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Application of the United Nations Framework Classification for Resources and the United Nations Resource Management System in different geographical contexts**Draft Guidance for the Application of the United Nations Framework Classification for Resources for Mineral and Anthropogenic Resources in Europe****Prepared by members of the Expert Group on Resource Management***Summary*

This draft Guidance for the Application of the United Nations Framework Classification (UNFC) for Mineral and Anthropogenic Resources in Europe has been prepared to assist regional and national authorities to establish and maintain a project inventory of primary and secondary raw materials projects in Europe. The inventory will be based on UNFC and its application for mineral and anthropogenic resource projects. A UNFC-based inventory on reserves and resources will facilitate decision-making by stakeholders related to raw material stocks and flows in Europe. The inventory, in this case for mineral and anthropogenic resource projects, will be based on UNFC. UNFC offers clarity in capturing the technical feasibility and addressing the social and environmental issues to facilitate a project being developed and progressing to commerciality. The objective of the Guidance is to facilitate: (i) Regional European resource management: to enable and support coherent and consistent regional resource project classification and management policies and associated regulations at European level; (ii) National resource project management: to assist the development and implementation of sustainable resource management policies and regulations at a national level in Europe; (iii) Company internal business process innovation to enable companies in Europe to develop and adopt business processes that are sustainable, profitable, socially inclusive, environmentally responsible, and resilient; and, (iv) Financial reporting to enable capital allocators to assess the opportunities and risks that projects represent for climate and with respect to the other goals set for the activities as well as the opportunities and risks related to the physical and regulatory uncertainties that climate change and reforms represent for investors.

This draft Guidance was issued on the United Nations Economic Commission for Europe website for public consultation on 9 March 2022 for a period of ninety days.

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Executive Summary

This Guidance for the Application of the United Nations Framework Classification (UNFC) for Mineral and Anthropogenic Resources in Europe will assist regional and national authorities to establish and maintain a project inventory of primary and secondary raw materials projects in Europe. The inventory will be based on UNFC and its application for mineral and anthropogenic resource projects.

A UNFC-based inventory on reserves and resources will facilitate decision-making by stakeholders related to raw material stocks and flows in Europe. Reliable and relevant information on sources and products is important, if not critical, for decision-making at many levels, including:

- In the public sector: ranging from onsite, municipality, regional, country, or European level on aspects of the resource life cycle (prospection, exploration, operation development, production, closure, and remediation)
- In the economic sector: for management (planning, organization, leading and control) activities of the middle and higher management of all corporate levels (unit, company, corporation)
- In the finance sector: as the basis for making investment decisions while considering not only economic, but also environmental and social aspects
- In expertise/knowledge and education.

The jurisdictions (United Nations and all levels of government) need to set framework conditions to achieve desired goals of which the climate goals currently are dominating, but there are many others in the UN 2030 Agenda for Sustainable Development and other relevant agenda. The framework conditions need to be set in such a way that industries can deploy their best capabilities to achieve the goals in ways that the capital markets are in positions to finance. This defines the primary stakeholders as:

- (i) The UN, the European Commission and governments at all levels;
- (ii) Industries with relevant capabilities, including appropriate qualifications and capacity;
- (iii) Capital allocators.

They need to work in a partnership where the constraints and obligations of each party is respected. In addition, there will be secondary stakeholders, including academia, media and the public at large, who need to be well and correctly informed in order to develop the intellectual capability to create and introduce change while maintaining necessary consensus through reliable factual and science-based information.

This Guidance will facilitate implementation of UNFC-based inventories across Europe. The implementation should be carried out by skilled, competent experts and/or teams under the relevant country and/or regional network/International Centre of Excellence on Sustainable Resource Management, together with the UNFC structure which would assure quality and comparability.

This Guidance is one of the first steps on the path to full implementation of UNFC in Europe. The next steps that should be taken in parallel are proposed as follows:

- Increased of awareness, acceptance, and implementation of UNFC in relevant societal and economic structures
- Creation and strengthening of the expert community of UNFC practitioners
- Inclusion of the information of interest that is carried by the projects into the international, national, corporate, and financial accounts and statistics, and
- Adaptation of relevant quality and purpose assurance structures (UN, EC, Member States) to the growth of activities.

This document provides guidance for use of the UNFC Update 2019 and the Supplementary Specifications for the Application of the United Nations Framework Classification for Resources to Minerals (2021) and Specifications for the Application of the United Nations Framework Classification for Resources to Anthropogenic Resources (2018). In case of a conflict between those documents and this Guidance, the texts in UNFC (2019) and its Specifications shall prevail.

The structure of the Guidance consists of a short main text and a series of annexes. The annexes are related to the specifications, sectoral guidelines, and an extended glossary of common terms¹ found in or to be developed for UNFC and the United Nations Resource Management System (UNRMS).

¹ <https://unece.org/sed/documents/2022/02/session-documents/unfc-glossary-common-terms>

I. Introduction

1. The Guidance for the Application of the United Nations Framework Classification for Resources (UNFC) for Mineral and Anthropogenic Resources in Europe (UNFC for Europe Guidance) provides guidance on the use of UNFC (2019)² for mineral and anthropogenic resources in Europe.³
2. The objective of the Guidance is to facilitate:
 - Regional European resource management: To enable and support coherent and consistent regional resource project classification and management policies and associated regulations at European level
 - National resource project management: To assist the development and implementation of sustainable resource management policies and regulations at a national level in Europe
 - Company internal business process innovation: To enable companies in Europe to develop and adopt business processes that are sustainable, profitable, socially inclusive, environmentally responsible, and resilient
 - Financial reporting: To enable capital allocators to assess the opportunities and risks that projects represent for climate and with respect to the other goals set for the activities as well as the opportunities and risks related to the physical and regulatory uncertainties that climate change and reforms represent for investors.
3. This document should be read and applied in conjunction with the latest version of UNFC and its Generic Specifications (2019), and Specifications for Minerals (2021)⁴ and Anthropogenic Resources (2018).⁵
4. The guidance does not change the various regulatory requirements set by governments or accounting standard setters for reporting on extractive resource production-cycle activities but offers an opportunity to improve them.
5. This guidance is provided to facilitate an establishment and/or maintenance of a UNFC raw materials project-based inventory. The inventory should be updated annually/biannually by reporting in preferably a UNFC reporting scheme. Other reporting schemes and standards are needed by some applications and stakeholders. These shall preferably be generated from the UNFC inventories through the use appropriate of bridging documents. The national inventories would be the base for the European UNFC Inventory.
6. Mineral and Anthropogenic Resources Specifications for Europe are provided in Annex I, Mineral and Anthropogenic Resources Sectoral Guidelines for Europe are provided in Annex II, and an extended Glossary of Terms is provided in Annex III.

II. UNFC for Europe Guidance

7. UNFC is a tool to communicate the availability of resources and the maturity of projects to make use of these resources. The objective is achieved by providing generic principles and harmonized terminology for classifying these projects and potential projects and their associated resources. Deriving its vision from the global requirements, UNFC is designed as a system to facilitate the supply of energy and raw materials required for sustainable development. The emerging challenges in these sectors are the sustainable,

² <https://unece.org/sustainable-energy/publications/united-nations-framework-classification-resources-update-2019-ece>

³ This document provides guidelines for European Member States for which specific UNFC Guidelines do not exist. For Nordic countries (Finland, Norway and Sweden), this document could be used in conjunction with the existing guidelines (Guidance for the Application of UNFC for Mineral Resources in Finland, Norway and Sweden).

⁴ <https://unece.org/sites/default/files/2022-01/UNFC%20Mineral%20Specifications%202021.pdf>

⁵ https://unece.org/fileadmin/DAM/energy/se/pdfs/UNFC/Anthropogenic_Resources/UNFC_Antropogenic_Resource_Specifications.pdf

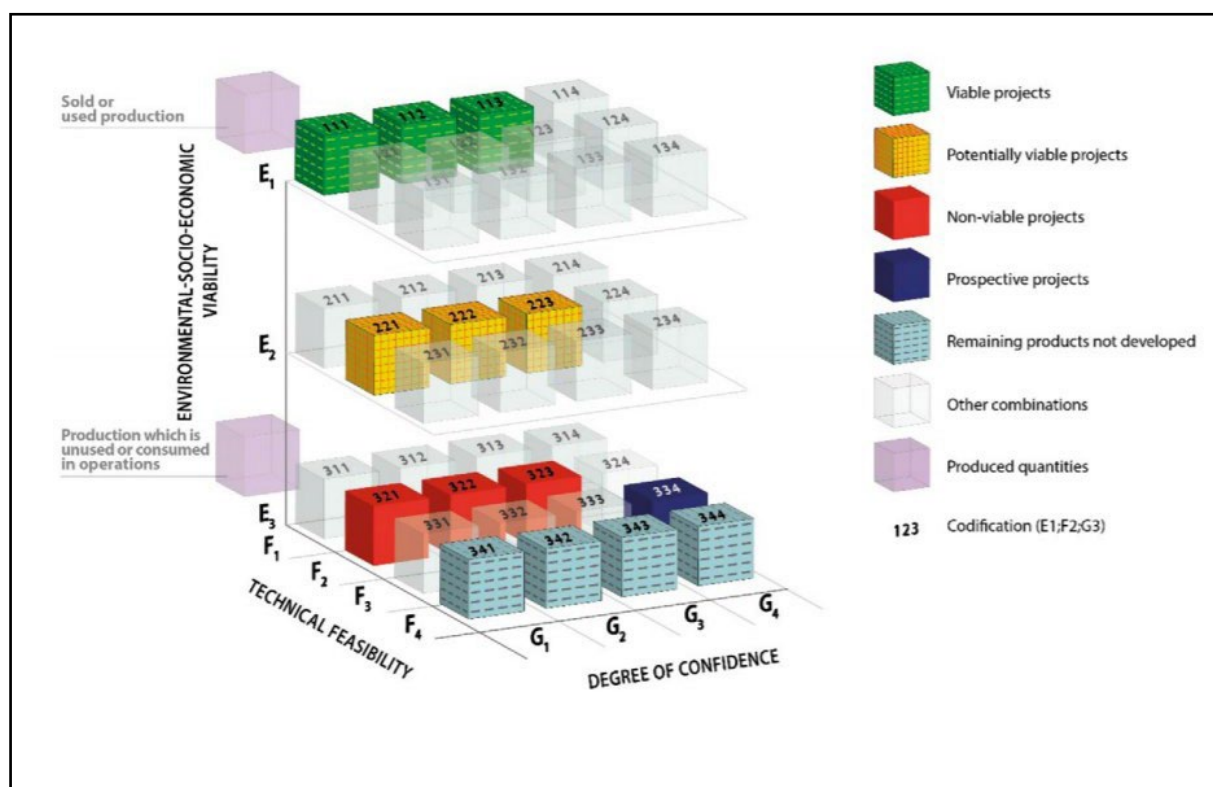
socially conscious, environmentally friendly, carbon neutral and efficient development and production of raw materials that are required for a growing population coming out of poverty on the planet.

