Reports and associated documentation
- Key economic assumptions used in assessing the CRIRSCO-based estimates, including aspects such as mineral product prices, reporting cut-off grades, product specifications, etc...

For a report which includes estimates of Mineral Reserves:

- Use the mappings shown in Table V.1 to obtain an initial indication of the relevant UNFC values to be assigned
- Use Table V.6 to verify the categories to be used for the G axis
- Then apply the following steps to determine whether any adjustments are required to the main E and F Categories and to assign appropriate Sub-category values:
 - Use Table V.2 to verify the main Category to be used for the E axis
 - Use Table V.3 to assign the appropriate Sub-category to be used for the E axis
 - Use Table V.4 to verify the main Category to be used for the F axis
 - Use Table V.5 to assign the appropriate Sub-category to be used for the F axis.

For a report which includes estimates of Mineral Resources:

- Before assigning a UNFC coding to a Mineral Resource estimate, it is necessary to check that this will not result in duplication of estimates for volumes that are being reported as Mineral Reserves at the same time. Where UNFC classification codes are being assigned to both Mineral Reserves and Mineral Resources for the same project, then it is necessary to ensure that the Mineral Resources have been reported as 'exclusive of Mineral Reserves' (i.e., the Mineral Resources represent quantities (tonnages or volumes) which have not been included in the mine plan used to estimate the Mineral Reserves). This is necessary in order to avoid potential double-counting of mineral product quantities in mineral inventory databases which are based on the UNFC codes
- In situations where both Mineral Reserves and Mineral Resources have been reported for a project, and where the Mineral Resources have only been reported as inclusive of Mineral Reserves, then these Mineral Resource estimates should not be mapped to UNFC as it would result in double counting of product quantities for that particular project. Instead a note should be added to the project record to indicate that additional product quantities may be present but have not been quantified separately
- Use the mapping shown in Table V.1 to obtain an initial indication of the relevant UNFC values to be assigned to the Mineral Resources
- Use Table V.6 to verify the Categories to be used for the G axis
- Then apply the following steps to determine whether any adjustments are required to the main E and F Categories and to assign appropriate Sub-category values:
 - Use Table V.2 to verify the main Category to be used for the E axis
 - Use Table V.3 to assign the appropriate Sub-category to be used for the E axis
 - Use Table V.4 to verify the main Category to be used for the F axis
 - Use Table V.5 to assign the appropriate Sub-category to be used for the F axis.

For a report which includes estimates of Exploration Targets:

- These will normally be assigned a UNFC coding 334 using the procedure outlined in subsection F.
- Users should review Table V.2, Table V.4 and Table V.6 to determine whether any adjustment to the code 334 is required

For a report with details of Exploration Results:

- Such reports should not include estimates of product quantities (other than estimates of Exploration Targets) and hence they should not be assigned a UNFC classification. Spatially located information contained in such reports may be of interest to capture in government databases of mineral occurrences or drillhole data

On completion of the steps outlined above, users should review the UNFC values obtained in order to ensure that no adjustments need to be made to account for other factors. For instance:

- Where more than 2-3 years have elapsed since the effective date for the original estimate to which a classification was assigned using the steps outlined above, the classification should be reviewed in order to determine whether any material changes have occurred since that date (e.g., an operating mine closing, revoking of a mineral permit, or dramatic commodity

price changes, etc.). In such cases, it may be necessary to adjust the E and F categories that are assigned.

- In cases where one or more of the Modifying Factors has a lower confidence that the level of geological confidence then the value assigned to the UNFC G axis should be downgraded to a lower confidence Category in order to reflect the lower level of confidence in the estimate.

VI. MAPPING UNFC TO THE CRIRSCO TEMPLATE

A. General considerations

Reporting based on the CRIRSCO principles of transparency, materiality, and competency enables stakeholders to assess the risks associated with minerals projects. All the national and regional CRIRSCO Template aligned reporting codes and standards use the CRIRSCO definitions for Mineral Resources and Mineral Reserves and their sub-categories. The use of common definitions and standards ensures transparent reporting of mineral deposit estimates and exploration progress in a consistent manner.

To maintain the confidence of investors in the reported information, all CRIRSCO Template aligned codes and standards require that the information on which the public disclosures are based must be prepared by, or under the supervision of a suitably qualified minerals industry professional(s) who has (have) relevant and up to date experience of the type of deposit and activity being carried out. Such individuals are termed Competent Persons (CPs)⁷, as defined in the CRIRSCO Template. The legislation and regulations governing market disclosure in most jurisdictions normally require that the CPs (or QPs) involved should take responsibility for the information that is disclosed so that they can be held accountable should such information be found to be false or misleading.

