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**Decision support: Development and deployment of the United Nations Framework Classification for Resources:
Applications: Minerals**

Bridging Document between the Committee for Mineral Reserves International Reporting Standards Template and the United Nations Framework Classification for Resources*

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

* Based on the Committee for Mineral Reserves International Reporting Standards (CRIRSCO) Template November 2019 version and the United Nations Framework Classification for Resources (UNFC) 2019.



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I. Introduction

1. 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 the Expert Group on Resource Management as a UNFC Aligned System for use in classifying estimates for minerals projects. This document outlines 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 to in the text as the “CRIRSCO-UNFC Bridging Document”.

2. The previous version of this Bridging Document explained the relationship with UNFC-2009 using the UNFC-2009 Numerical Codes. Since its publication, the most recent version of UNFC (UNFC (2019)) has substantially updated UNFC-2009 which incorporates Specifications for its Application (United Nations Economic Commission for Europe (ECE) Energy Series 42 and ECE/ENERGY/94). The revision of UNFC was required for the application of UNFC to extend the system to renewable energy, injection projects for geological storage and anthropogenic resources.

3. CRIRSCO, currently known as the Committee for Mineral Reserves International Reporting Standards, was formed in 1994 and has grown from five member organisations to an association representing fifteen national reporting organisations (NROs).¹ In 2006, CRIRSCO published an agreed-to set of Standard Definitions in the CRIRSCO International Reporting Template (the “CRIRSCO Template”), which was most recently revised 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 includes standard definitions of common terms that are used in all 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 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.

4. The use of 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. The CRIRSCO Template aligned reporting codes and standards focus on the detailed requirements for Market-listed mineral companies to substantiate the conclusions of their activities transparently 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 those assessments. Unless constrained by regulation, the application of the Bridging Document shall not limit the use of the full granularity of UNFC (2019).

5. 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

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

the estimates. Likewise the value assigned to the G axis of UNFC is used to communicate the degree of confidence in the estimate.

6. Since their initial releases, both UNFC and the CRIRSCO Template have included updated information. Additionally, the national reporting codes and standards aligned to the CRIRSCO Template may also be updated periodically and may not necessarily be aligned with the most recent version of the CRIRSCO Template. Relevant information concerning 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 have been used. Reference to the following documents should be made for further information:

- The CRIRSCO Template (CRIRSCO, 2019)
- UNFC Principles and Generic Specifications
- UNFC Supplementary Specifications for Minerals (UNECE, 2021)
- UNFC guidelines as appropriate.

II. Overview of system contents

A. The CRIRSCO Template

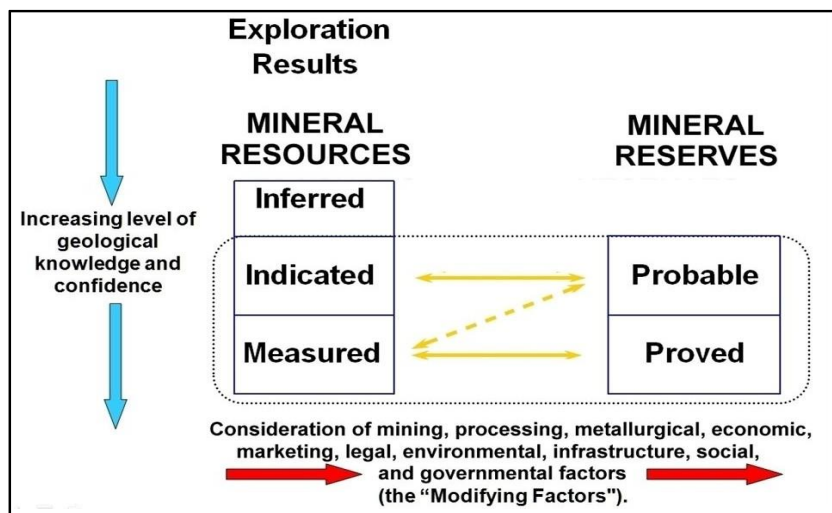
7. The term ‘CRIRSCO Template’ as used in this document refers to the 2019 version of the CRIRSCO International Reporting Template for the public reporting of Exploration Targets, Exploration Results, Mineral Resources and Mineral Reserves (CRIRSCO, 2019). The principles of the CRIRSCO Template can be applied 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. The CRIRSCO Template applies to all mineral deposit types of solid minerals, including anthropogenic deposits such as stockpiles, dumps, and tailings storage facilities.