8. UNFC is an internationally applicable scheme for the classification of energy and raw material resource projects at all stages of development, as well as national and regional level assessments, and is currently the only classification in the world to do so. 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 the projects and the ever-present uncertainties and is aligned to the requirements of the 2030 Agenda for Sustainable Development (2030 Agenda). 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.

9. UNFC is a generic principle-based system in which quantities are classified by the three fundamental criteria of

- Social, environmental, and economic viability (E)
- Field project status and feasibility (F), and
- General level of knowledge/confidence in the estimates (G).

Figure I
UNFC Categories and examples of Classes



10. European raw material inventories, both primary and secondary resources, can be reported in UNFC using the definitions and guidelines provided in this document. The definitions follow the UNFC (2019) definitions and generic specifications, and are aligned to various EU directives, tools, and guidelines. This document clarifies how UNFC Classes are linked to various EU instruments, such as INSPIRE.⁶ In addition, since UNFC is a classification of projects, other information of relevance to resource management decisions may be included in the inventory. This may be scalar quantities such as total costs, emissions,

⁶ <https://inspire.ec.europa.eu/inspire-directive/2>

employment etc. or vectors such as a time series of the same, as well as of production both for sale and not for sale.

11. UNFC inventories may be constructed both at the national level, considering 100% shares of the projects included, and at the entities level considering the metrics that their assets hold according to the legal rights that define the assets. This can be a proportionate share of the project metrics or more complex metrics defining the sharing of products, cash flows, obligations, rights etc.

12. The latest version of the UNFC Generic Specifications 2019 is applicable to all resources and it applies for overall application for inventories of sources and products.

A. UNFC for Europe Guidance - Terms and Definitions for Mineral and Anthropogenic Resources

13. **Minerals project plan and definition:** A minerals project is a defined development or operation which provides the basis for environmental, social, economic, and technical evaluation and decision-making. Minerals projects may include all stages of the mineral life cycle including:

- Prospecting/Exploration
- Mining
- Beneficiation
- Processing
- Decommissioning
- Remediation.

14. The minerals project plan may be detailed or conceptual (in the case of long-term national resource planning). Feasibility and design studies fall within three major categories of (i) order of magnitude (scoping), (ii) preliminary studies, and (iii) detailed studies. The minerals project plan should be sufficiently detailed to allow an appropriate assessment for the stakeholder needs at the defined level of maturity. The estimation of quantities shall be done in accordance with professional quality assured methods.

15. **Mining Project:** A mining 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 mineral project is comprised of a defined activity or set of activities, which provide the basis for estimating technical viability on the one hand (F-axis issues) and environmental-socio-economic viability, including costs and potential revenues associated with its implementation, on the other (E-axis issues).

16. **Viable projects:** Current or future recovery by viable mining operations. Viable Projects have been confirmed to be technically, social, environmental, and economically viable.

17. **In production** is used where the project is producing, and supplying one or more mineral products to market, at the Effective Date of the evaluation (E1F1.1):

- Quantities associated to a mine operating continuously (INSPIRE code list "operating continuously") should be classified as E1.1F1.1G1,2,3
- Quantities associated to a mine operating intermittently (INSPIRE code list "operating intermittently") should be classified as E1.1F1.1G1,2.⁷

⁷ In UNFC, it would be natural to distinguish between the F- and E-axis causes for intermittency. Technical issues could be climate or other factors such as subsidence, collisions, sabotage, fire etc. causing production to be disrupted. Depending on the seriousness and need for redevelopment decisions, this would cause the project to be reclassified to F2. Economic, social or environmental impairments could cause the project to be reclassified as E2, without necessarily introducing design or operational changes to the physical plant.

18. **Approved for Development** requires that all approvals/permits/contracts be in place, and capital funds have been committed (E1F1.2):

- Under construction (INSPIRE code list “under development”).

19. **Justified for development** requires that the project has been demonstrated to be technically feasible and viable, and there shall be a reasonable expectation that all necessary approvals/contracts for the project to proceed to development will be forthcoming (E1F1.3):

- Pending approval (INSPIRE code list “pending approval”).

20. **Potentially viable projects:** Potential future recovery by mining operations, where development is pending or on- hold.

21. **Development pending** is limited to those projects that are actively subject to project-specific technical activities, such as the acquisition of additional data (e.g., appraisal drilling) or the completion of feasibility studies and associated social, environmental, and economic analyses designed to confirm the viability including the determination of optimum development scenarios or mine plans. Also, the status may include projects that have non-technical contingencies, provided these contingencies are currently being actively pursued by the developers and are expected to be resolved positively within a reasonable period:

- Quantities associated with a detailed feasibility study (INSPIRE code “feasibility”) E1F2; E2F1; E2F2.1.

22. **Development on hold** is used where a project is considered to have at least a reasonable chance of achieving viability (i.e., there are reasonable prospects for eventual social, environmental, and economically viable production), but where there are currently major non-technical contingencies (e.g., environmental, or social issues) that need to be resolved before the project can move towards development:

- Quantities associated to a mine under care and maintenance (INSPIRE code list “care and maintenance”) should be classified as E1F2.2; E2F1; E2F2.2
- Quantities associated to a mine that can be kept unexploited until the price of contained commodity(ies) makes it economical (INSPIRE codes list “retention”) should be classified as E2F1; E2F2.2.

23. **Non-viable projects:** Potential future recovery by mining operations, but where development is uncertain, or development is currently assessed as not viable.

24. **Development unclarified** is appropriate for projects that are in the initial stages of technical and economic evaluation (e.g., a recent new discovery), and/or where significant further data acquisition is required, to make a meaningful assessment of the potential for an economic development (i.e., there is currently insufficient basis for concluding that there are reasonable prospects for eventual social, environmental, and economically viable production):

- E3.2F2.2 – Involves drilling activities to add additional recoverable quantities (INSPIRE code list “advanced exploration”)
- E3.2F2.2 – Indicates that initial recoverable quantities have been calculated (INSPIRE code list “resources definition”).

25. **Development not viable** is used where a technically feasible project can be identified, but it has been assessed as having the insufficient potential to warrant any further data acquisition activities or any direct efforts to remove economic impairments:

- Quantities associated to a mine closed for technical, economical, or techno-economic reasons (INSPIRE code list “closed”) should be classified as E3.3F2.3G1,2,3

Note: quantities in place without plans for recovery should be classified as F4E3.3F4G1,2,3

- Quantities associated to an abandoned mine (INSPIRE code list “abandoned”) should be classified as E3.3F2.3G1,2,3

- *Note:* quantities in place without plans for recovery should be classified as F4E3.3F4G1,2,3
- Quantities associated to an 'old' mine for which records are not of use (INSPIRE code list historic) should be classified as E3.3F2.3G1,2,3

Note: quantities in place without plans for recovery should be classified as F4E3.3F4G1,2,3.

26. **Exploration projects:** Potential future recovery by successful exploration activities. An Exploration Project is associated with one or more major occurrences, i.e., a deposit that has not yet been demonstrated to exist by direct evidence (e.g., drilling and/or sampling), but has been assessed primarily on indirect evidence (e.g., surface, or airborne geophysical measurements).

27. **Additional quantities in place:** Additional quantities in place associated with a known deposit that will not be recovered by any currently defined mining operation. Quantities should only be classified as additional quantities in place where no technically feasible projects have been identified that could lead to the production of any of these quantities.

Figure II
UNFC-2019 Classes and Sub-classes defined by Sub-categories. Mapping of INSPIRE and Technological Readiness Level (TRL)

UNFC Classes defined by Categories and Sub-categories						INSPIRE Code list	TRL (Relevant to F axis)	
Produced	Sold or used production							
	Production which is unused or consumed in operations <i>Future production that is either unused or consumed in the project operations is categorized as E3.1. These can exist for all classes of recoverable quantities^d</i>							
Class	Sub-class	Categories			INSPIRE Code list			TRL (Relevant to F axis)
		E	F	G ^a				
Total Products	Known Sources	<u>Viable Projects</u> <i>Estimates associated with Viable Projects are defined in many classification systems as Reserves, but there are some material differences between the specific definitions that are applied within different industries and hence the term is not used here.^d</i>	On Production	1	1.1	1, 2, (3) ^b	Operating Continuously Operating intermittently	9
			Approved for Development	1	1.2	1, 2, 3	Under development	8
			Justified for Development	1	1.3	1, 2, 3	Pending approval	5,6,7
		<u>Potentially Viable Projects</u> <i>Not all Potentially Viable Projects will be developed.^d</i>	Development Pending	2 ^c	2.1	1, 2, 3	Evaluation of Resources (Detailed Feasibility Study, Prefeasibility)	3,4
			Development On Hold	2	2.2	1, 2, 3	Care and maintenance Retention	
		<u>Non-Viable Projects</u> <i>Non-Viable Projects include those that are at an early stage of evaluation in addition to those that are considered unlikely to become viable developments within the foreseeable future.^d</i>	Development Unclassified	3.2	2.2	1, 2, 3	Assessment of Resources (Advanced exploration, Resources' definition, Prefeasibility, Scoping study(resources))	3,4
	Development Not Viable		3.3	2.3	1, 2, 3	Closed Abandoned Historic		
	<u>Remaining products not developed from identified projects</u> <i>Remaining products not developed from identified projects or prospective projects may become developable in the future as technological or environmental-socio-economic conditions change. Some or all of these estimates may never be developed due to physical and/or environmental-socio-economic constraints.^d</i>		3.3	4	1, 2, 3		1,2	
	Potential Sources	<u>Prospective Projects</u>		3,2	3,1	4	Subsurface exploration (Exploration Target Outline)	3,4
				3,2	3,2	4	Detailed surface exploration(Exploration)	3,4
				3,2	3,3	4	Regional reconnaissance (Grassroots)	3,4
		<u>Remaining products not developed from prospective projects</u>		3,3	4,1	4		2
3,3				4,2	4		1	
3,3				4,3	4			

^a G Categories may be used discretely, or in cumulative scenario form (e.g., G1+G2).