The competency requirement outlined above is a key element of the CRIRSCO Template, however the specific requirements to act as a Competent Person are determined by each individual CRIRSCO member (National Reporting Organisation or NRO) as specified in a list of Recognised Professional Organisations (RPOs). Consequently, conversion of a UNFC estimate into a CRIRSCO-compliant estimate is not straightforward since it would need to consider the requirements of a specific CRIRSCO Template aligned code or standard.

B. Reporting UNFC estimates using CRIRSCO terminology

Despite the comments made above, it is recognised that in certain circumstances it may be useful to refer to information based on UNFC coding using the definitions provided in the CRIRSCO Template. For instance, this may apply where a governmental or intergovernmental organisation wishes to report data from mineral inventories using the widely recognised CRIRSCO terminology. In such cases the mapping indicated in Table VI.1 should be used.

UNFC-coded estimates should not be converted to CRIRSCO Exploration Targets as this would require the aggregation of results with very different levels of associated uncertainty and would risk misleading users of such information.

It is important to note that for estimates relating to individual mineral projects, a specific reporting code or standard should always be used for reporting purposes to ensure that users properly understand the basis on which such estimates have been prepared.

⁷ Referred to as Qualified Persons (QPs) in some jurisdictions.

Table VI.1

Simplified mapping of UNFC coded estimates to the CRIRSCO Template (only to be used for the reporting of mineral inventory data using CRIRSCO terminology)

UNFC code	Type of study on which the estimates are based	CRIRSCO category
111	Life of Mine Plan or Feasibility Study (estimates included in a life of mine plan which is viable under current conditions)	Proved Mineral Reserve
112		Probable Mineral Reserve
211		Measured Mineral Resource
212		Indicated Mineral Resource
213		Inferred Mineral Resource
221 + 121	Pre-Feasibility Study (estimates included in a life of mine plan which is potentially viable under current conditions)	Proved Mineral Reserve
222 + 122		Probable Mineral Reserve
223 + 123		Inferred Mineral Resource
221 + 121	Pre-Feasibility Study or Scoping Study report or a Public Report on a Mineral Resource estimate (estimates which are considered to be economically extractable under reasonably assumed conditions)	Measured Mineral Resource
222 + 122		Indicated Mineral Resource
223 + 123		Inferred Mineral Resource

NOTES:

- 1 In all cases the estimates in different UNFC Classes for an individual mineral project should not overlap, such that the derived CRIRSCO categories of Mineral Resources would be considered to be reported exclusive of Mineral Reserves.
- 2 The mappings indicated above should only be used for the purposes of reporting information from mineral inventory databases. In cases where such data are based on aggregated information from multiple projects, the proportions of the estimates in each category that are derived from CRIRSCO Template aligned codes or standards should be stated.
- 3 Results of Mineral Reserves and Mineral Resources should not be aggregated together.
- 4 Where total Mineral Reserves or total Mineral Resources are reported, the amounts allocated to each individual confidence category should also be reported.
- 5 In cases where the results of a CRIRSCO Pre-Feasibility Study have been used when reporting estimates of Mineral Reserves, they will be coded as 221 or 222 thus overlapping with the mapping assigned to Mineral Resources based on CRIRSCO studies. In such cases care should be taken to ensure that the appropriate CRIRSCO categories are applied in order to avoid accidentally 'uprating' or 'downrating' the reported estimates.

C. Reporting a UNFC estimate in compliance with a CRIRSCO code or standard

As indicated above, reporting of a UNFC estimate in compliance with a CRIRSCO Template aligned code or standard cannot be done solely using the mappings presented in Table V.1, Table VI.1 and elsewhere in this document. Should it be required to publicly report an estimate prepared under UNFC in compliance with a CRIRSCO code or standard, the following additional aspects must be considered:

- **Objective:** The reason why it is necessary to report the UNFC estimate in compliance with a CRIRSCO Template aligned code or standard should be clarified in order to confirm that this is actually necessary. Since the two systems are complementary, this type of mapping may involve unnecessary duplication of effort and consideration should be given as to whether it may be possible, and more effective, to use the two systems in parallel
- **Relevant legislation and regulations:** A specific CRIRSCO code or standard which is recognised by the relevant government legislation or stock exchange regulations must be selected (e.g., the JORC Code, PERC Reporting Standard, NI 43-101 legislation, the SAMREC Code, etc.)