8. 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 current mineral projects with economic potential and operating mines. It does not allow for disclosure of estimates of quantities of non-economic mineralisation. 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.

9. The relationships between some of the key terms used in the CRIRSCO Template are shown in diagrammatic form in Figure I.

Figure I

General Relationships between Exploration Results, Mineral Resources and Mineral Reserves, as set out in the CRIRSCO Template (CRIRSCO, 2019)



10. The CRIRSCO Template includes sixteen Standard Definitions that provide consistent terminology across the individual national or regional reporting codes and standards. In addition to the nine terms shown in Figure I, 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*.

11. **Modifying Factors** are considerations which must be accounted for when converting *Mineral Resources* to *Mineral Reserves* and, as indicated in Figure I, they include mining, processing, metallurgical, infrastructure, economic, marketing, legal, environmental, social, and governmental factors. Preliminary consideration of the **Modifying Factors** is necessary to confirm that mineralisation included in a *Mineral Resource* estimate has reasonable prospects for eventual economic extraction (RPEEE) based on the relevant **Modifying Factors**.

12. 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.

B. The United Nations Framework Classification for Resources

13. 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. UNFC provides a consistent framework to describe the level of confidence in estimates of the future quantities to be produced by such projects. Sector-specific guidance has been developed for resource sectors where well-established methodologies and systems for project assessment and the estimation of future production potential exist. Users should refer to the "Supplementary Specifications for the Application of the United Nations Framework Classification for Resources to Minerals" (UNECE, 2021) for additional information.

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

- **Environmental-socio-economic viability (E)** 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)** indicates the maturity of technology, studies and commitments necessary to implement the project. This allows the coding of projects ranging from early conceptual studies through to fully developed projects that are producing, reflecting 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.

15. Categories (e.g. E1, E2, E3) and, in some cases, Sub-categories (e.g. E1.1) are defined for each of these three criteria. Using combinations of the Sub-categories for each Category, a high level of detail (granularity) is provided.

16. 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.

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

Figure II
Diagrammatic representation of the UNFC classification (from UNECE, 2019)