^b In minerals projects the parallel categorization of G3 together with E1 and F1 categories usually is **not** publicly reported due to lack of direct evidence (further explanation: The source of this is the application in traditional mineral classifications that basically reflect rocks in place. Then the upside is excluded for financial reporting purposes in order not to mislead investors that unmeasured quantities are investment grade. In project classification, this becomes less logical. Cumulative future production, which is what reserves in fact are, is influenced by many factors also beyond rocks in place. They will be uncertain and have both upsides and downsides. To ignore the upside of

the probability distribution function makes little sense, both because it contributes to the ascertainment of the expected value and because it represents an important part of the information for investing in options. Not to recognize the full probability distribution function can have disastrous effects as investments in flexibility i.e. real options for capturing it cannot be valued. The potentially high value they represent may be lost if the upside is ignored.

^c Potentially Viable Projects may satisfy the requirements for E1.

^d Commentaries in *Italics* are essential for further clarifications of related terms.

Figure III
Mapping of the E-F Matrix to TRL Classification

	F1.1	F1.2	F1.3	F2.1	F2.2	F2.3	F3.1	F3.2	F3.3	F4.1	F4.2	F4.3
E.1.1	TRL 9	TRL 8	TRL 5,6,7									
E.1.2	TRL 9	TRL 8	TRL 5,6,7									
E2				TRL 3, 4								
E3.1												
E3.2					TRL 3,4		TRL 3,4	TRL 3,4	TRL 3,4			
E3.3										TRL 2	TRL 1	

Figure IV
Mapping of the E-F Matrix to INSPIRE code list classification

	F1.1	F1.2	F1.3	F2.1	F2.2	F3.1	F3.2	F3.3
E.1.1	Operating Continuously Operating intermittently	Under development	Pending approval					
E.1.2	Operating Continuously Operating intermittently	Under development	Pending approval					
E2				Evaluation of Resources (Detailed Feasibility Study, Prefeasibility)				
E3.1								
E3.2					Assessment of Resources (Advanced exploration, Resources definition, Prefeasibility, Scoping study (resources))	Subsurface exploration (Exploration Target Outline)	Detailed surface exploration (Exploration)	Regional reconnaissance (Grassroots)

28. Figures III and IV work in most cases, but not in all, so additional considerations of placing TRL / INSPIRE classes might be needed.

III. Conclusions and Recommendations

29. This Guidance builds on the latest UNECE documents (United Nation Framework Classification for Resources (Update 2019), Specifications for the Application of UNFC to Minerals (2021) and Specifications for the Application of UNFC to Anthropogenic Resources (2018). It provides information regarding mapping raw materials (primary and secondary) tailored for Europe. The main document is prepared for a broad audience dealing with UNFC (government officials, industry, finance sector, academia etc.) while the annexes (specifications, guidelines, extended glossary) have been prepared for technical experts, including UNFC practitioners.

30. An approach to use the classification for resource management may be:

- (i) Identify the key resource management decisions to be supported in government, industry and finance;
- (ii) List the key information required to inform these decisions and that projects carry;
- (iii) Identify the metrics to be included in the project inventories to allow the information to be generated;
- (iv) Develop high security and quality shared data management facilitating the work of both preparers and users making sure both have strong professional and economic interests in the results.

31. The Guidance should assist in developing a European Union (EU) Action Plan for implementation of UNFC at the national/Member State level. The proposed Action Plan at national level while using the UNFC for Europe Guidance would include several steps:

- Create a national contact point and team of UNFC practitioners
- Review the national situation
- Prepare a bridging document(s) to the national system(s) (if needed)
- Establish a national UNFC inventory
- Dissemination and communication of the UNFC inventory
- Extended use of the UNFC inventory information for different purposes, in policy and decision-making on various areas /economy, environment, society, statistics .../
- Further development of UNFC practices together with the ECE Expert Group on Resource Management.

32. For aggregation at the European level and coordination of activities at the national level/Member States, the EU Action Plan should include the following points/steps for implementation by Members States in cooperation with the ECE Expert Group on Resource Management:

- Establishment of a Network of National Contact Points
- Establishment of a Network of Practitioners as part of the future European International Centre of Excellence(s) (ICE)
- Continuous development of UNFC and UNRMS
- Coordinated implementation of UNRMS in Europe.

Annex I

Mineral and Anthropogenic Resources Specifications - Guidelines for Europe

I. UNFC-Europe Mineral and Anthropogenic Resource Specifications

1. The UNFC Sectoral Specifications for Minerals and Anthropogenic Resources have been adapted to aid application of UNFC to mineral and anthropogenic resources in Europe and are provided in the following sections.
2. For minerals, the latest Bridging Document⁸ between the CRIRSCO Template and UNFC may be consulted for interoperability between the two systems.
3. In case of conflicts between the statements in this document and UNFC or the UNFC Minerals or Anthropogenic Specifications, UNFC prevails over the Specifications and the UNFC Mineral and Anthropogenic Specifications prevail over the statements in this document.

A. Use of numerical code

4. While the defined Classes and Sub-classes may be used as supplementary terminology, the relevant Numerical Code(s) shall always be reported in conjunction with the estimated mineral or anthropogenic resource quantity and its associated social, environmental, economic, technical and confidence in estimates / level of knowledge information. For example, these may be documented in the form 111, 111+112, E1.1F1.2 or 1.1;1.2;1, as appropriate, where the option with the letters and the numbers (E1.1F1.2) is preferred.
5. Note that some Sub-categories which are defined below are in addition to those provided in Part I of UNFC (2019). These optional Sub-categories have been identified as potentially useful in certain situations and have been defined in order to ensure consistency in their use. Nothing in this document precludes the definition of additional Sub-classes in the future that may be useful in particular cases.

B. Bridging documents and aligned systems

6. UNFC may be compared with other classification systems. A Bridging Document explains the comparable aspects between the UNFC and the other classification system, including instructions on how to convert estimates generated in UNFC for those systems and vice versa, recognizing that the generally higher granularity of the UNFC and its clear identification of the E axis will not in general allow UNFC classes to be fully reflected in classifications not recognizing the E-axis issues in distinct categories defining classes of projects. When going from other classifications of lower granularity to UNFC some categories may not be identified without additional information. This will require either rework or approximations where some projects will be misplaced in the UNFC.
7. Bridging documents between national reporting codes in Europe and UNFC should consider the specific provisions included in this document.
8. (Bridging documents between national reporting codes and UNFC should be established.)

⁸ https://unece.org/fileadmin/DAM/energy/se/pdfs/UNFC/UNFC_specs/Revised_CRIRSCO_Template_UNFC_Bridging_Document.pdf

C. Effective date

9. [No further provisions are proposed.]

10. The estimates of quantities as at the Effective Date of the evaluation. The effective date marks the conclusion of data collection to be used in the calculation and reporting of a resource. The definition is: “effective date” – This is the cut-off date for the scientific and technical information included in the technical report. The Effective Date shall be clearly stated in conjunction with the reported quantities. The evaluation should take into account all data and information available to the evaluator prior to the Effective Date. If information becomes available subsequent to the Effective Date, but prior to classification, that could have significantly changed the estimated quantities as at the Effective Date, the likely effect of this information shall be mentioned.

D. Product type

11. Each product type that will be sold, used, transferred or disposed of separately should have quantities estimated separately.

12. **Minerals:** Product types could include metallic minerals, non-metallic minerals, industrial (developmental) minerals including aggregates, coal, diamond etc. Where estimates for different product types have been aggregated for classification purposes, and separate estimates are not provided, the aggregated estimates shall be accompanied by a statement clarifying which product types have been aggregated and the conversion factor(s) used to render them equivalent for the purposes of aggregation.

13. **Anthropogenic Resources:** Where a Project produces more than one Anthropogenic Material Product (e.g. copper and zinc), the quantities for each shall be estimated and included in a single report for the Project. For each Reference Point (The definition of “reference point” is given in section F) the same information shall be declared for each reported quantity, including the type of Anthropogenic Material Product. It is noted that the Specifications focus primarily on Anthropogenic Material Products from Anthropogenic Material Sources. In some cases, it might be that the Project produces multiple Anthropogenic Material Products (material quantities) and energy quantities. In such cases, each single quantity should be reported and considered for the evaluation of the Project. For example, a landfill mining project recovers metals (material quantity) and produces refuse-derived fuel (energy quantity). A Project might also produce material quantities that are disposed on land (e.g. landfills, underground storage facilities and tailings). These quantities should be included in the reporting (see also guidance relating to the use of Sub-category E3, in the UNFC Anthropogenic Specifications).

14. Product type denomination will be as described in the INSPIRE "Technical Guidelines for Data Specification on Mineral Resources", annex F and the INSPIRE "Technical Guidelines for Data Specification on Mineral Resources" and the INSPIRE energy resources.

E. Basis for estimate

15. [No further provisions are proposed.]

16. Estimated quantities may be those mineral/anthropogenic resources and other (such as cost and revenue) estimated quantities attributable to the project as a whole or may reflect the proportion of those quantities that is attributable to the classifying entity’s environmental-socio-economic- interest in the project. The reporting basis shall be clearly stated in conjunction with the reported quantities. Government royalty obligations are often treated as a tax to be paid in cash and are therefore generally classified as a cost of operations. In such cases, the reported quantities may include the proportion attributable to the royalty obligation. Where the reported quantities exclude the proportion attributable to the royalty obligation, this shall be disclosed. In summary, it is important to address project inventories and asset inventories distinctly in order to develop appropriate support for decisions in the tripartite partnership between government, industry and finance. The project inventories hold the

metrics 100% for overall resource management, while the asset inventories hold the metrics that accrue to asset holders, including governments through the legal rights that define the assets, and thus their interest in developing the projects.