- **Competent Person (CP)⁸ requirement:** A minerals industry professional(s) who has a qualification that is recognised by the relevant legislation, regulations and reporting code or standard would need to be identified. This person will need to have sufficient relevant experience for the type of deposit and the activity being undertaken. They will also need to be prepared to provide their consent to the public report based on their work and by doing so will accept responsibility for the information which they have provided and may be held accountable if the report proves to contain information that is found to be false or misleading. The CP requirements vary according to the CRIRSCO Template aligned code or standard to be used and differ from the requirements for a Qualified Expert as defined by UNECE (UNECE, 2022) and the terms cannot be regarded as being synonymous.
- **Technical Report requirement:** For the initial announcement of a material estimate on a mineral property (e.g., initial Mineral Resource estimate, results of a scoping (Preliminary Economic Assessment (PEA)) study, initial Mineral Reserve estimate, etc) or a material change in a previously reported estimate, the release of an accompanying Competent Person's Report (CPR) or other specific forms of internal documentation and/or public reporting may be required. A CPR is a technical report which summarises the information and assumptions on which the reported estimates are based, and also discusses any material uncertainties in a clear and transparent information. A CPR is intended to provide sufficient information for an investor, potential investor, and their advisors to enable them to compare the risks and uncertainties associated with alternative investment opportunities
- **Supporting information:** In preparing a CPR, the Competent Person(s) should, as a minimum, consider all of the aspects within the checklist provided in Table 1 of the CRIRSCO Template (or the corresponding Table in the relevant CRIRSCO Template aligned code or standards in compliance with which the UNFC estimate is to be reported). Comments on the Table 1 checklist items should be included in the supporting documents prepared by the CP to support the preparation of the CPR
- **Types of estimates that can be reported:** In order to minimise the possibility of misleading investors, reporting in compliance with CRIRSCO Template aligned codes and standards does not allow the reporting of estimates for non-viable projects. Estimates for prospective projects where the prospects for economic extraction have not yet been assessed to the level required for reporting of Mineral Resources or Mineral Reserves, can only be reported as Exploration Targets and must be presented as a range of quantities and qualities to indicate the associated uncertainty.

VII. References

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⁸ Referred to as Qualified Persons (QPs) in some CRIRSCO Template aligned codes and standards.

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VIII. Appendix I: Key features of the CRIRSCO Template and UNFC

Category	Item	CRIRSCO	UNFC
Governance	Competency requirement	Competent Person (CP) is a defined term and all public reports must be prepared by or under the supervision of a CP.	A requirement for UNFC estimates to be prepared by a Qualified Expert was recently introduced (UNECE, 2022).
	Accountability	A CP must consent to the release of a public report based on supporting information which they have prepared (or supervised the preparation of). CPs must belong to a professional association which has a code of conduct/ethics and a disciplinary process which includes the power to suspend or expel a member.	The Qualified Expert is required to include a statement of their qualifications and expertise in any reports containing resources information. The Qualified Expert is required to be a member of a professional association with a code of conduct or ethics.
	Sanctions	If responsible for a false or misleading public report a CP would be in breach of their association's code of conduct and could be subject to its disciplinary process. In the case of stock exchange listed companies, this may also be a breach of legislation or regulations which could result in court action being taken against the company concerned as well as the CP.	If responsible for a false or misleading report which caused problems for others a Qualified Expert would be in breach of their association's code of conduct and could be subject to its disciplinary process.
Mineral Inventory	Reporting	Whilst sub-economic material is commonly estimated in mineral resource models, such material cannot be publicly reported.	Estimates of sub-economic material can be reported.
	Avoiding double counting	Where Mineral Resources are reported inclusive of Mineral Reserves, these will duplicate the volumes covered by the Mineral Reserves. For conversion to UNFC only Mineral Resources reported exclusive of Mineral Reserves should be used.	For a given minerals project all codes are considered to represent different (non-overlapping) volumes of material.
	Quantities reported	Mineral Resources are reported as in-situ grades/qualities without the application of recovery factors. Mineral Reserves are commonly reported as estimates of material that is deliverable to a processing plant.	Quantities are reported at "a mineral reference point" which may be the point of sale, use or transfer of the mineral project (UNECE, 2021)
Project classification	Categories	Six main terms are used, namely: two categories of Mineral Reserves; three categories of Mineral Resources, and Exploration Targets.	There are potentially at least 48 Categories, based on 3 values for E, 4 values for F, and 4 values for G. However, in practice many of the possible combinations would not be used. Additional Categories may result from reporting of aggregates of the Categories based on unique E, F and G values.