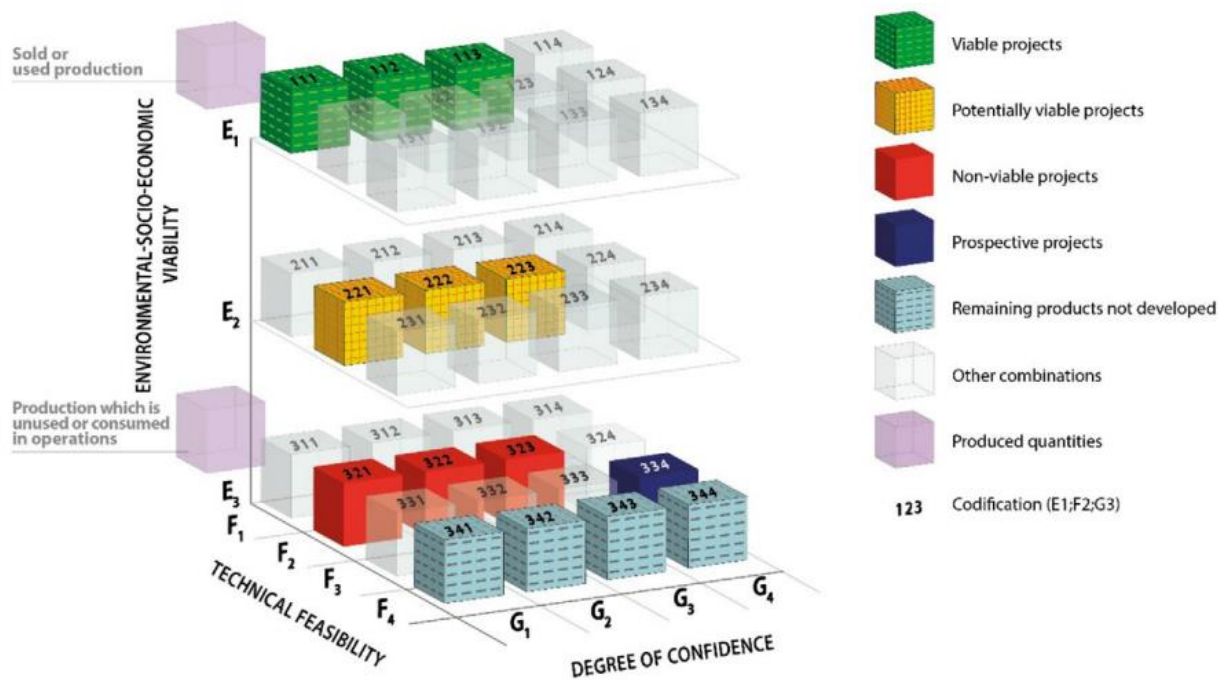


Table 1
UNFC Classes, Sub-Classes, Categories and Sub-Categories (from UNECE, 2021)

<i>UNFC Classes Defined by Categories and Sub-categories</i>							
Produced	Sold or used production						
	Production which is unused or consumed in operations						
	Class	Sub-class	Categories				
			E	F	G		
Total Products	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	
			Remaining products not developed from identified projects	3.3	4	1, 2, 3	
	Potential Sources		Prospective Projects	[No Sub-classes defined]	3.2	3	4
				Remaining products not developed from prospective projects	3.3	4	4

^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.

18. 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 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 versions of UNFC
- **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 (UNFC (2019)).

19. The reporting of multiple estimates for the same volume of ground is not allowed 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.

C. Competency and Qualification requirements

20. 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. ECE has recognised that, such work should be performed by suitably qualified and experienced personnel, as outlined in the 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.

21. Reporting under all codes and standards which are based on the CRIRSCO Template include a requirement that all such reports should be based on work done by, or under the supervision of a **Competent Person** (CP). A CP is a minerals industry professional(s) who has a qualification that is recognised by the relevant legislation, regulations and reporting code or standard that apply. The CP needs to have sufficient relevant experience for the type of deposit and the activity being undertaken. The CP also needs to be prepared to provide their consent to the release of 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 the UNECE (UNECE, 2022) and the terms cannot be regarded as being synonymous.

22. For the application of the CRIRSCO-UNFC Bridging Document:

- To map estimates from the CRIRSCO Template to UNFC, based on information contained in a report prepared by a CRIRSCO Competent Person (CP), the following considerations need to be satisfied:
 - The CP has familiarised themselves with UNFC and the CRIRSCO-UNFC Bridging Document and is satisfied that they have sufficient experience to carry out the mapping; and
 - The independence and objectivity requirements are satisfied, meaning that the CP does not have a potential conflict of interest concerning 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 CP 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. Alternatively these details could be provided in a separate standalone document signed off by the CP.

III. Mapping the CRIRSCO Template to the UNFC Categories and Sub-categories

A. Minerals Project

23. 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.

24. Although the term ‘project’ is mentioned frequently in the CRIRSCO Template the term is not specifically defined.

B. Generalised overall mapping

1. Geological Confidence (CRIRSCO Y-Axis)

25. 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. As illustrated in Figure I, 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.

26. Although there is a correlation between the CRIRSCO Template Y-Axis and the UNFC G Axis there is a need to consider the confidence level of the Modifying Factors. In situations where a Modifying Factor has a confidence lower than the level of geological confidence then the value assigned to the UNFC G Axis should be assigned a lower confidence Category.

2. Modifying Factors (CRIRSCO X-Axis)

27. As defined in the CRIRSCO Template, **Modifying Factors** are considerations used to convert Mineral Resources to Mineral Reserves. These include 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).

28. 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

29. The standard mapping for estimates in CRIRSCO Template aligned reports for different study types is provided in

Table 2, with the following caveats:

- 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
- 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 the UNFC as it would result in double counting of product quantities for that particular project.

30. As indicated in Table 2, 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 2 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.

Table 2
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	Viable Projects	
		Probable			G2		
Pre-feasibility Study ^d	Mineral Reserves	Proved	E2	F2	G1	Potentially Viable Projects	
		Probable			G2		
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 such material has 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.