F. Reference point

17. **Minerals:** The Reference Point is a defined location within a mining or production operation at which the classified mineral quantities are measured or estimated. The Reference Point may be the product sales point from the operation, point at which the product is utilized, 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. The Reference Point shall be mentioned in conjunction with the classified quantities. Where the Reference Point is not the point of sale to third parties (or where custody is transferred to the entity's downstream operations), and such quantities are classified as E1, the information necessary to derive estimated sales quantities shall also be provided. Quantities flowing out of the reference points shall where possible be defined to be coherent with the definition in general statistics of quantities entering the economy.

18. **Anthropogenic Resources:** The default for the Reference Point shall be the location in the sourcing process at which the reported quantities of Anthropogenic Material Products are measured or estimated. Any deviation from this location shall be clearly justified. The Reference Point may be the product sales point from the operation, point at which the product is utilized, 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. The Reference Point shall be mentioned in conjunction with the classified quantities. Where the Reference Point is not the point of sale to third parties (or where custody is transferred to the entity's downstream operations), and such quantities are classified as E1, the information necessary to derive estimated sales quantities shall also be provided. Quantities flowing out of the reference points shall where possible be defined to be coherent with the definition in general statistics of quantities entering the economy. The material quantities through the Reference Point should be coherent (e.g. identical in time, quantity, quality and price) with the common definitions in general statistics, accounting and reporting schemes, as for instance, the System of Environmental Economic Accounting and European Waste Statistics. No matter where the reference point is located, the categorization and classification of material quantities have to consider all relevant factors on the E Axis and on the F Axis from all relevant Anthropogenic Material Processes, Stocks and Flows in the Project. Where a Project produces multiple Anthropogenic Material Products, there might be different Reference Points for each Anthropogenic Resource. The reference point is a defined location at which the reported estimate or measurement is made. 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 after the delivery point. The Reference Point shall be disclosed in conjunction with the classification. Where the Reference Point is not the point of sale to third parties (or where custody is transferred to the entity's other operations), and such quantities are classified as E1, the information necessary to derive estimated sales shall also be provided.

G. Aggregation of quantities

19. [No further provisions are proposed.]

20. Estimated mineral and anthropogenic resource quantities associated with projects that are classified in different Categories on the Environmental-Socio-Economic Viability or Technical Feasibility axes shall not be aggregated with each other without proper justification and mention of the methodology adopted. In all cases, the specific Classes that have been aggregated shall be mentioned in conjunction with the classified quantity (e.g. 111+112+221+222) and a footnote added. The footnote shall state how projects with different E and F Categories have been aggregated to account for the likelihood that not all will be realized. It shall also state, when relevant how quantities with different G Categories

have been aggregated (arithmetically or stochastically, and if stochastic aggregation is used, how).

21. Where estimated quantities have been aggregated from multiple mineral or anthropogenic resource projects, consideration should be given to sub-dividing the aggregated totals by type and by location. Quantities flowing out of the reference points shall where possible be defined to be coherent with the definition in general statistics of quantities entering the economy.

H. Evaluator qualifications and accountability

22. For public reporting (to stock exchanges, financial institutions etc.) evaluators must possess an appropriate level of expertise and relevant experience in the estimation of quantities associated with the type of resource source under evaluation. (See rules of the relevant entity where reports are to be filed.)

23. Professional Organization: a self-regulatory professional association and/or government licensing authority⁹ 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 organization; requires or encourages continuing professional development; and has and applies disciplinary powers, including the power to suspend or expel individuals.

I. Units and conversion factors

24. To facilitate global comparability of resource estimates the *Système International d'Unités* (SI units) shall be used for reporting of resource quantities.

J. Documentation

25. [No further provisions are proposed.]

26. Estimates of mineral and anthropogenic resource quantities shall be documented in sufficient detail that would allow an independent evaluator or auditor to clearly understand the basis for estimation of the classified quantities and their classification.

K. Mineral and anthropogenic specifications applicable to E axis Categories

1. Environmental-Socio-Economic assumptions

27. In accordance with the definitions of E1, E2 and E3, environmental-socio-economic assumptions shall be based on current market conditions and realistic assumptions of future market conditions. Except where constrained by regulation, assumptions of future market conditions should reflect the view of either:

28. Authorized body:

(a) Management;

(b) The view of a competent qualified person or independent evaluator; or,

(c) An externally published independent view, which is considered to be a reasonable forecast of future market conditions.

29. The basis for the assumptions (as opposed to the actual forecast) shall be disclosed. Where the use of alternative assumptions is required, the alternative estimates shall be

⁹ Aside from an association or authority, this could also be the user.

identified with an attribute, i.e. E1F1G1, and accompanied by an explanation of the assumptions used.

2. Distinction between E1, E2, E3

30. [No further provisions are proposed.]

31. The distinctions between mineral and anthropogenic quantities that are categorized on the Environmental-Socio-Economic Viability axis as E1, E2 or E3 are based on the phrase “reasonable prospects for social, environmental and economically viable production for sale in the foreseeable future”. The definition of “foreseeable future” can vary depending on the product type and should be provided.

32. The Environmental-Socio-Economic Viability axis Categories encompass all non-technical issues that could directly impact the viability of a mineral or anthropogenic project, including product type prices, operating costs, legal/fiscal framework, environmental regulations and known environmental or social impediments, barriers and opportunities. Any one of these issues could prevent or be advantageous for a new project from proceeding (and hence quantities would be classified as E2 or E3, as appropriate), or it could lead to the suspension or termination of production activities in an existing operation or it could be the main driver for a project to move ahead. Where production activities are suspended, but there are “reasonable prospects for economic, social and environmentally viable production for sale in the foreseeable future”, remaining quantities that can be technically produced shall be reclassified from E1 to E2. Where “reasonable prospects for economic, social and environmentally viable production for sale in the foreseeable future” cannot be demonstrated, remaining quantities shall be reclassified from E1 to E3.

3. Produced quantities that may be saleable in the future

33. [No further provisions are proposed.]

34. The Sub-categories of E3 permit a distinction to be made between those mineral or anthropogenic resource quantities that may be forecast to be produced, but which will not be available for sale (E3.1) and those for which there are currently no reasonable prospects for economic, social and environmentally viable production for sale in the foreseeable future (E3.3). In the former case, the quantities are those that will be used, stored, lost, destroyed or otherwise disposed of during the production process, and hence will not be sold as part of the project. In some situations, quantities may be produced and then stored in some way for possible economic sale in the future and these may be assigned to E3.3 (and subsequently moved to E2 and E1 as appropriate). Depending on how the project is shaped and changed going forward, the future non-sales and/or non utilized production may in part or on the whole be forecasted to be sold and/or utilized and upgraded to E2 or E1 or constitute the resource source of another project.

L. Mineral and anthropogenic specifications applicable to F axis Categories

1. Classifications of projects based on level of maturity

35. Where it is considered appropriate or helpful to sub-classify mineral or anthropogenic projects to reflect different levels of project maturity, based on the current status of the project, the optional Sub-classes shown in Figures II and III of UNFC (2019) (see Part I) may be adopted. Additional guidance on the distinction between the Sub-classes of UNFC is provided in Part III Section II.

2. Distinction between quantities that can be potentially produced and in situ quantities

36. [No further provisions are proposed.]

37. Other than quantities of minerals or anthropogenic resources that are classified on the Technical Feasibility axis as F4, all classified quantities shall be limited to those mineral or

anthropogenic resource quantities that are potentially producible on the basis of existing technology or technology currently under development, and are associated with actual or possible future projects, i.e. the reported quantities should be potentially recoverable quantities. In the absence of any consideration of potential production, all reported quantities shall be classified as F4.

3. Classification of quantities associated with Exploration Projects

38. [F3.1 should be further developed?]

39. In some situations, it may be helpful to sub-classify Exploration Projects on the basis of their level of maturity. In such cases, the following specification shall apply:

(a) F3.1: where site-specific studies have identified a potential mineral deposit or anthropogenic resources and product(s) with sufficient confidence to warrant further testing;

(b) F3.1 does not cover advanced exploration and resources definition; hence this should go to F2;

(c) F3.2: where local studies indicate the potential for one or more mineral deposits or anthropogenic resources in a specific part of an area, but requires more data acquisition and/or evaluation in order to have sufficient confidence to warrant further testing;

(d) F3.3: at the earliest stage of studies, where favourable conditions for the potential discovery of a mineral deposit or anthropogenic resources in an area may be inferred from regional studies.

4. Classification of additional quantities in place

40. [No further provisions are proposed.]

41. In some situations, it may be helpful to sub-classify Additional Quantities in Place on the basis of the current state of technological developments. In such cases, the following specification shall apply:

(a) F4.1: the technology necessary to produce some or all of these mineral or anthropogenic resource quantities is currently under active development, following successful pilot studies on other mineral deposits or anthropogenic resources, but has yet to be demonstrated to be technically feasible for the style and nature of mineral deposit or anthropogenic resource in which that product type is located;

(b) F4.2: the technology necessary to produce some or all of these mineral or anthropogenic resource quantities is currently being researched, but no successful pilot studies have yet been completed;

(c) F4.3: the technology necessary to produce some or all of these mineral or anthropogenic resource quantities is not currently under research or development.

M. Mineral and Anthropogenic specifications applicable to G axis Categories

1. Confidence levels for G1, G2 and G3

42. The level of confidence for quantities that are classified on the G axis as G1, G2 and G3 is defined as “high”, “medium” and “low”, respectively. These are not specified more precisely at a generic level.

2. Expansion of G4 to account for uncertainty

43. [No further provisions are proposed.]

44. In some situations, it may be helpful to express a range of uncertainty for mineral or anthropogenic quantities that are classified on the G axis as G4, e.g., Exploration Projects. In such cases, the following specification shall apply:

(a) G4.1: low estimate of the quantities;

(b) G4.2: incremental amount to G4.1 such that $G4.1+G4.2$ equates to a best estimate of the quantities;

(c) 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;

(d) Category G4, when used alone, shall reflect the best estimate and is equal to $G4.1+G4.2$.

3. Optional labels for estimates

45. [No further provisions are proposed.]