Category	Item	CRIRSCO	UNFC
	Granularity	No further sub-division of Mineral Resources or Mineral Reserves is provided, however, additional information about a mineral project is derived from the level of technical study that has been completed.	Sub-categories are provided; with up to 3 potential Sub-categories on the G axis, up to 12 potential Sub-categories on the F axis and up to 6 potential Sub-categories on the E axis.
Uncertainty (risk)	Communication	The Mineral Resource and Mineral Reserve sub-categories provide an indication of uncertainty. Projects evolve from the lowest uncertainty Exploration Target through Inferred Resources to Measured Resources and then Probable Mineral Reserves to Proved Mineral Reserves (greatest certainty).	The numeric codes provide an indication of certainty, with projects evolving from the highest value (334) reflecting the lowest certainty to the lowest values (111) reflecting the highest certainty.
	Assessment	The Table 1 checklist provides a basis for assessing potential sources of uncertainty.	General guidance is provided for assigning the specific category codes.
Other features	Reporting of probabilistic estimates	Probabilistic estimates are often made but not reported directly. The results obtained from such estimates can be used to support the selection of the Mineral Resource and Mineral Reserve categories.	The G10, G50, G90 type approach used in the petroleum sector can also be applied when using UNFC. This approach is not used in the minerals sector.
	Effective date	The effective date of a Mineral Resource or Mineral Reserve statement must be provided.	The Effective Date of the evaluation shall be clearly stated in conjunction with the estimate.
	Project timeline	This is not reported directly but is considered when developing the production schedule and financial model for a project.	This is not considered explicitly but would be taken into account when determining the project viability.
	Comparison of investment opportunities	Financial indicators such as net present value (NPV), internal rate of return (IRR), payback period, etc. which are reported for technical studies can be used.	The UNFC coding can be applied to projects from other sectors (e.g., recycling, waste processing) to allow them to be compared with minerals projects.

IX. Appendix II: Terminology

A. Abbreviations and acronyms used

A list of abbreviations and acronyms used in this report is provided in the table below:

Abbreviation or Acronym used	Description
CMMI	Council of Mining and Metallurgical Institutions
CP	Competent Person
CPR	Competent Person's Report
CRIRSCO	Committee for Mineral Reserves International Reporting Standards
CRIRSCO Template	Refers to the 2019 version of the CRIRSCO International Reporting Template (CRIRSCO, 2019)
CRMA	Critical Raw Materials Act
EC	European Commission
ECOSOC	United Nations Economic and Social Council
EGRC	Expert Group on Resource Classification
EGRM	Expert Group on Resource Management
ESG	Environmental, Social, and Governance
ESIA	Environmental and Social Impact Assessment
EU	European Union
IRR	internal rate of return
JORC	Joint Ore Reserves Committee
JORC Code	Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves
LoMP	Life of Mine Plan
NI 43-101	National Instrument 43-101 legislation on Standards of Disclosure for Mineral Projects
NPV	net present value
NRO	National Reporting Organisation
PEA	Preliminary Economic Assessment
PRMS	Petroleum Resource Management System
QP	Qualified Person
RPEEE	reasonable prospects for eventual economic extraction
RPO	Recognised Professional Organisation
UN	United Nations
UNECE	United Nations Economic Commission for Europe
UNFC	United Nations Framework Classification for Resources
UNFC-1997	United Nations Framework Classification for Reserves and Resources of Solid Fuels and Mineral Commodities
UNFC-2004	United Nations Framework Classification for Fossil Energy and Mineral Resources 2004
UNFC-2009	United Nations Framework Classification for Fossil Energy and Mineral Reserves and Resources 2009
UNFC	United Nations Framework Classification for Resources

Glossary of terms

In order to avoid the possibility of introducing inconsistent definitions of terms, a separate glossary has not been prepared for this document. Users who wish to have more information about specific terms related to UNFC or the CRIRSCO Template should refer to the following documents for more information.

1. The CRIRSCO Template: APPENDIX 1 – GENERIC TERMS AND EQUIVALENTS

This provides a table with a list of generic terms plus related synonyms or similar terms, and a description of their intended generalised meanings. This is contained in the following reference.

- CRIRSCO (2019) International Reporting Template for the Public Reporting of Exploration Targets, Exploration Results, Mineral Resources and Mineral Reserves. Available at: <https://crirSCO.com/the-international-reporting-template/>

2. UNFC-2019: ANNEX I – GLOSSARY OF TERMS

This provides a table with a list of terms and their definitions. This is contained in the following reference.

- UNECE (2019) United Nations Framework Classification for Resources Update 2019 (UNFC-2019). Available at: https://unece.org/DAM/energy/se/pdfs/UNFC/publ/UNFC_ES61_Update_2019.pdf

3. UNFC-2021 Mineral Specifications: Section IX – GLOSSARY OF TERMS

This provides a table with a list of terms and their definitions. The table includes the terms given in UNFC (2019) (see previous reference) plus additional terms used in the mineral specifications document. This is contained in the following reference.

- UNECE (2021) Supplementary Specifications for the Application of the United Nations Framework Classification for Resources to Minerals. Available at: https://unece.org/sites/default/files/2021-09/ECE_ENERGY_2021_23_UNFC_MineralsSpecs.pdf