4. Other aspects

31. 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 (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.

32. The existence of an operating mine, or the completion of a positive Feasibility Study, is required 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, merely meaning that a potential development scenario has been defined that warrants further study at a Feasibility Study level.

C. Detailed mapping of the E axis

33. When estimating Mineral Resources judgement must be made on the Modifying Factors to ensure that the mineralisation in the estimate has reasonable prospects for eventual economic extraction. Portions of a mineral deposit with insufficient information, or that do not have reasonable prospects for eventual economic extraction, must not be included in a Mineral Resource. Social and environmental aspects of a project are considered to be included in the Modifying Factors. All Modifying Factors must be considered to demonstrate that, at the time of reporting, the extraction of the estimated material is considered justified based on reasonably assumed conditions.

34. As illustrated in Table 3, in CRIRSCO Template aligned reporting the results of an assessment of the prospects for economic extraction, including consideration of the Modifying Factors, is similar to the assessment used for assigning a value on the E axis (Environmental-Socio-Economic Viability) under UNFC.

Table 3

Specification of the UNFC E axis and corresponding CRIRSCO Template consideration

<i>UNFC E axis: Environmental-Socio-Economic Viability (based on UNECE, 2021)</i>		<i>CRIRSCO Template considerations</i>	
<i>Category</i>	<i>Definition</i>	<i>Supporting explanation</i>	<i>Prospects for eventual economic extraction / consideration of the Modifying Factors</i>
E1	Development and operation are confirmed to be environmentally-socially economically viable.	Development and operation are environmentally-socially-economically viable based on 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, based on realistic assumptions of future	The reported estimates have reasonable prospects for eventual economic extraction based on a preliminary judgement concerning reasonably assumed Modifying Factors (including Environmental, Social and Governance (ESG) aspects). This should be based on the results of studies carried out at

<i>UNFC E axis: Environmental-Socio-Economic Viability (based on UNECE, 2021)</i>			<i>CRIRSCO Template considerations</i>
<i>Category</i>	<i>Definition</i>	<i>Supporting explanation</i>	<i>Prospects for eventual economic extraction / consideration of the Modifying Factors</i>
		conditions, there are reasonable prospects for environmental-socio-economic viability in the foreseeable future.	Pre-Feasibility or Scoping study levels. Such studies should identify any social and environmental requirements that would need to be met 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, or economically viable in the foreseeable future or evaluation is at too early a stage to determine environmental-socio-economic viability.	Based on 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.

35. 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 include environmental and social impact assessment studies. Once the main coding for the E axis has been determined using Table 3 users should refer to descriptions of the E-axis Sub-categories given in UNFC to determine the appropriate E-axis Sub-category to assign.

D. Detailed mapping of the F axis

36. As illustrated in Table 4, the CRIRSCO Study types correspond in broad terms as equivalents to the F-axis Categories.

Table 4
Specification of the UNFC F axis and corresponding CRIRSCO Template considerations

<i>UNFC F axis: Technical Feasibility and Maturity (based on UNECE, 2021)</i>			<i>CRIRSCO Template considerations</i>
<i>Category</i>	<i>Definition</i>	<i>Supporting explanation</i>	<i>Technical study type</i>
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 3.

<i>UNFC F axis: Technical Feasibility and Maturity (based on UNECE, 2021)</i>			<i>CRIRSCO Template considerations</i>
<i>Category</i>	<i>Definition</i>	<i>Supporting explanation</i>	<i>Technical study type</i>
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 3.
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 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).

37. The three CRIRSCO study types are typically completed successively during the development of a mineral project, and are defined as follows:

- A **Scoping Study** (or Preliminary Economic Assessment) *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).*

38. In addition, the CRIRSCO Template defines a Life of Mine Plan (LoMP) as:

- *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 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.

39. Once the main coding for the F axis has been determined using Table 4, users should refer to descriptions of the F-axis Sub-categories provided in UNFC to determine the appropriate F-axis Sub-category to assign.

E. Detailed mapping of the G axis

40. The vertical axis of Figure I (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) 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 I based on the level of detail of the studies and the degree of confidence in the geological interpretation and resource estimate as illustrated in Table 5.