46. Where it is considered appropriate or helpful to use labels in addition to the numerical codes for a range of estimates for a specific project, the terms “Low Estimate”, “Best Estimate” and “High Estimate” may be used to correspond to quantities that are classified on the G axis as G1, $G1+G2$ and $G1+G2+G3$ respectively. For scalars, the low estimate is defined as one having a 90% probability of being exceeded (P90). The Best Estimate is ideally the Expected Value, also known as the Mean value. In practice, an approximation is often used corresponding to the value with a 50% probability of being exceeded (P50). There can be important differences that become important when estimates are aggregated. The High Estimate is defined as one having a 10% probability of being exceeded.

Annex II

Mineral and Anthropogenic Resources Sectoral Guidelines for Europe

I. UNFC for Europe Mineral Resources Guidelines

1. Controlling Factors (CF)¹⁰, are all social, environmental, economic, technological and geological factors that maybe considered when changing a mineral project from one class to another. In the early stages of the project, many of the CFs will be vague or unclarified. With the availability of more data, the CFs will acquire more clarity. Not all controlling factors may be equally important in all cases. It is therefore recommended that the lists below be reviewed and that the final categorization to be applied be chosen based on a balanced judgement of the likelihood that the project may be impaired if one or more of the controlling factors are not met, or if other conditions apply in a specific case that must be taken into account.

2. Controlling Factors that may be considered are:

A. E Axis – Environmental-Socio-Economic Viability

3. [Here it is suggested to follow the E-Axis Categories and Sub-Categories-Definitions and Supporting Explanations.]

4. *Source:* https://unece.org/sites/default/files/2022-01/ECE_ENERGY_GE.3_2021_6e.pdf, page 9.

5. Lowest Ranking Issue: for the tables that follow (Tables 1 to 14), the rule of lowest ranking issue should be respected, which means that the lowest rank prevails.

1. Policy

6. *Note:* Some elements can be extracted from STRADE H2020 project https://www.stradeproject.eu/fileadmin/user_upload/pdf/STRADE_Rpt_D2-01_EU-MiningIndustry-Competitiveness_Apr2017_FINAL.pdf

Table 1
Policy. Potential E Categories^a

<i>Issue / potential CF</i>	<i>Level of engagement</i>	<i>Probability of approval</i>	<i>Potential E Category</i>	<i>Comments</i>
EU policy on non-energy raw materials	Minerals included in the Critical Raw Materials (CRM) list, minerals for energy transition	Yes, No	E1, E2.1 (Yes) E2.2 (No)	CRM can be different for MS
Raw Materials Policy at EU MS/Regional/local level	Policy is favourable, neutral, unknown or not favourable	High, medium, low	E1, E2.1 (favourable) E2.2 (neutral) E3.2 (unknown) E3.3 (not favourable)	
National interest	Mineral may be of national, regional, local interest	Yes (high, medium) No (medium, low)	E2.1, E2.2 (Yes) E2.2, E3.2, E3.3 (No)	
Regulatory approval process	Efficient permitting process ^b		E1, E2.1 (efficient) E2.2 (neutral) E3.2 (unknown) E3.3 (inefficient)	

^a Since UNFC (2019) does not subdivide E2, an explanation is provided in the brackets.

^b Fraser Institute, Investment Attractiveness Index may be a source.

7. *Aligning with UN policies (2030 Agenda, SDGs, etc.) is a prerequisite.*

¹⁰ Similar to Modifying Factors according to the CRIRSCO Template.

2. Legal framework

8. Related contingencies may include the right to produce and sell (or benefit) from a resource:

- E1 if the legal right to produce and sell is established and not in dispute
- E2 if the legal right to produce and sell is being negotiated but not finalized or is in dispute
- E3 if there is no legal right to produce and sell¹¹, as is the case for many exploration activities and no negotiation or application in process.

9. *Source:* https://unece.org/sites/default/files/2022-01/ECE_ENERGY_GE.3_2021_6e.pdf, page 7.

Table 2
Exploration rights (early exploration). Potential E Categories

<i>Issue / potential CF</i>	<i>Level of engagement</i>	<i>Probability of approval</i>	<i>Potential E Category</i>	<i>Comments</i>
Exploration rights (early exploration)				
Exploration exclusivity	The exploration rights are exclusive to the holder, including undiscovered minerals	Yes/No/unknown	E3.2 (Yes) E3.3 (No, unknown)	Should be E3 because it's exploration
Exploration duration	Right to keep exploration rights by performing work	Yes/No/unknown	E3.2 (Yes) E3.3 (No, unknown)	Should be E3 because it's exploration

Table 3
Exploration rights (advanced exploration). Potential E Categories

<i>Issue / potential CF</i>	<i>Level of engagement</i>	<i>Probability of approval</i>	<i>Potential E Category</i>	<i>Comments</i>
Exploration rights (early exploration)				
Exploration exclusivity	The exploration rights are exclusive to the holder, including undiscovered minerals	Yes/No/unknown	E3.2 (Yes) E3.3 (No, unknown)	Should be E3 because it's exploration
Exploration duration	Right to keep exploration rights by performing work	Yes/No/unknown	E3.2 (Yes) E3.3 (No, unknown)	Should be E3 because it's exploration?

Table 4
Mining rights. Potential E Categories

<i>Issue / potential CF</i>	<i>Level of engagement</i>	<i>Probability of approval</i>	<i>Potential E Category</i>	<i>Comments</i>
Mining rights				
Right to Mine	Explorationist has priority to acquire mining rights	Yes/No	E1, E2.1, E2.2 (Yes) E3.2 (unknown) E3.3 (No)	In the case Yes, E2.1/E2.2 will depend on how effective the transmission of rights is.
Tenure certainty, duration	Priority for renewal	Yes/No	E1, E2.1, E2.2 (Yes) E3.2 (unknown) E3.3 (No)	

¹¹ Except for non-sales production, (E3.1).

3. Regulatory approval

10. It is important for efficient resource management to take the decisions in the right order. Here it is an advantage to have a proactive government engagement rather than a reactive one. This may lead to an early exploration phase carried out by the government to move projects from F4G4 to F3E3. For the projects that look promising, Governments may also consider performing an early strategic impact assessments to ascertain whether projects can or cannot be carried out. Where there is potential and the impact assessment is favorable, industry can be invited to compete for licenses setting out any restrictions that may apply. Many of the roadblocks on the E axis can then be removed before investments start, protecting the economic interests of the industry, government (through avoiding tax losses) and capital allocators. In this mode, development can be accelerated relative to a process where a government is reactive.

11. Regulatory approval is required for many aspects of extraction operations, ranging from major environmental approval to routine minor issues such as individual abandonment approvals of minor parts of the operations:

- E1 if approved or, located in areas and jurisdictions where there is an established history of approval indicates that approval can be expected with the appropriate level of assurance
- E2 if applied and awaiting approval
- E3 if required but not applied for or applied for and not approved.

12. *Source:* https://unece.org/sites/default/files/2022-01/ECE_ENERGY_GE.3_2021_6e.pdf, page 7.

Table 5

Exploration permits (early exploration). Potential E Categories

<i>Issue / potential CF</i>	<i>Level of engagement</i>	<i>Probability of approval</i>	<i>Potential E Category</i>	<i>Comments</i>
Exploration permit (early exploration)	Not been initiated	Unknown	E3.3	
Exploration permit	Been approved	high	E3.2	Should be E3 because it is exploration
	Not been approved	low	E3.3	
Application, submission to public enquiry	Being initiated and in the process of being considered	high, medium, low	E3.2 (high, medium probability) E3.3 (low probability)	Should be E3 because it is exploration
Exploration permit (advanced exploration)	Not being initiated	-	E3.3	
Exploration permit	Been approved	high	E2.1 (evaluation of resources) E2.2 (scoping study?) E3.2 (assessment of resources)	
	Not been approved	low	E3.2	E3.2 should be assigned since early exploration can be considered granted
Application, submission to public enquiry	Being initiated and in the process of being considered	high, medium, low	E3.2 (evaluation of resources & medium probability) E3.2 (assessment of resources & high/medium probability) E3.3 (low probability)	<i>Estimation</i>

Table 6
Extraction permits. Potential E Categories

<i>Issue / potential CF</i>	<i>Level of engagement</i>	<i>Probability of approval</i>	<i>Potential E Category</i>	<i>Comments</i>
Extraction license	Not been initiated		E3.2, E3.3	
Extraction	Been approved	high	E1, E2.1	Risk of appeals should be assessed and could lower E beyond E2.1 Would construction risks be assessed here or under F-axis?
	Approved subject to modifications	high, medium	E2.1, E2.2	
	Not been approved	low	E3.3	There could be a contradiction with the first row "extraction license not been initiated" that could be E3.2 or E3.3
Extraction license application, submission to public enquiry	Being initiated and in the process of being considered	high, medium, low	E2.1, E2.2, E3.2	<i>Estimation</i>
Timing	<5 year >5 year		<5 year: E2 >5 year: E3.2, E3.3	

13. The **Environmental Impact Assessment (EIA) Directive** (2011/92/EU) requires Member States to carry out environmental impact assessments of certain public and private projects, before they are authorised, where it is believed that the projects are likely to have a significant impact on the environment. The objective is to identify the environmental impacts and assess whether prevention or mitigation is appropriate. The public must be consulted and its comments considered when a decision is taken on whether to authorise the project. Account must be taken of specific factors such as whether the location is important for nature conservation.

14. The **Extractive Waste Directive** sets up measures, procedures and guidance to prevent or reduce the possible adverse effects of the management of mining wastes (wastes from the extractive industry) on the environment, fauna and flora, as well as water, air and soil and human health.

15. The **Water Framework Directive (WFD)** is the main regulatory tool of the EU water policy. It has a double target: to get the polluted water to reach the clean water status and on the other hand to ensure that waters are kept clean.

16. The key objective of the WFD is to achieve **good status for all water bodies by 2015**. This comprises the objectives of **good ecological** and **chemical status for surface waters** and **good quantitative** and **chemical status for groundwater**.

17. **Land use.** Spatial planning is an effective regulatory tool which has the potential to find common grounds between different interests and facilitate permitting procedures. Access to land for exploration and extraction of mineral raw materials is a key requirement. The information in the UNFC enhance transparency, which is of great importance to resource management at regional or national level.

18. There are a number of project contingencies related to the use and protection of land. These differ between Member States of EU.

19. Land use types are designated according to their nature and location, their contribution to fulfilling existing societal needs, and general long-term sustainable development objectives. Close coordination between land use planning and mineral planning, zones designated as "raw material priority areas", raw materials designated of national interest are some of the instruments used by Member States for land use planning.

20. If co-existence of the conflicting interests is impossible, one of the interests must be given precedence. It is important for all parties that this is resolved before substantial investments are made. The project information in the UNFC classification can be applied in land use planning to avoid unreasonable decisions which might hinder justified, effective and sustainable exploration of mineral resources. It can avoid large expenditures not only by project participants but also by governments through the fiscal system on projects that cannot be realized.

Table 7
Regulatory approval. Potential E Categories^a

Issue / potential CF	Level of engagement	Probability of approval	Potential E Category	Comments
Environmental Impact Assessment (exploitation)	Not been initiated		E2.2 (high), E3.3 (medium)	When not initiated should have a lower ranking since can be considered there is not active engagement
EIA permits	Been approved		E1, E2.1	
	Not been approved		E3.2, E3.3	
Application/Submission to public enquiry	Being initiated and in the process of being considered	high, medium, low	E1, E2.1 (not affected) E2.2 (affected but compatible) E3.2 (unknown; further studies required) E3.3 (affected incompatible)	Potential affections: population, human health, biodiversity, land, water, air, climate, human health, landscape, material assets, cultural heritage ^b
Mining waste (external emergency plans, financial guarantee, EWMP)	Not been initiated	-	E2.2 (high), E3.3 (medium)	When not initiated should have a lower ranking since can be considered there is not active engagement
Mining waste permits	Been approved	high	E1, E2.1	
	Not approved	low	E3.2, E3.3	
Application/Submission to public enquiry	Being initiated and in the process of being considered		E2.1, E2.2, E3.2	
Land use planning	Not been initiated	-	E2.2 (high), E3.3 (medium)	When not initiated should have a lower ranking since can be considered there is not active engagement
Land use planning considers the area as "minerals area"	Been approved (including landowners agreement)		E1, E2.1	
Change of land uses for non-minerals areas	Not approved		E3.2, E3.3	
		Feasible (high), not feasible (low)	E2.2 (feasible) E3.2; E3.3 (not feasible)	
Landowner agreement	A process to resolve differences and align interests with a good chance of success	high	E1, E2.1	
	Landowner issues are complex or there is a strong misalignment	low	E3.2, E3.3	
Construction	Not been initiated	-	E2.2 (high), E3.3 (medium)	
Construction licenses	Been approved	high	E1, E2.1	
	Not been approved	low	E3.2, E3.3	

<i>Issue / potential CF</i>	<i>Level of engagement</i>	<i>Probability of approval</i>	<i>Potential E Category</i>	<i>Comments</i>
Application submitted	Being initiated and in the process of being considered	high, medium, low	E1, E2.1	
Timing	<5 year >5 year		<5 year: E2 >5 year: E3.2, E3.3	
Others				

^a Topics included in this table include too many criteria. The more criteria that are included, the less is the probability that a project will proceed. Furthermore, they are connected. Potential CF could be simplified to: "land use planning"; "environmental permits" (including mining waste permits); "construction"; "others".

^b EIA Directive, Annex IV.

4. Fiscal framework/contractual conditions

21. Fiscal framework includes taxes, royalties, production sharing, or other fiscal provisions under which extraction operations are carried out:

- E1 if established, not in dispute or uncertain, and allows a decision to implement a project to be made
- E2 if it is being negotiated but not finalized, is in dispute, or there is uncertainty due to the possibility of a change that could affect the viability of a project
- E3 if not determined.

22. There may be projects that are economic in themselves, but not for one or more critical asset holders due to fiscal patterns, tariff structures etc. This could inform parties about changes that may cause or prevent impairment of projects.

23. Contractual conditions are specific to an asset or project, but may contain terms beyond those of the legal or fiscal framework (e.g., a requirement to use local labour, private sector contracts, lease expiry after a specific time, abandonment and reclamation obligations, etc.). A contract may not always be required, but if it is:

- E1 if established, not in dispute or uncertain in any manner, and is expected to be concluded with a high degree of certainty
- E2 if they are being negotiated but not finalized, are in dispute, or there is uncertainty due to the possibility of a change that could affect the commercial viability of a project
- E3 if it does yet not exist.

24. *Source:* https://unece.org/sites/default/files/2022-01/ECE_ENERGY_GE.3_2021_6e.pdf, page 7.

Table 8
Fiscal framework. Potential E Categories

<i>Issue / potential CF</i>	<i>Level of engagement</i>	<i>Probability of approval</i>	<i>Potential E Category</i>	<i>Comments</i>
Fiscal framework				
Taxes	Have been established and allows the project or are being negotiated	high, medium, low	E1 (established and allows project) E2.1, E2.2 (being negotiated, in dispute, uncertain) E3.2 (not determined) E3.3 (not approved)	
Royalties	Have been established and allows the project or are being negotiated	high, medium, low	E1 (established and allows project) E2.1, E2.2 (being negotiated, in dispute, uncertain) E3.2 (not determined) E3.3 (not approved)	
Production sharing	Have been established and allows the project or are being negotiated	high, medium, low	E1 (established and allows project) E2.1, E2.2 (being negotiated, in dispute, uncertain) E3.2 (not determined) E3.3 (not approved)	
Corporate tax	Have been established and allows the project or are being negotiated	high, medium, low	E1 (established and allows project) E2.1, E2.2 (being negotiated, in dispute, uncertain) E3.2 (not determined) E3.3 (not approved)	
Others				

5. Social considerations

25. Includes “social” contingencies could inhibit or prevent a decision to proceed with the project. Could be formally or not formally expressed.

Table 9
Social. Potential E Categories

<i>Issue / potential CF</i>	<i>Level of engagement</i>	<i>Probability of approval</i>	<i>Potential E Category</i>	<i>Comments</i>
National/regional/local (political) interests	Support from national, regional, local authorities.	high, medium, low	E1, E2.1 (formal support) E2.1, E2.2 (support but not formal) E3.2 (support unknown) E3.3 (opposition)	
Local community interests	Support from local community	high, medium, low	E1, E2.1 (formal support) E2.1, E2.2 (support but not formal) E3.2 (support unknown) E3.3 (opposition)	
Other organizations involved	Support from third organizations.	high, medium, low	E1, E2.1 (formal support) E2.1, E2.2 (support but not formal) E3.2 (support unknown) E3.3 (opposition)	

6. Economic considerations

Table 10
Economic. Potential E Categories

<i>Issue / potential CF</i>	<i>Level of engagement</i>	<i>Probability of approval</i>	<i>Potential E Category</i>	<i>Comments</i>
Preliminary economic assessment (Scoping study)		high, medium, low	E2.2	
Prefeasibility		high, medium, low	E2.1	
Detailed feasibility		high, medium	E1, E2.1	
Pre-planning and design		high, medium	E1, E2.1	
Construction		high	E1, E2.1	
Operation		high	E1	
Mine closure		low	E3	Mine closure may be on-off
Post closure monitoring		low	E3	
Timing	Not applicable			

B. F Axis – Technical Feasibility

1. Technology Readiness Levels

26. Technology readiness levels (TRLs) are a method for estimating the maturity of technologies. The TRL is perceived as an effective way to indicate the development stage of a given technology or product:

- TRL 1 – basic principles observed
- TRL 2 – technology concept formulated
- TRL 3 – experimental proof of concept
- TRL 4 – technology validated in laboratory
- TRL 5 – technology validated in relevant environment (industrially relevant environment in the case of key enabling technologies)
- TRL 6 – technology demonstrated in relevant environment (industrially relevant environment in the case of key enabling technologies)
- TRL 7 – system prototype demonstration in operational environment
- TRL 8 – system complete and qualified
- TRL 9 – actual system proven in operational environment (competitive manufacturing in the case of key enabling technologies; or in space).

27. An aggregated approach may be appropriate, so rather than responding on whether the various considerations have been made and what the outcomes are, the questions may be asked whether the activities have progressed to the next level, i.e. is exploration taking place, is design underway, have the technical facilities been approved for construction, is construction under way, is production going on and has decommissioning started. Decommissioning may in fact be an addition to the F axis as it is not defined in UNFC (2019). This makes categorization and classification quite simple in contrast to the complex task undertaken in each of the classes. In this system, TRLs do not enter, only the decisions based on them if they are based on them. They may not always be.

Table 11
Mapping of TRLs to UNFC F Categories

<i>TRL Definition</i>	<i>TRL</i>	<i>Potential F Category</i>	<i>Definition</i>	<i>Comments</i>
Actual system proven in operational environment (competitive manufacturing in the case of key enabling technologies; or in space)	9	F1.1	Extraction is currently taking place	
System complete and qualified	8	F1.2	Capital funds have been committed and implementation of the development project or mining operation is underway	
System prototype demonstration in operational environment	7	F1.3		
Technology demonstrated in relevant environment (industrially relevant environment in the case of key enabling technologies)	6	F1.3	Sufficiently detailed studies have been completed to demonstrate the feasibility of extraction by implementing a defined development project or mining operation.	
Technology validated in relevant environment (industrially relevant environment in the case of key enabling technologies)	5	F1.3		
Project activities are ongoing to justify development in the foreseeable future.	?	F2.1		
Project activities are on hold and/or where justification as a viable development may be subject to significant delay.	?	F2.2		
Technology validated in laboratory	4	F3	Feasibility of extraction by a defined development project or mining operation cannot be evaluated due to limited technical data	
Experimental proof of concept	3	F3		
Technology concept formulated	2	F4	No development project or mining operation has been identified	
Basic principles observed	1	F4		

2. Mining Methods

28. There are numerous conventional and unconventional mining methods, which could be utilized to exploit mineral resources. Each has its pros and cons depending on situation-specific characteristics like deposit type, ore morphology, mineralization style, mineralization depth, rock mechanics, safety, geopolitical factors, infrastructure, economics etc.

29. The following mining methods are considered as conventional mining technologies:

- Surface Mining (Open Pit Mining, Quarrying)
- Subsurface Mining (Room & Pillar, Longwall, Slope Mining and others)
- Placer Mining (Trenching).