Table 5
Specification of the UNFC G axis and corresponding CRIRSCO Template considerations

<i>UNFC G axis: Degree of Confidence (based on UNECE, 2021)</i>			<i>CRIRSCO considerations</i>
<i>Category</i>	<i>Definition</i>	<i>Supporting explanation</i>	<i>Resource/Reserve confidence categories</i>
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 estimated 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.

F. Exploration Target

41. 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.

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

43. 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).²

44. 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: $Q_{\text{av}} = 0.5 * (Q_{\min} + Q_{\max})$.

45. The following UNFC classification would then be reported:

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

G. Additional considerations

1. Exploration Results

46. **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 and 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. Mineral Inventory

47. 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

² It may not be possible to handle qualities expressed using other types of measurement using this approach.

mineralization is classified as “inventory” and is not converted to a Mineral Resource.³ “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 economic 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.

48. 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.

3. Mineral Resources – Reporting as Inclusive or Exclusive of Mineral Reserves

49. It should be noted that in UNFC, estimates in classes such as 221 are always exclusive of other classes, such as 111, to avoid double-counting of quantities (tonnages or volumes). Where classes are aggregated, this must be documented explicitly (e.g., 111 + 221).⁴

50. 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. When assigning UNFC codes to such estimates, only the estimates for Mineral Resources reported exclusive of Mineral Reserves should be used to avoid double counting of the estimated volumes.

4. Effective Date

51. Both UNFC and the CRIRSCO Template require 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 to determine whether any new information (e.g., changes in costs and prices, changes in permitting status) has become available after 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.

5. Historical estimates

52. 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 as following 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. 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

³ For more discussion regarding what constitutes “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.

⁴ 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.

Table 2).

IV. Concluding remarks

53. 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 inter-governmental organisation wishes to report aggregated data from mineral inventories using the widely recognised CRIRSCO terminology. It must be considered though that reporting based on the CRIRSCO principles of transparency, materiality, and competency enables stakeholders to assess the risks associated with minerals projects.

54. To maintain the confidence of investors in the reported information, all CRIRSCO Template aligned codes and standards require that when preparing the information on which the public disclosures are based the following aspects must be considered:

- **Objective:** The purpose of reporting a UNFC estimate in compliance with a CRIRSCO Template aligned code or standard should be clarified
- **Relevant legislation and regulations:** A specific CRIRSCO code or standard recognised by the relevant government legislation or stock exchange regulations must be selected (e.g., the Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves (JORC Code), the Pan European Reserves and Resources Reporting Committee (PERC) Reporting Standard, National Instrument (NI) 43-101 Standards of Disclosure for Mineral Projects, the South African Code for the Reporting of Exploration Results, Mineral Resources and Mineral Reserves (SAMREC Code), etc.)
- **Competent Person (CP)⁵ requirement:** A minerals industry professional(s) who has a qualification that is recognised by the relevant legislation, regulations and reporting code or standard is needed. Qualified Expert as defined by ECE (UNECE, 2022) may not be sufficient
- **Technical Report requirement:** The release of an accompanying Competent Person's Report (CPR) or public reporting may be required which summarises the information and assumptions on which the estimates are based and also discusses any material uncertainties as clear and transparent information. The Competent Person(s) should, as a minimum, consider the checklist provided in the CRIRSCO Template (Table 1 in CRIRSCO, 2019)
- **Types of estimates that can be reported:** CRIRSCO Template aligned codes and standards, do not allow the reporting of estimates for non-viable projects. Estimates for prospective projects can only be reported as Exploration Targets and must be presented as a range of quantities and qualities to indicate the associated uncertainty.

55. While these comments are suggested as a starting point, a more complete discussion can be found in the "Guidance Note on the use of the CRIRSCO Template-UNFC Bridging Document" (CRIRSCO and UNECE, 2024). 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.

⁵ Referred to as Qualified Persons (QPs) in some CRIRSCO Template aligned codes and standards.

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

The initial draft version of the updated Bridging Document formed the basis for the preparation of the “Guidance Note on the use of the CRIRSCO Template-UNFC Bridging Document” (CRIRSCO and UNECE, 2024) which is a longer more expansive document than this Bridging Document.

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