30. Unconventional mining technologies:

- In-situ Recovery (ISR) or In-situ Leaching (ISL)
- Solution Mining
- Brine Mining
- Borehole Mining
- Seafloor Mining
- Tailings Re-mining

- Space Mining.

31. Quantity/volume estimates vary significantly depending on the deployed mining method. The most significant differences in quantity estimates become evident when comparing conventional open pit to underground production methods. Underground mining is more commonly applied to high-grade, low tonnage deposits whereas open pit mining provides an economically feasible approach for rather a homogenous low- to medium-grade hightonnage deposits with limitations based on the depths and strip ratio. Key parameters defining the quantity estimates for both methods vary significantly since the overburden or strip ratio is crucial for an open pit operation making it amenable only to shallow deposits while underground operations do not consider any overburden thickness and instead require a precise understanding of the ore morphology and have much higher unit costs.

3. Mining Projects

Table 12
Mining projects. Potential F Categories

<i>Issue / potential CF</i>	<i>Level of engagement</i>	<i>Potential F Category</i>	<i>Inspire category</i>
Technical feasibility			
	F1.1 (extraction on-going)	F1 if TRL > 5	
Detailed Feasibility Studies	F1.2 (detailed feasibility studies)		
Prefeasibility Studies Complete and Successful or Ongoing	F2.2		Advanced Exploration/Resource definition Prefeasibility
Scoping Study Completed or Ongoing	F2.2		Scoping study (resources)
Detailed Feasibility / Prefeasibility Studies Not Planned	F2.3		Closed, Abandoned, Historic

Table 13
Exploration projects. Potential F Categories

<i>Issue / potential CF</i>	<i>Potential F Category</i>	<i>Comments</i>	<i>Inspire category</i>
Exploration Projects			
Site-specific geological studies and exploration activities have identified the potential for an individual deposit with sufficient confidence to warrant drilling or testing that is designed to confirm the existence of that deposit in such form, quality and quantity that the feasibility of extraction can be evaluated	F3.1	TRL 3 and 4	Subsurface exploration (Exploration Target Outline)
Local geological studies and exploration activities indicate the potential for one or more deposits in a specific part of a geological province, but requires more data acquisition and/or evaluation in order to have sufficient confidence to warrant drilling or testing that is designed to confirm the existence of a deposit in such form, quality and quantity that the feasibility of extraction can be evaluated	F3.2		Detailed surface exploration (Exploration)
Earliest stage of exploration activities, where favorable conditions for the potential discovery of deposits in a geological province may be inferred from regional geological studies.	F3.3		Regional reconnaissance (Grassroots)
Conceptual studies Ongoing or Planned	F4	TRL 1 and 2	
Additional Quantities in place:			
Technology under active development	F4.1	TRL 2	
Technology being researched	F4.2	TRL 1	
Technology not under research or development	F4.3	TRL 1	

C. G Axis – Degree of Confidence in Estimates¹²

Table 14
Exploration projects. Potential G Categories

<i>Issue / potential CF</i>	<i>Potential G Category</i>	<i>Comments</i>
Geological Evidence		
Derived from detailed and reliable exploration, sampling and testing and is sufficient to confirm geological and grade or quality continuity between points of observation.	G1	
Derived from adequately detailed and reliable exploration, sampling and testing and is sufficient to assume geological and grade or quality continuity between points of observation	G2	
Sufficient to imply but not verify geological and grade or quality continuity.	G3	
Based primarily on indirect evidence.	G4	

II. UNFC for Europe Anthropogenic Resources Guidelines

A. Anthropogenic Resources

32. Anthropogenic resources or secondary resources that could be produced for residues and potential wastes need to be managed in line with the objectives of Sustainable Development Goal (SDG) 12, notably objective 12.5. Energy and mineral value chains usually involve the generation of large quantities of residues. These residues often are defined a priori as “wastes” in laws or regulations or de facto end up as wastes and, if not properly managed threaten not only the environment but also the health and safety of the local populations. With energy and mineral production increasingly coming from lower grade sources, the quantities of residues and wastes are also growing exponentially, thus exacerbating the problem.

33. However, these residues are almost without exception important sources of secondary resources meaning that the residues themselves can safely be used for productive purposes rather than being consigned for disposal. In the past, there were technological challenges for the utilization of wastes, but this is being addressed today through innovative approaches. The activities that produce valuable secondary raw materials and energy required for society could also be environmental, social, and economically attractive. Use of secondary resources importantly helps to conserve non-renewable primary resources for the benefit of future generations. This activity helps to meet the target of SDG 12 “Responsible Production and Consumption” on wasteminimization through prevention, reduction, recycling and reuse.

B. Waste Hierarchy

34. The UNFC for Europe Guidance applies the European Waste Hierarchy (Directive 2008/98/EC) as shown in the diagram that follows. It shows that indefinite disposal is the least favoured option. By contrast, reuse, recycling and the recovery of energy from wastes has now become central to the project life-cycle. In this model, provision for “end of life” (EoL) requirements, some of which, such as progressive remediation, run in parallel with the project must be included in the project financials, including a care and maintenance plan with associated financial resources, for any residues or tailing left behind. An effective plan for

¹² The G axis reflects the degree of confidence in estimates of the metrics included in the inventories.

waste, with, as a vision, “zero waste” as the outcome, according to which no legacy problem should be left of subsequent generations than can be dealt with in the current generation.



C. Defining the Project

35. An anthropogenic material sourcing Project is a defined development or sourcing operation, which provides the basis for socio, environmental and economic evaluation and decision-making. In the early stages of evaluation, including exploration, the Project might be defined only in conceptual terms, whereas more mature Projects will be defined in significant detail.

36. Where no development or sourcing operation can currently be defined for quantities, based on existing technology or technology currently under development, all quantities associated with that Project (or part thereof) are classified in Category F4.

37. The classification procedure consists of identifying a Project, or Projects, estimating the existing and future quantities in place, with an associated level of confidence, and classifying the Project(s) based on Project status (or maturity) and viability.

38. The “treatment and sourcing” process is the link between the quantities in the Anthropogenic Material Source and the Anthropogenic Material Products. There is a clear recognition of risk versus reward for the investors and keystakeholders such as governments and industry associations, linked to uncertainties and/or variability in the material quantity and quality, the efficiency of the sourcing process (e.g. reuse, preparation for reuse, recycling, recovery), the Anthropogenic Material Product prices and market conditions (including policy support mechanisms), social acceptance and the environmental benefits compared to primary material sourcing. In the early stages of evaluation, the Project might be defined only in conceptual terms, whereas more mature Projects will be defined in significant detail.

39. Anthropogenic Material Stocks cover Anthropogenic Material quantities and qualities, which change over time. So, estimates on future quantities are based primarily on indirect evidence. A deposit with quantities based on indirect evidence is defined as a “Potential deposit”, which is a “Potential Anthropogenic Material Source” in this document. These quantities shall be added to Category G4. It might be helpful to introduce Sub-categories (G4.1, G4.2, and G4.3), based on the level of confidence, as it is defined for G1, G2 and G3.

D. Project Lifetime

40. The estimated quantities for a Project shall be limited to quantities that will be produced during the Project Lifetime, which is defined as the social, environmental and economic limit, design life, or for particular asset holders, contract period for the Asset, as defined below. The Project Lifetime can sometimes be limited by the availability of the source

material or by the extent of entitlement or social licenses. Because of its importance in estimating material quantities, the Project Lifetime and its basis shall be disclosed in association with any reported quantities.

41. The ‘social, environmental and economic limit’ is defined as the time at which the Project reaches a point beyond which the subsequent cumulative discounted net operating cash flows from the Project would be negative. For a Project, the social, environmental and economic limit may be the time when the expected recovery rate declines to a level that makes the Project unviable, or when it is unviable to invest in the further infrastructure required to retrieve remaining quantities from the Anthropogenic Material Source.

42. The ‘design life’ of a Project is the expected operating life of major physical infrastructure as defined during the technical and social, environmental and economic assessment of the Project. The replacement of significant project components will constitute a new Project, and a new evaluation and estimation of Anthropogenic Resources shall be performed. The ‘contract period’ for an Anthropogenic Material sourcing Asset is the term of all existing, or reasonably expected sales contracts for the Anthropogenic Material Products.

43. The contract period should not include contract extensions unless there is a reasonable expectation of such extensions, based upon the historical treatment of similar contracts.

44. Entitlement: Entitlement refers to the rights to access Anthropogenic Material quantities that accrue to Project participants. The ‘entitlement period’ is the term of all licenses and permits which provide rights to access the Anthropogenic Material Source, respectively, retrieve the material quantities and deliver the Anthropogenic Material Product into the market. The Anthropogenic Material Source may be expected to last much longer than the Asset or Project Lifetime, but any future recovered quantities beyond those estimated for the Asset or Project would be assessed and classified as subsequent or additional Asset (i.e. legal rights) or Projects.

E. Development Plan

45. In order to assign Anthropogenic Resources to any Class, except for Category F4 (no development project or sourcing operation has been identified), a development plan consisting of one or more Projects needs to be defined. The level of detail appropriate for such a plan may vary according to the maturity of the Projects and may also be specified by regulation.

Annex III

Mineral and Anthropogenic Resources Glossary of Terms

I. Generic Terms

<i>Generic Terms</i>	
<i>Terms</i>	<i>Definition</i>
Aligned System	A classification system that has been aligned with UNFC as demonstrated by the existence of a Bridging Document that has been endorsed by the Expert Group on Resource Management.
Bridging Document	A document that explains the relationship between UNFC and another classification system, including instructions and guidelines on how to classify estimates generated by application of that system using the UNFC Numerical Codes.
Category	Primary basis for classification using each of the three fundamental Criteria of environmental-socio-economic viability (related Categories being E1, E2, and E3), technical feasibility (related Categories being F1, F2, F3 and F4), and degree of confidence (related Categories being G1, G2, G3 and G4). Definitions of Categories are provided in Annex I of Part I of UNFC (2019).
Class(es)	Primary level of resource classification resulting from the combination of a Category from each of the three Criteria (axes).
Criteria	UNFC utilises three fundamental Criteria for reserve and resource classification: favourability of environmental-socio-economic conditions in establishing the viability of the project (E axis); maturity of technology, studies and commitments necessary to implement the project (F axis); and, degree of confidence in the estimate of quantities of products from the project (G axis). These Criteria are each subdivided into Categories and Sub-categories, which are then combined in the form of Classes or Sub-classes.
Evaluator	Person, or persons, performing estimation and/or classification.
Generic Specifications	Specifications (as documented in a Specifications Document) that apply to the classification of products of a resource project using UNFC.
Identified Project	An identified project is a project associated with a known source.
Known Source	A source that has been demonstrated to exist by direct evidence. More detailed specifications can be found in relevant source-specific Aligned Systems.
Mapping Document	The output of a comparison between another resource classification system and UNFC, or between that system and existing Aligned Systems, which highlights the similarities and differences between the systems. A Mapping Document can provide the basis for assessing the potential for the other system to become an Aligned System through the development of a Bridging Document.
Numerical Code	Numerical designation of each Class or Sub-class of resource quantity as defined by UNFC. Numerical Codes are always quoted in the same sequence (i.e. E;F;G).
Potential Source	A source that has not yet been demonstrated to exist by direct evidence, but is assessed as potentially existing based primarily on indirect evidence. More detailed specifications can be found in relevant source-specific Aligned Systems.

<i>Generic Terms</i>	
<i>Terms</i>	<i>Definition</i>
Product	Products of the project may be bought, sold or used, including electricity, heat, hydrocarbons, hydrogen, minerals, and water. It is noted that with some projects, such as for renewables, the products (electricity, heat etc.) are different from the sources (wind, solar irradiation etc.). In other projects the products and sources may be similar e.g. in petroleum projects both the sources and products are oil and/or gas, although the fluid state and properties may change from reservoir to surface conditions.
Project	A Project is a defined development or operation which provides the basis for environmental, social, economic and technical evaluation and decision-making. In the early stages of evaluation, including verification, the Project might be defined only in conceptual terms, whereas more mature Projects will be defined in significant detail. Where no development or operation can currently be defined for all or part of a source, based on existing technology or technology currently under development, all quantities associated with that source (or part thereof) are classified in Category F4. These are quantities which, if produced, could be bought, sold or used.
Sources	Sources, such as bioenergy, geothermal, hydro-marine, solar, wind, injection for storage, hydrocarbons, minerals, nuclear fuels and water, are the feedstock for resource projects from which products can be developed. The sources may be in their natural or secondary (anthropogenic sources, tailings, etc.) state.
Specifications	Additional details (mandatory rules) as to how a resource classification system is to be applied, supplementing the framework definitions of that system. Generic Specifications provided for UNFC in a Specifications Document ensure clarity and comparability and are complementary to the source-specific requirements included in Aligned Systems, as set out in the relevant Bridging Document.
Specifications Document	Specifications for the application of the United Nations Framework Classification for Resources (UNFC).
Sub-categories	Criteria of environmental, social and economic viability, technical feasibility, and degree of confidence.
Sub-classes	Optional subdivision of resource classification based on project maturity principles resulting from the combination of Sub-categories. Project maturity Sub-classes are discussed further in Annex III of this Specifications Document.
Système International d'Unités	Internationally recognized system of measurement and the modern form of the metric system. Prefixes and units are created and unit definitions are modified through international agreement as the technology of measurement progresses, and as the precision of measurements improves. Abbreviated to SI.
UNFC	United Nations Framework Classification for Resources.

II. Minerals Terms

<i>Minerals Terms</i>	
<i>Terms</i>	<i>Definition</i>
Minerals Source	A Minerals Source is a concentration or occurrence of material quantity of intrinsic commercial or Political interest, in such form, quality and quantity from which a benefit is produced.
Minerals Life Cycle	The Minerals Life Cycle usually starts with the exploration and subsequent primary mineral production in the course of a mining operation, and decommissioning and site remediation. This step reflects the primary entrance of raw materials into the stock available for economic value chains. During the length of stay within value-added chains, the mineral nature and compositions might be multiply altered in linear and cyclic processes (recycling).
Potential (Minerals) Source	A Minerals Source that has not yet been demonstrated to exist by direct evidence but is assessed as potentially existing based primarily on indirect evidence or evidence with limited density of exploration data.
Product (Minerals)	Products of the project may be bought, sold or used. In some cases the product and the source are similar and might be utilised directly (e.g., aggregates); in other cases the product is indirectly utilised i.e. derived from the source by industrial processes like beneficiation (steel / iron from iron ore).
Prospective Project	A Project that is associated with one or more Potential Minerals Source (See Potential Source). The results of a prospective project might potentially provide the necessary direct evidence for a Known Minerals Resource.
Remediation (or Reclamation)	The restoration of a project site conditions that are required by regulatory or other provisions.
Reasonable Expectations	High level of confidence. This term is used within the E1 classification and concerns the likelihood that all necessary conditions will be met. It is also used in the F1.3 Sub-category and concerns the likelihood that all necessary approvals/contracts for the project to proceed to development will be forthcoming.
Reasonable Prospects	Moderate level of confidence. This term is used within the E2 and E3 classification and concerns the likelihood that all necessary conditions will be met.
Reasonable Time Frame	The time frame within which all approvals, permits and contracts necessary to implement the project are to be obtained. This should be the time generally accepted as the typical period required to complete the task or activity under normal or typical circumstances.
Viable	A project is viable when it has been confirmed to be economically, socially, technically and environmentally feasible and satisfies all the relevant criteria of the E, F, and G axes that are required for it to proceed.

III. Anthropogenic Resources Terms

<i>Anthropogenic Resources Terms</i>	
<i>Terms</i>	<i>Definition</i>
Geological knowledge	<p>Level of confidence in the potential recoverability of the quantities.</p> <p>When applied to Anthropogenic Materials, the G axis should be understood to reflect the “level of confidence in the potential recoverability of the quantities”, which might require a multi-disciplinary approach. Thus, the G axis Categories are intended to reflect all significant uncertainties impacting the estimated Anthropogenic Material quantities that are forecasted to be sourced or not sourced by the Project. Uncertainties refer to all parameters that influence both variability in the Anthropogenic Material Source and the efficiency of the recovery and conversion methodology (where relevant).</p>
Mining (the anthroposphere)	<p>Sourcing quantities of Anthropogenic Material from Anthropogenic Material Sources. The term “sourcing” is equivalent to “production” or “recovery”, commonly used for petroleum projects. It includes diverse activities for waste “re-use”, “preparing for re-use”, “recycling”, “recovery” and “disposal”. The latter terms are used by the EU Waste Directive 2008/98/EC [17] and guidance on their interpretation is given in [12]. “Sourcing” implies the overall process of converting quantities from an Anthropogenic Material Source into Anthropogenic Material Products.</p>
Known deposit / Known Anthropogenic Material Source	<p>A known deposit that has been demonstrated to exist by direct evidence. More detailed specifications can be found in relevant commodity-specific Aligned Systems. An Anthropogenic Material Source that has been demonstrated to exist by direct evidence. More detailed specifications can be found in relevant commodity-specific Aligned Systems.</p>
Potential Deposit	<p>A deposit that has not yet been demonstrated to exist by direct evidence (e.g., drilling and/or sampling), but is assessed as potentially existing based primarily on indirect evidence (e.g., surface or airborne geophysical measurements). More detailed specifications can be found in relevant commodity-specific Aligned Systems.</p>
Potential Anthropogenic Material Source	<p>An Anthropogenic Material Source that has not yet been demonstrated to exist by direct evidence (e.g. sampling), but is assessed as potentially existing based primarily on indirect evidence (e.g., aerial and satellite photograph, indirect estimations based on statistics and proxy indicators, dynamic material flow analysis). It also includes material quantities that are assumed to become available in the project lifetime, but that are not yet observable in the Anthropogenic Material Stock.</p>
Anthropogenic Material	<p>The physical matter without any attribution from a social, environmental, economic, legislative, perspective, and without a specification of the aggregate state (solid, liquid, gaseous). Anthropogenic materials include, for instance, mineral materials, sewage sludge, biomass, and off-gas.</p>
Anthropogenic Resource	<p>A concentration or occurrence of Anthropogenic Material of intrinsic social, environmental, and economic interest, in such form, quality and quantity that there are reasonable prospects for eventual social, environmental, and economically viable production.</p>
Anthropogenic Material System	<p>The system that locates Anthropogenic Material quantities inside the Anthroposphere and its surrounding environment. It comprises Anthropogenic Material Processes, linked by Anthropogenic Material Flows within defined system boundaries. Primary raw materials are the product of the primary production sectors, which extracts resources from the earth’s crust and transform them by processing or refining. The resultant materials include but</p>

Anthropogenic Resources Terms

<i>Terms</i>	<i>Definition</i>
	are not restricted to primary commodities. Primary commodities are typically traded as base materials for subsequent manufacturing (value-add) and consumption or use. Residues from primary production and primary commodities if not disposed of as wastes comprise Anthropogenic Material Stocks, from which Anthropogenic Materials quantities (also known as secondary resources) can be sourced.
Anthropogenic Material Sourcing Project	An anthropogenic material sourcing Project is a defined development or sourcing operation, which provides the basis for social, environmental, and economic evaluation and decision-making.
Anthropogenic Material Process	A process is defined as the transformation, transport, or storage of materials. Depending on the location of the process, a process is further defined as Anthropogenic Material Process or Environmental Material Process. In waste management, for example, transformation and storage takes place in terms of “reuse” “recycling recovery” (preferred) and “disposal. Each process is subject to the mass conservation principle, which means that the sum of inflows, stock changes and outflows is zero.
Anthropogenic Material Stock	An Anthropogenic Material Stock results from the accumulation of an Anthropogenic Material quantity in an Anthropogenic Material Process.
Anthropogenic Material Flow	An Anthropogenic Material Flow is the movement of Anthropogenic Material between two Anthropogenic Material Processes and is measured in mass per time.
Anthropogenic Material Source	Any Anthropogenic Material Stock or any Anthropogenic Material Flow can be an Anthropogenic Material Source. An Anthropogenic Material Source contains material quantities that can be converted to Anthropogenic Material Products.
Anthropogenic Material Product	An Anthropogenic Material Product is a quantity that is saleable in markets. The cumulative quantities are equivalent to “Sales Production.”
